Atlantic States Marine Fisheries Commission

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Patrick C. Keliher (ME), Chair *Spud Woodward (GA), Vice-Chair* *Robert E. Beal, Executive Director*

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

MEMORANDUM

January 22, 2020

TO: Commissioners; Proxies; Atlantic Herring Management Board; Atlantic Menhaden Management Board; Atlantic Striped Bass Management Board; Bluefish Management Board; Coastal Sharks Management Board; Executive Committee; ISFMP Policy Board; South Atlantic State/Federal Fisheries Management Board

FROM: Robert E. Beal REB
Executive Director

RE: ASMFC Winter Meeting: February 4-6, 2020 (TA 20-014)

The Atlantic States Marine Fisheries Commission's Winter Meeting will be held February 4-6, 2020 at **The Westin Crystal City** (Telephone: 703.486.1111), located at 1800 South Eads Street, Arlington, VA. Meeting materials are currently available on the Commission website at http://www.asmfc.org/home/2020-winter-meeting and supplemental materials will be posted there on Wednesday, January 29th.

The agenda is subject to change. The agenda reflects the current estimate of time required for scheduled Board meetings. The Commission may adjust this agenda in accordance with the actual duration of Board meetings. Interested parties should anticipate Boards starting earlier or later than indicated herein.

Board meeting proceedings will be broadcast daily via webinar beginning at 9:30 a.m. on Tuesday, February 4th and continuing daily until the conclusion of the meeting (expected to be 12:30 p.m.) on Thursday, February 6th. The webinar will allow registrants to listen to board deliberations and view presentations and motions as they occur. No comments or questions will be accepted via the webinar. Should technical difficulties arise while streaming the broadcast the boards/sections will continue their deliberations without interruption. We will attempt to resume the broadcast as soon as possible. To register, please go to https://attendee.gotowebinar.com/register/3853611638258510347.

We look forward to seeing you at the Winter Meeting. If the staff or I can provide any further assistance to you, please call us at 703.842.0740.

Enclosures: Final Agenda, Hotel Directions, TA 20-014, and Travel Reimbursement Guidelines

Atlantic States Marine Fisheries Commission

Winter Meeting

February 4–6, 2020

The Westin Crystal City

Arlington, Virginia

Public Comment Guidelines

With the intent of developing policies in the Commission's procedures for public participation that result in a fair opportunity for public input, the ISFMP Policy Board has approved the following guidelines for use at management board meetings:

<u>For issues that are not on the agenda</u>, management boards will continue to provide opportunity to the public to bring matters of concern to the board's attention at the start of each board meeting. Board chairs will use a speaker sign-up list in deciding how to allocate the available time on the agenda (typically 10 minutes) to the number of people who want to speak.

<u>For topics that are on the agenda</u>, but have not gone out for public comment, board chairs will provide limited opportunity for comment, taking into account the time allotted on the agenda for the topic. Chairs will have flexibility in deciding how to allocate comment opportunities; this could include hearing one comment in favor and one in opposition until the chair is satisfied further comment will not provide additional insight to the board.

<u>For agenda action items that have already gone out for public comment</u>, it is the Policy Board's intent to end the occasional practice of allowing extensive and lengthy public comments. Currently, board chairs have the discretion to decide what public comment to allow in these circumstances.

In addition, the following timeline has been established for the **<u>submission of written comment for issues for which the Commission has *NOT* established a specific public comment period</u>** (i.e., in response to proposed management action).

1. Comments received 3 weeks prior to the start of a meeting week will be included in the briefing materials.
2. Comments received by 5:00 PM on the Tuesday immediately preceding the scheduled ASMFC Meeting (in this case, the Tuesday deadline will be ***January 28, 2020***) will be distributed electronically to Commissioners/Board members prior to the meeting and a limited number of copies will be provided at the meeting.
3. Following the Tuesday, ***January 28, 2020 5:00 PM deadline***, the commenter will be responsible for distributing the information to the management board prior to the board meeting or providing enough copies for the management board consideration at the meeting (a minimum of 50 copies).

The submitted comments must clearly indicate the commenter's expectation from the ASMFC staff regarding distribution. As with other public comment, it will be accepted via mail, fax, and email.

Final Agenda

The agenda is subject to change. The agenda reflects the current estimate of time required for scheduled Board meetings. The Commission may adjust this agenda in accordance with the actual duration of Board meetings. Interested parties should anticipate Boards starting earlier or later than indicated herein.

Tuesday, February 4

9:30 – 11:00 a.m. **Atlantic Herring Management Board**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey
Other Members: NEFMC, NMFS
Chair: O'Keefe
Other Participants: Zobel, Brown
Staff: Rootes-Murdy

1. Welcome/Call to Order *(C. O'Keefe)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. Consider Draft Addendum III for Public Comment *(K. Rootes-Murdy)* **Action**
5. Set Sub-Annual Atlantic Herring Fishery Catch Limit Specifications for the 2020 Fishing Year *(K. Rootes-Murdy)* **Final Action**
6. Elect Vice-Chair **Action**
7. Other Business/Adjourn

11:15 a.m. – 3:00 p.m. **Atlantic Striped Bass Management Board**
Lunch will be served 12:30-1:00 p.m.
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina
Other Members: DC, NMFS, PRFC, USFWS
Chair: Borden
Other Participants: Lengyel Costa, Blanchard
Staff: Appelman

1. Welcome/Call to Order *(D. Borden)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. Consider Addendum VI State Implementation Plans and Conservation Equivalency Proposals **Final Action**
   - Review Implementation Plans and Conservation Equivalency Proposals *(M. Appelman)*
   - Technical Committee Report (*N. Lengyel Costa*)
   - Law Enforcement Committee Report *(M. Appelman)*
   - Consider Approval of State Implementation Plans and Conservation Equivalency Proposals
5. Review and Populate Advisory Panel Membership *(T. Berger)* **Action**
6. Other Business/Adjourn

3:15 – 4:00 p.m. **Coastal Sharks Management Board**

Member States: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: NMFS, USFWS
Chair: Batsavage
Other Participants: Frazier, Garner
Staff: Rootes-Murdy

1. Welcome/Call to Order *(C. Batsavage)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. Update on Implementation of CITES Appendix II Provisions for Atlantic Shortfin Mako (*USFWS Staff)*
5. Update from November 2019 Meeting of the International Commission for the Conservation of Atlantic Tunas Meeting on Atlantic Shortfin Mako *(K. Rootes-Murdy)*
6. Other Business/Adjourn

4:15 – 5:00 p.m. **Bluefish Management Board**

Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia North Carolina, South Carolina, Georgia, Florida
Other Members: NMFS, PRFC, USFWS
Chair: Batsavage
Other Participants: Celestino, Kersey
Staff: Colson Leaning

1. Welcome/Call to Order *(C. Batsavage)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from April 2018
3. Public Comment
4. Consider Approval of Conservation Equivalency Proposals *(D. Colson Leaning)* **Final Action**
   - Review Conservation Equivalency Proposals
   - Technical Committee Report
   - Law Enforcement Committee Report
5. Elect Vice-Chair
6. Other Business/Adjourn

Wednesday February 5

8:30 a.m. – Noon **Atlantic Menhaden Management Board**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: NMFS, PRFC, USFWS
Chair: Meserve
Other Participants: Ballenger, Kersey, Cieri, Jones, Schueller
Staff: Appelman

1. Welcome/Call to Order *(N. Meserve)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. Atlantic Menhaden 2019 Single-Species and Ecological Reference Point Benchmark Stock Assessments and Peer Review Reports **Action**
   - Overview of Single-Species Assessment *(A. Schueller)*
   - Overview of Ecological Reference Point Assessment *(M. Cieri)*
   - Presentation of Peer Review Reports *(M. Jones)*
   - Consider Acceptance of 2019 Benchmark Stock Assessments and Peer Review Reports for Management Use *(N. Meserve)*
5. Consider Management Response to 2019 Benchmark Stock Assessments *(N. Meserve)* **Action**
6. Other Business/Adjourn

Noon – 1:00 p.m. **Lunch** *(On Your Own)*

1:00 – 5:00 p.m. **South Atlantic State/Federal Fisheries Management Board**
Member States: New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: NMFS, PRFC, SAFMC, USFWS
Chair: Geer
Other Participants: Giuliano, McDonough, Rickabaugh, Hodge, Buckel, Siegfried
Staff: Schmidtke

1. Welcome/Call to Order *(P. Geer)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. SEDAR 58 Cobia Benchmark Stock Assessment and Peer Review Report **Action**
   - Presentation of Stock Assessment Report *(K. Siegfried)*
   - Presentation of Peer Review Report *(J. Buckel)*
   - Consider Acceptance of Benchmark Stock Assessment, Reference Points, and Peer Review Report for Management Use *(P. Geer)*

5. Consider Management Response to SEDAR 58 Cobia Assessment **Action**
   - Presentation of Recommended Harvest Quota Options from the Cobia Technical Committee *(A. Giuliano)*
   - Set Harvest Specifications *(P. Geer)*
6. Consider Atlantic Croaker Addendum lll and Spot Addendum lll for Final Approval *(M. Schmidtke)* **Final Action**
   - Review Options and Public Comment Summary
   - Review Committee Reports
   - Consider Final Approval of Atlantic Croaker Addendum lll and Spot Addendum lll
7. Consider Management Action to Align State and Federal Management of Spanish Mackerel *(P. Geer)* **Action**
8. Review Red Drum Stock Assessment Road Map and Consider Recommendations for Changes to the Assessment Timeline *(J. Kipp)* **Possible Action**
9. Elect Vice-Chair
10. Other Business/Adjourn

Thursday February 6

8:00 – 10:00 a.m.	**Executive Committee**
Breakfast will be available at 7:30 a.m.	***(A portion of this meeting may be a closed session for Commissioners and Committee members only)***
	Members: Abbott, Anderson, Bowman, Bell, Cimino, Clark, Davis, Estes, Gilmore, Keliher, McKiernan, McNamee, Miller, Murphey, Shiels, White, Woodward
	Chair: Keliher
	Staff: Leach

1. Welcome/Call to Order *(P. Keliher)*
2. Committee Consent
   - Approval of Agenda
   - Approval of Meeting Summary from October 2019
3. Public Comment
4. Discuss Potential Allocation of Remaining Plus-up Funds *(R. Beal)*
5. Update on Review of Advisory Panel and Public Input Process *(R. Beal)*
6. Discuss Management Board Changes to Accommodate Shifts in Species Distributions *(R. Beal)*
7. Future Annual Meetings Update *(R. Beal)*
8. Other Business/Adjourn

10:15 a.m. – 12:15 p.m. **Interstate Fisheries Management Program Policy Board**

Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: DC, NMFS, PRFC, USFWS
Chair: Keliher
Staff: Kerns

1. Welcome/Call to Order *(P. Keliher)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. Update from Executive Committee *(P. Keliher)*
5. Review and Discuss 2019 Commissioner Survey Results *(D. Tompkins)*
6. Discuss Strategy to Incorporate Ecosystem Management into the Interstate Fisheries Management Process *(T. Kerns, K. Drew)*
7. Progress Update on Benchmark Stock Assessments *(J. Kipp)*
   - American Shad
   - American Lobster
8. Review and Consider Revisions to Stock Status Definitions *(T. Kerns)*
9. Review Noncompliance Findings (If Necessary) **Action**
10. Other Business/Adjourn

12:15 – 12:30 p.m. **Business Session**

Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Chair: Keliher
Staff: Beal

1. Welcome/Call to Order *(P. Keliher)*
2. Committee Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2019
3. Public Comment
4. Consider Noncompliance Findings (If Necessary) **Final Action**
5. Other Business/Adjourn

Atlantic States Marine Fisheries Commission

Atlantic Herring Management Board

February 4, 2020
9:30 – 11:00 a.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(C. O'Keefe)*	9:30 a.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2019	9:30 a.m.
3.	Public Comment	9:35 a.m.
4.	Consider Draft Addendum III for Public Comment (*K. Rootes-Murdy*) **Action**	9:45 a.m.
5.	Set Sub-Annual Catch Limit Specifications for the 2020 Fishing Year (*K. Rootes-Murdy*) **Final Action**	10:30 a.m.
6.	Elect Vice-Chair (*C. O'Keefe*) **Action**	10:45 a.m.
7.	Other Business/Adjourn	11:00 a.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW

Atlantic Herring Management Board
Tuesday, February 4, 2020
9:30 – 11:00 a.m.
Arlington, Virginia

Chair: Cate O'Keefe (MA) Assumed Chairmanship: 10/19	Technical Committee Chair: Renee Zobel (NH)	Law Enforcement Committee: Delayne Brown (NH)
Vice Chair: VACANT	Advisory Panel Chair: Jeff Kaelin (NJ)	Previous Board Meeting: October 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, NMFS, NEFMC (9 votes)		

2. Board Consent
- Approval of Agenda
- Approval of Proceedings from October 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Consider Draft Addendum III for Public Comment (9:45 – 10:30 a.m.) Action
Background • The Board initiated development of Addendum III to provide more tools for managing the Area 1A fishery under low quotas. • The PDT met via conference call several times in December and January to develop the document. (**Supplemental Materials**)
Presentations • Overview of draft Addendum III for public comment by K. Rootes-Murdy
Board actions for consideration at this meeting • Approve draft Addendum III for public comment

5. Set Sub-ACL Specifications for 2020 Fishing Year (10:30 – 10:45 a.m.) Final Action
Background • In October the Board set the seasonal allocations for the 2020 Area 1A fishery but the sub-ACL specifications were not available at the time. • A proposed rule for the 2020 Area 1A sub-ACL has not been published yet and the final rule will be published after the Board Meeting.
Presentations

• Overview of 2020 sub-ACL specifications by K. Rootes-Murdy
Board actions for consideration at this meeting • Set the 2020 sub-ACL specifications via Board motion, pending release of proposed rule by NOAA Fisheries

6. Elect Vice-Chair

7. Other Business/Adjourn

Atlantic Herring Technical Committee Task List

Activity Level: Medium

Committee Overlap Score: Medium

Committee Task List
While there are no Board tasks for the TC at present, there are several annual activities in which TC members participate, both through the Commission and NEFMC • Participation on ASMFC PDT (currently working on Draft Addendum III) • Participation on NEFMC PDT • Summer/fall collection of spawning samples per the spawning closure protocol • Annual state compliance reports are due February 1

TC Members
Renee Zobel (NHFG – Chair), Kurt Gottschall (CT DMF), Dr. Matt Cieri (ME DMR), Micah Dean (MA DMF), Corinne Truesdale (RI DFW), Deirdre Boelke (NEMFC), Jonathan Deroba (NOAA NEFSC), Carrie Nordeen (NOAA)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC HERRING MANAGEMENT BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 28, 2019

These minutes are draft and subject to approval by the Atlantic Herring Board Management Board.
The Board will review the minutes during its next meeting.

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INDEX OF MOTIONS

1. **Move to approve agenda** by Consent (Page 1).

2. **Move to approve proceedings of April, 2019** by Consent (Page 1).

3. **Move to allocate the 2020 Area 1A sub-ACL seasonally with 72.8 percent available from June through September and 27.2 percent allocated from October through December. The fishery will close when 92 percent of the seasonal period's quota has been projected to be harvested and underages from June through September shall be rolled into the October through December period** (Page 14). Motion by David Pierce; second by Joe Cimino. Motion carried (Page 16).

4. **Move to initiate an addendum to expand the quota period options in Amendment 3 by adding options which address challenges experienced in low quota scenarios (frequent starting and stopping of fishing days, small amounts of quota left at the end of the year). The addendum should include, but does not have to be limited to, an option which allocates 100% of the Area 1A quota to the months of June-December. The addendum should also consider expanding the Small Mesh Bottom Trawl Fleet Days Out provision to all Category C and D permits** (Page 16). Motion by Steve Train; second by Doug Grout. Motion carried (Page 17).

5. **Move to nominate Cate O'Keefe (MA) as Vice-Chair to the Atlantic Herring Board** (Page 19). Motion by David Pierce; second by Eric Reid. Motion carried (Page 19).

6. **Motion to adjourn** by Consent (Page 19).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Megan Ware, ME, Administrative proxy
Steve Train, ME (GA)
Sen. David Miramant, ME (LA)
Doug Grout, NH (AA)
G. Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
David Pierce, MA (AA)
Raymond Kane, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Bob Ballou, RI, proxy for J. McNamee (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
Maureen Davidson, NY, proxy for J. Gilmore (AA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Peter Kendall, NEFMC, proxy for T. Nies
Allison Murphy, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Renee Zobel, Technical Committee Chair
Rob Beal, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Max Appelman
Kirby Rootes-Murdy
Maya Drzewicki

Guests

Erik Anderson, NH CFA
John-Paul, Bilodeau, Portland, ME
Dierdre Boelke, NEFMC
Gabriela Bradt, NH Sea Grant
Delayne Brown, NH F&G, Law Enforcement
Peter Burns, NMFS
Sarah Heil, NOAA
Jeff Kaelin, Lund's Fisheries
Alix LaFierriere, TNC
Nicole Lengyel, RI DEM
Chip Lynch, NOAA
Shanna Madsen, NJ DFW
Jason McNamee, RI DEM
Mike Millard, USFWS
Carrie Nordeen, NMFS
Glenn Normandeau, NH F&G
Cate O'Keefe, MA DMF
Michael Pentony, NMFS
Ryan Rabe, Portland, ME
Jocelyn Runnebaum, TNC
John Satterly, VSSA
Geoffrey Smith, TNC
Melissa Smith, ME DMR
Kevin Staples, NE Regional Council
Kevin Sullivan, NH F & G
Pam Thames, NOAA
Megan Ware, ME DMR
Lindsey Williams, MIT Sea Grant

These minutes are draft and subject to approval by the Atlantic Herring Management Board.
The Board will review the minutes during its next meeting.

The Atlantic Herring Management Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Monday, October 28, 2019, and was called to order at 8:30 o'clock a.m. by Chairman Patrick C. Keliher.

CALL TO ORDER

CHAIRMAN PATRICK C. KELIHER: Good morning and welcome to the Herring Board. My name is Pat Keliher, the Chair. We've got a fairly quick agenda in front of us, but first I don't know if the host state would like to welcome everybody. I think we're somewhere in New Hampshire.

MR. DOUGLAS E. GROUT: Yes thank you very much and we would like to welcome you all. We arranged yesterday to have a classic New Hampshire nor'easter come through, just so that you felt right at home, how we feel and stuff. We've got a lot of good things planned for this week, both work wise and what we need to accomplish here as a Commission, and also social wise.

I think we have a good reception planned for tonight here at the hotel, and then on Tuesday night we're going to go over to the Elks Club, and have a good old lobster feast, and we're going to have New Hampshire sized lobsters, as opposed to Maine sized lobsters. I'll tell you the dress-code for Tuesday night is casual please, casual. You don't come to a lobster bake with a suit on. Welcome everybody, and thank you for coming.

CHAIRMAN KELIHER: Thank you, Doug. I just want to give everybody a heads up. We do have some AV technical difficulties. We are going to not wait for them; we're going to kind of power it through. There may be some delays with the visuals when we get into the slides, but we'll adapt here as we move through the program.

APPROVAL OF AGENDA

CHAIRMAN KELIHER: Item Number 2 on the agenda is Approval of the Agenda. Are there any changes to the agenda? Seeing none, the agenda is approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN KELIHER: Proceedings of the April, 2019 meeting, are there any corrections that need to be made to those minutes? Seeing none, those minutes are approved.

PUBLIC COMMENT

CHAIRMAN KELIHER: Public Comment, we do have one individual, Jeff Kaelin who has signed up for public comments for items that are not on the agenda. Is there anybody else in the audience that would like to speak? Seeing none, Jeff why don't you come right up to that public microphone, please?

MR. JEFF KAELIN: Good morning, and good morning to the Herring Board. Yes I just wanted to bring to your attention a letter that we wrote to the EPA on October 18. I copied Bob on it, but it didn't get in the supplemental materials. It is comments on the EPA designation of an ocean dredge material disposal site for the southern Maine, New Hampshire, and northern Massachusetts coastal region. In the Federal Register Notice of September 18, the EPA says that this site would have minimal potential for interfering with other existing or ongoing uses of the marine environment, including fishing activities, and it's not a unique fishing ground or highly significant fishery harvest area.

But, I understand it does overlap the western Maine, Massachusetts, New Hampshire spawning area. We asked the EPA to evaluate to the extent the site overlaps with the closed areas in the Gulf of Maine, particularly the western area, whether or not the proposed sites specific impacts may be significant. That is on the record, sent to Bob, and I just wanted to raise it today.

Maybe it could be evaluated by the Technical Committee, to see to what extent it overlaps, and what the bottom is like, and whether there is some potential for smothering herring eggs out there. That is the issue I wanted to put on the table today. Thank you, Mr. Chairman.

CHAIRMAN KELIHER: Jeff, thank you for those comments. I know a state specifically will comment on those from an individual basis. But I don't believe there has anything tasking that has been done with the TC. We'll talk about that to see if it would be appropriate to bring them forward. Does anybody have any comments on the issue that Jeff has brought up at this time? Dr. Pierce.

DR. DAVID PIERCE: I'll echo the point that you just made that it seems to be an issue of importance that we need to address as an organization, the Sea Herring Board. With your instruction, Mr. Chairman I would suggest that the Technical Committee take a look at what has been proposed, and prepare some comments for submission. I don't know what the deadline is for receipt of comments by EPA, and I don't know how much they are intending to dispose of and where. I would encourage you to charge the TC to take a look at this.

CHAIRMAN KELIHER: Thank you, Dr. Pierce. Are there any objections to charging the Technical Committee to look at the issues that have been raised in the Federal Register by the EPA? Doug Grout.

MR. GROUT: No objections, but we've been well aware of this and been involved with the siting of this at our state. We feel fairly comfortable about this that the Army Corp and the EPA have looked at the areas for the marine resources. But it might be good just to take a look one more time, and I can have Cheri Patterson take a look at things as to whether we evaluated for egg presence for herring.

CHAIRMAN KELIHER: Great, thank you. I don't think this is going to be a big draw of time on the TC. I believe Maine DMR has also looked at that. We'll have the TC look at it if there are no objections. Seeing none let's continue to move on through the agenda.

MR. KAELIN: Mr. Chairman, it was the comment period in a proposed rule closed October 18, so I'm sure there is going to be a final rule, so there is time to work with them. But thank you.

CHAIRMAN KELIHER: Thank you Jeff, appreciate you bringing it forward.

PROGRESS UPDATE ON 2019 ATLANTIC HERRING 1A FISHERY PERFORMANCE

CHAIRMAN KELIHER: Is there any additional public comment? Seeing none, we're going to go to Item Number 4, which is a Progress Update on 2019 Atlantic Herring 1A Fishery Performance**,** Renee.

MS. RENEE ZOBEL: Good morning and welcome to New Hampshire. I'll just quickly review the performance of the 1A fishery thus far this year. Here a lovely picture of actually the State of Maine Inshore Trawl Survey this year of our local herring. Our total season TAC for herring was 3,850 metric tons in Area 1A.

That took into account the 39 metric tons for the fixed-gear fishery, 8 percent for bycatch, basically the areas close at 92 percent, and 131 metric tons for research set aside for herring. The Board chose to pursue bimonthly periods for this year for the first time. We were working with four periods. The first period was May and June, with no catch allocated to May, July and August, September and October and Period 4 we are in very shortly, and that will be November and December.

The breakdown of how that worked. There are specific percentages allocated to each of those bimonthly periods. Just as a reminder, there are different management tools available during different times of year. For Period 1 through the first half of Period 3, this is a little bit odd, because we traditionally have gone in trimesters, and the trimester ends at the end of September.

Now, September is one of the bimonthly periods that end at the end of October. This can get a little bit confusing. The tools available for the period starting in June and ending in September are choices for Category A vessels. The Board may choose landing days, weekly landing limits per vessel, the use of carriers.
For Category C and D vessels landing days are the options for management tools. The second half of Period 3 and Period 4, the only option available to the Board is landing days, so that again starts October 1, so it is part way through one of our periods, which is a little bit confusing. For Period 1 and 2, we actually rolled, or the Board chose to roll Period 1 TAC into Period 2. The TAC allocated to June was rolled into the July-August period, which resulted in 2,175 metric tons available for that timeframe.

That period opened on July 15, and went to zero landing days on August 19. The options that were chosen for the Category A vessels during that timeframe were four landing days, also they were limited to possessing herring taken from 1A during those landing days, so effectively those were landing and fishing days, 160,000 pounds per vessel per week, harvest-to-harvest transfer only.

The use of carriers was prohibited during this timeframe. There were 11 Category A vessels that participated in the fishery during that timeframe. Category C and D vessels were limited to five landing days, and there were six vessels participating. For Period 3, the period we're currently in, the allowable catch for September through the end of October was 1,309 metric tons.

That period opened September 2, and went to 0 landings days on September 15. The options chosen by the Board were identical to that of Period 2. The same number of vessels participated in the fishery during Period 2 and Period 3. Period 4 that's the period we are headed into here very shortly. There is a slight overage in Period 3, so while originally we had 366 metric tons allocated, 295 metric tons are remaining currently, and likely that number will drop by about 50 metric tons due to an overage that was yet to be reported at this point.

All vessels will open on November 2, but that is pending a transfer of catch from GARFO, will either transfer a catch of 1,000 metric tons or not, depending on the performance of the New Brunswick weir fishery, so if they catch under a certain threshold that management uncertainty comes back into the 1A fishery, if that does not happen the Board will have to make a decision.

Until that happens Period 4 will remain at 0 landings days as it stands right now, this has recently been updated, so should that happen they currently have it moving to 1 landing day not 2. This is just taken from GARFOs website; this shows you the 1A fishery this year. You can see that we're very close to the end of the fishery at that 92 percent line, which is the red line.

Just a quick overview of how the spawning closures went this year. Eastern Maine there was no samples. We knew this year would be difficult with the low quota to get adequate samples to be able to project spawning, instead of closing on default dates, so all our areas actually closed on default dates.

This area closed on August 31 on the default date, opened again on September 13. Western

Maine, there were two samples. The sample threshold is 3 for being able to project, and that is if the information produces an estimate that is precise enough to do that. This also closed on its default date, which was September 23. It will reopen on November 4.

Mass/New Hampshire spawning closures, this did have four samples, which is over the threshold, but the precision was not good enough to project, so the P value is far greater than 0.05. I think it was 0.11. This closed on the default date as a result of that which was September 23, and it will reopen on November 4. That is all I have today and I'm happy to take any questions.

CHAIRMAN KELIHER: Any questions for Renee? Dr. Pierce.

DR. PIERCE: Yes Renee, regarding the Period 3 overage, to what extent was that overage caused by that violation sited by the Maine Marine Patrol?

MS. ZOBEL: That number did not include the violation. That would be approximately an additional 50 metric tons.

CHAIRMAN KELIHER: Any additional questions? Mr. Train.

MR. STEPHEN TRAIN: Renee, I know normally we – well I don't know if it's Renee or if I should ask Pat – normally we will add any overage to the following year or it will come off the quota, but if we know we have an overage from a violation, shouldn't that be added in now?

MS. ZOBEL: I believe the state of Maine, I've seen a letter that has been submitted to GARFO to request that to happen as soon as possible. I don't know if NOAA Fisheries wants to speak to that.

CHAIRMAN KELIHER: We do have a letter that is submitted, it was part of the supplemental. We have not heard back, but I know Ali, do you have any comments?

MS. ALI MURPHY: I got an e-mail update this morning. I think we're still trying to figure out exactly how to account for that in our monitoring. But we will be accounting for that in our projections, and we're looking for a way to build that overage in. More to come, but we're working on it.

CHAIRMAN KELIHER: Great, thank you for that. While your microphone is on, can you tell me time wise as far as any transfers from the Canadian fishery?

MS. MURPHY: We are working on that package as I updated folks on the days out call. We were routing it, kind of without numbers last week, because we were working with Canada to finalize those numbers. It's all set and ready to go, and fingers crossed in the next few days it publishes.

CHAIRMAN KELIHER: Great, thank you very much.

UPDATE ON THE DEVELOPMENT OF THE NEW ENGLAND COUNCIL GEORGES BANK SPAWNING PROTECTION DISCUSSION

CHAIRMAN KELIHER: Any additional questions for Renee, seeing none let's move right on to Item Number 5, which is an Update on the Development of the New England Council Georges Bank Spawning Protection Discussion, and Deirdre Boelke is here to give that presentation. Thank you, Dee.

MS. DEIRDRE BOELKE: Good morning everyone, my name is Deirdre Boelke; I work on the New England Council staff. I am the Plan Coordinator for the Atlantic herring fishery management plan, so I'm happy to be here. I was talking with Kirby several weeks ago about this section of your meeting, and we thought it would be helpful if I came, since it's not that far away from our office in Newburyport to update you on where the New England Council is with this topic.

We know this is very important to this Commission; you've discussed it over the years as well. I'm here to update you about where the New England Council is, and kind of review some next steps. There is a draft report that was available in your materials that was provided in advance, and then I do have several slides that will just touch on that.

It's a lot of information. I'm going to be trying to go through it pretty quickly, so there is an opportunity for questions. I'm happy to stay after, because I will not have time. This is a pretty short agenda to really dig into the nuts and bolts of the report. But I will stay afterward if you would like to hear more.

Just to give you a little background. The New England Council did identify this as a priority for 2019, so we've been working on it really in the second half of the year. This was decided, we didn't want to fall behind. This was important to a lot of people, so we actually solicited a contract to help us fast track this topic. The Gulf of Maine Research Institute was the Successful Award went to them in May, and we've been working with Dr. Graham Sherwood, Ashley Weston, and Aaron Whitman; three staff from GMRI. It has gone very well, and they've been working over the summer, and then really kind of working on the analysis. Then this fall we've been working through out Council and Committee and PDT to finalize the report.

The scope of this work really, was to review the historical and current scientific research and other relevant info about offshore spawning of Atlantic herring. It was very general, and the report probably in the end will be about 75 pages. There are a lot of figures, a lot of analysis is included in it, and this work was brought to the Plan Development Team for the Council in August.

Then subsequent meetings with industry advisors and our Herring Committee, more recently the Council got a draft report in September, and since then the report is pretty much almost finished. We'll be bringing it back to the New England Council in December, but we're just kind of polishing it, so that will be on track to be completed this year.

The Council, just to let you know, did initiate an action – I'll talk about that at the end of the presentation – for next year, to work on a measure to protect Atlantic spawning of herring offshore. The brief outline of the report itself, the first few sections are not complete in the report that you received.

They are more complete now, but there is going to be some helpful background information about what we do know about spawning of Atlantic herring, the different management actions that have been considered over time. There is also some information from other regions, and other spawning information that we can learn about other measures that are used locally, as well as abroad.

But really the core of this analysis was to try to bring all the data together, really look everywhere, see what we could find, and these researchers from the Gulf of Maine Research Institute did that for us. The idea was to see if when all the data sources were put together there was any kind of consensus or general area, any trends that we could find.

It's essentially a mapping project, taking all this information, putting it into GIS, and producing different figures of this data. The main sources are on the screen. There were six different datasets that were analyzed. The first was a very extensive dataset from Maine DMR, and Massachusetts DMF have been collecting portside data, as you know very well at this table, for many years.

All of that information was reviewed for just the offshore regions, so not including Area 1A. All the other regions were kind of evaluated for the GSI values and the maturity stage of Atlantic herring portside. As well the Northeast Fisheries Science Center also has an extensive database of bottom trawl information, as you know.

That was reviewed for any information about maturity of herring. The third dataset was larval, tows have been taken in this region for many years, and those were reviewed specifically for small herring larvae, very tiny less than 9 millimeters. The diet database, we also evaluated to look at fish stomachs that the Northeast Fisheries Science Center keeps. They evaluate kind of the contents of stomachs, and that was investigated to see if there were any records of herring fish eggs. Finally, herring EFH, we do know, you know have a sense of where the herring EFH important areas are offshore, so that was evaluated.

Finally, there are some historical maps and information and we looked at those figures to see if they were kind of jiving with our more updated information. This group also interviewed industry stakeholders, a few less than 10 individuals were interviewed to share their ideas about where there may be spawning areas offshore, and any other input they had about this topic.

Then finally, which is useful for this Commission, the Plan Development Team, which by the way includes the entire Commission Technical Team, discussed possible research recommendations. We're aware that there are some funds that the Commission has set aside to help support this work, and so there are some recommendations at the end of possible ways to survey and support this topic.

I'm not going to go through this in detail, but just to let you know this gives you a feel for the extensive amount of data that was available and included in this report, over 50 years of information, thousands and thousands of fish and tows completed from these various sources, were all combined in this analysis, and this just gives you a sense of the richness of this information.

I have one slide for each of these topics, just to give you a feel for the information that's included in the draft report, starting with the Maine DMR portside data. The Massachusetts data as I mentioned was also reviewed, but it is not as long, so we'll just show you the Maine DMR as an example here.

Over the last several decades over 17,000 fish have actually been measured for their GSI level, and that is what is mapped on the screen. You can start to get a sense of the core places where the more mature spawning fish are showing up, the ripe and running herring you see kind of along the northern edge of Georges Bank, and kind of these two nodes, as well as a little bit south of Rhode Island as well.

There was so much data there we were able to break it out by month, which was very informative as well. This is a heat map of all the different GSI values for a particular year, the mean GSI by month. It's pretty clear that September and October, those are the dark red, very consistently year after year; this is when the GSI values are highest in the fish that have been observed portside.

Moving to the trawl data, again similar story, a lot of data, in this case over 46,000 records. You'll see the dates are a little bit shorter. That's because this is when in the late eighties the Science Center expanded their bottom trawl survey to include maturity of Atlantic herring, not just numbers and weights.

The maturity stage is what's being mapped on the figure on the right, and it's really again the ripe plus ripe and running stage for Atlantic herring. Similar kind of along the northern edge of Georges Bank and this is again over time. We also looked at these, breaking it out over a decade, so really interesting information over time. The third dataset is the larval tows that I mentioned, again very similar story, again a lot of data so we were able to break it out by year, and also looked at this by season.

But 13,000 tows are in this dataset, but then you can get down to the very small herring larvae, and the over 2,000 tows is what's shown in the figure. Again, in similar places, so we are seeing this trend. This is not a surprise. I think this is what people would have expected, but it's nice to see all of this data in agreement.

The months that were the highest frequency of this small herring larvae were October and November, again what you would expect. The food habits database, again this is a huge dataset, not maybe as fruitful as some of the previous datasets, because really there was a small selection of animals that were found to have positive ID for herring eggs.

Really only 113 stomachs of fish out of the over 600,000 samples that are available, the species that did have herring eggs was mostly haddock, a few cod and pollock, and a few flounder and sculpin. The regions where those 113 are in the blue squares on the screen, and you know this is maybe not as weighted as the other datasets that were previously shown, but again similar kind of pockets of where this is being observed.

Not really surprising that it's so few, it's pretty hard I've heard to identify fish eggs in a fish's stomach, they break down pretty quick. But still we wanted to kind of include everything that was available. The New England Council is involved in essential fish habitat, and we are required to have maps and descriptions for places where we believe essential fish habitat is by species and by life stage.

We looked at specifically herring eggs, and the blue ten minute squares on the screen, this is the original definition of herring eggs, and this was used in this an analysis, rather than the more updated version, which is a bit more expanded, including other sources. The researchers felt that this was the best depiction of really where the herring eggs are expected to be, so this is what was used for that layer.

Finally, the historical spawning grounds as I mentioned there are a few different datasets available here and figures, but this is the one that was selected to give a sense of historical view of Atlantic herring, where we think spawning occurred. This is from some work, Olsen et al in 1977, and was later produced in some maps that were used for petroleum interactions offshore, so the dark red. Some of the other species are these other, displayed differently, but the dark red patches is Atlantic herring, believed to be spawning important grounds.

Finally, all of these different datasets were put together to try to build a consensus. The thought here is each one of those six datasets has a different color, and kind of the core areas from each have been displayed in this figure. The thinking of the researchers was to see where at least three of these different datasets overlapped as a starting point, maybe it should be two, maybe it should be four, but this was the approach taken so far is to see and highlight where three are overlapping. This was all presented to the Atlantic herring advisors and Committee in September. People really grabbed on to the fact that all this information was available, and started thinking about kind of two core areas here on the northern flank by the Hague Line, and then here kind of in the Channel. When you highlight those two boxes, again this is just really for illustration, nothing too specific yet, and try to think about how that overlaps with the herring fishery. That was the next component of this report.

We looked at fishing effort in a few different ways, this is just one example. Taking the last ten years and looking at where the fishery has been reporting their fishing locations, again you see some here in Area 1A, and then a few hot spots east of the Cape, and basically across the northern flank of Georges Bank.

But there isn't really too much overlap within these two core areas for spawning. There is definitely some here, and this varies by year. This is just an average of the ten years combined, but the report looks into it in more detail. Just to give you a sense of where these two boxes overlap with existing management areas, this figure is really just for reference.

Again, you have the dark black boxes, potentially where there is maybe more data agreeing for spawning, and then you have the original groundfish mortality closed areas in purple, and this dotted line is under review. Herring Amendment 8 in the Federal FMP is looking at a midwater trawl prohibited area on this dotted portion here, about 12 miles from shore, which extends out to 20 miles, which is again not approved yet.

But that is as proposed by the New England Council. This just gives you a sense, both of these happen to overlap existing habitat management areas in a solid line, as well as you know decently, heavily fished areas right outside in both cases so pretty diverse areas for widespread fishing, but in terms of herring not as much so.

The industry interviews, I just have one slide about this. Again the key takeaways—these were nice conversations that the researchers had—really was that spawning the industry felt was very variable, and it would be hard to pinpoint the exact time and location where you would be able to expect year-after-year spawning to occur.

The spawning condition of herring is relatively rare, people were saying from their experience, and their fishing efforts offshore, and really the data that we've looked at agrees with those sentiments. The histogram on the right is showing you that same Maine portside data, the GSI kind of in bins, getting to more ripe and running fish on the right.

This is from all of the fish over all of those years, 17,000 fish records, only 400 of them really are falling in this ripe and running portion over here. Really most of the fish observed, again this is landed by the portside program, are in these less mature phases to the left. Very much in agreement with what the data is describing as well.

Finally, the research recommendations are described toward the end of the report. There is some suggestions here about enhancing portside sampling, if we had more trips observed from the Georges Bank trips in particular there would be more information. There is more sampling in the Gulf of Maine, as you would imagine. It has increased over time, especially with the Massachusetts program coming online. But there always could be more. There is another suggestion to look at at-sea collection of this information; observers currently now are not documenting maturity of herring. It's possible that that could be a feasible idea moving forward, if people are interested in exploring that more.

Finally, a fishery independent survey would probably of course be the best way to see what's happening, not just where the fleet is fishing but everywhere across the resource. It would be more expensive, it would probably take several, and maybe five years the PDT is thinking, to really get a handle on the variability.

Those ideas are described, and the PDT just wants to remind everyone that the herring stock is at low abundance right now, compared to where it's been in the past. It may not be representative. What we're seeing right now may not be really where spawning happens normally. We need to kind of keep that in mind.

This is the initial highlights from the authors. Looking at all these different datasets it does point towards spawning in these two core locations. The data is also very supportive of September and October being the primary months to focus on. Spring spawning was reviewed through the trawl surveys, not seeming to be very important.

Very few records were found with spawned fish ripe and running. Right now the industry is interacting minimally with these grounds, a bit so more further east. The Plan Development Team recently had a conference call to update and review the more final report, and there were maybe a handful of things that the Plan Development Team would like the researchers to work on for the final report.

But after that as I mentioned, sometime in November this report should be finalized and presented to the New England Council at their December meeting, and would be available online for everyone else to use. The New England Council met in September, I'm almost finished here, and they did pass a motion to initiate a framework action to protect spawning of herring in Herring Management Areas 3, 2, and 1B, so everywhere outside of Area 1A.

This motion did carry unanimously, and it is part of a suite of other things the Council may work on next year. The Council is kind of in the middle right now of deciding what to work on next year. This is a process they go through every year. The five items on the screen are the things that potentially could be on the list for herring.

The Center has already committed to doing the assessment, which is the first one. There will be an updated assessment in June, so that is a definite. The herring specifications could be modified following that updated assessment for the next three years, again that is probably pretty much a definite that we would be working on that.

Numbers 3, 4, and 5 are kind of the potential things that would be worked on. The Herring Committee looked at those to date, and they have already provided input to the Council that they would rank this action on spawning above the others. That is the current input from the Herring Committee. Each individual Council member will now go through the process of thinking about what they think is important, and then finally at the December Council meeting they'll make this final decision. It appears, at least for now, that the spawning issue is the priority that would be added to the mix of things to be worked on next year. They have already had this motion from above that has been passed unanimously.

That basically starts the process, and the bulk of this work most likely would occur in 2020. In terms of the other topics, the mackerel related issues. If those get added it just might extend the amount of time that some of these things can take, if people want to try to work on all of them. I'm just trying to give you this background to give you a sense.

I know this is an important topic for the folks here, and the Council is working on it. Probably by the December Council meeting would be the most apparent, clear way that we'll know where we'll be with this topic. But for now the Council has definitely initiated this framework, and is starting work. I think that is all I have.

CHAIRMAN KELIHER: Deirdre that was a great update. I appreciate the Council's work on this, as a lot of good work has been done, and we look forward to seeing the final report from GMRI in December. Are there any questions from the Board? Dr. Pierce.

DR. PIERCE: Okay Deirdre, thank you for that. Would you be willing to speculate as the staff is involved in all of this? From what we've heard, from what we've read in that report that's been provided in draft form that the Council will be considering spawning closure protection in those relatively small blocks that were identified as a consensus spawning area.

With the potential to expand those areas, if indeed they should be expanded based upon the research that is going to be done following up with those recommendations made by the PDT. I'm kind of getting the impression that is where we're going, and just curious as to whether you might have the same perspective, or something different.

MS. BOELKE: Sure David, I've worked at the Council long enough never to speculate about what they'll do. But I'll humor you, since this is your last meeting. Yes. The Herring Committee was headed in that direction, and they highlighted those boxes as kind of direction, initial direction to the Herring PDT, as well as some sort of potential expanded type of approach.

As you know, when that got to the Council table the thought was, well before we get too specific let's see the final report, see where things are headed. I crystal ball, yes, the action will likely include several alternatives, because they always do. It probably will start with where that report finished, and probably some expansions.

There were lots of other conversations though about, well what gear types are we talking about? Is this just the herring fishery? Are there other fisheries included? We need to really spend more time looking at some monthly impacts on the fishery. You know it might look one way when it's the entire year, but quite a different story if you're just looking at the fall and things like that.

We definitely have a bit ahead of us, in terms of really knowing what the universe of alternatives may be. Peter Kendall is here, the Chair of the Herring Committee, if he wants to add anything else about his predictions of where the action will go, since he gets to help craft that more than I do. But I think people should feel comfortable that there will be likely a range of alternatives, similar in spirit of what we've seen so far, I would imagine.

CHAIRMAN KELIHER: I have a feeling we might be doing a lot of humoring of Dr. Pierce as the week goes along. Ritchie White.

MR. G. RITCHIE WHITE: Great report, a lot of data that you've given to us clearly. I could use a little humor on the answer to this question. If this is chosen for high priority, what is the best-case-scenario timeline that this could be implemented?

MS. BOELKE: Thank you for asking that question, because I meant to mention that during my slides and forgot to. If the Council really seriously starts Council PDT working on this with the Committee, most likely after the priorities discussion in December, you know we would really get going in January, in reality.

It would take probably at least one Council cycle to look at the alternatives, another Council cycle to look at the impacts. You know best case scenario, we could have a final action in June. I think that's pretty aggressive, from some of the issues that have come up. But even if they take final action, you know through the federal program, there are still lots of review that happens later.

I did want to make it clear today that even if we have a package by June, and the Council takes final action on it, it would not be in place for that fall spawning season in 2020. I think people should hear that and appreciate that to kind of manage expectations. If it went as normal, even under a good scenario, people should think more not in place by fall.

CHAIRMAN KELIHER: Any additional questions for Deirdre? I'm conscious of the time here, we've got about 20 minutes left for this time slot for the Board. Doug Grout.

MR. GROUT: Just a quick question, Deirdre. The work that GMRI did was well above what I expected there was that kind of data for. I was kind of curious; do you think something similar could be done for the Gulf of Maine by them, if somebody was to contract them to do it? Do you think they have the information up there?

MS. BOELKE: Sure, so the datasets that they've focused on so far have not included Area 1A for the most part, but those obviously exist. I have spoken about this with them briefly, just as a curiosity myself, and yes all of these data do exist for Area 1A as well. I'm sure if someone was willing to pay for it they would be interested.

CHAIRMAN KELIHER: It never takes long for money to come up. Are there any additional questions?

REVIEW AND SET THE 2020-2021 FISHERY SPECIFICATIONS

CHAIRMAN KELIHER: Seeing none, let's move on to Item Number 6, which is Review and Set the 2020-2021 Fishery Specifications. This is a final action, and Kirby has a few slides on this.

MR. KIRBY ROOTES-MURDY: As Deirdre has mentioned, the Council approved Framework 6 in June of this year. That contains 2019 to 2021 specifications, and a new overfishing definition consistent with the 2018 benchmark assessment, because they incorporated that information it required them to go through a framework process. The framework has been submitted to National Marine Fisheries Service for review, and it proposes a lower catch limit for Area 1A sub-ACL for 2020 and 2021.

It would decrease to 3,344 metric tons, based on the ABC Control Rule proposed in Amendment 8, so that is approximately a 23 percent decrease from 2019 levels. In terms of other key specifications that were approved as part of Framework 6 by the Council, the management uncertainty buffer was set at 4,560 metric tons.

Previously it had been set at 6,000 metric tons, and just as background, this management uncertainty buffer is the difference between the ABC, the acceptable biological catch, and the ACL, the annual catch limit. It was set at this new level based on ten years-worth of data from the Canadian catch.

Basically we take the information that comes out of the Canadian, New Brunswick weir fishery, and that is accounted for through this management uncertainty buffer to ensure that it doesn't cause the total catch combined plus U.S. catch to go over the ABC. The Border transfer was set at 100 metric tons, basically this applies to fish caught in Area 1A by U.S. fishermen that is transferred to Canada via a Canadian carrier.

The fish must be for human consumption, and until 2019 it had been set much higher, at about 4,000 metric tons. In terms of specific to the sub-ACLs, Area 1A was apportioned 28.9 percent of the ACL. It also maintained the seasonal sub-ACLs, so for Area 1A, 0 quota would be attributed to January through May, and 100 percent from June through December.

The 2021 specifications will likely be revised, based on the 2020 Stock Assessment Update that would be completed next year. The target implementation date for this framework and these specifications is January 1. With that I'll take any questions for this portion of my presentation.

CHAIRMAN KELIHER: Are there any questions for Kirby? Seeing none, continue.

MR. ROOTES-MURDY: All right I'll continue on to Area 1A Specifications. What this Board typically does is approve specifications as recommended by the New England Fishery Management Council, as well as a motion to allocate how that sub-ACL for Area 1A will be divvied up, either seasonally, by trimester, or bimonthly, then also specifying that the fishery would close when 92 percent of the seasonal period quota has been harvested, and that any underages would be rolled into subsequent allocation periods.

Now a decision point for this Board today is because Framework 6 has not been approved by NOAA yet, this Board could similar to last year punt, and deal with the actual specifications in February of next year, or you could choose today to set them as approved by the Council, understanding they may be adjusted for any overages that occur this year.

That aside, this Board still needs to set the allocation of the 2020 Area 1A sub-ACL at this meeting today. As a reminder, per Amendment 3, the Board can consider distributing the sub-ACL using bimonthly, trimester, or seasonal quota periods. The Board can also decide whether quota from January 1 through May 31 would be allocated to later in the fishing season. Just as a reminder, this is how we had the quota allocated this year. Basically we had a four bimonthly quota period, first period was June, that was rolled into July, which is part of Period 2, which has July and August, and then there is Period 3, September-October.

Period 4, November through December, and the approximate allocations are on the screen. There are other options, in terms of divvying up the quota. These are all laid out in the Amendment. I want to make clear though that if there is an interest in coming up with a different allocation scheme than what is laid out in Amendment 3, that would require an addendum.

Again, decision points today, whether to set the sub-ACL for 2020 and then the need to allocate that sub-ACL throughout the fishing season. The other thing that can be considered that Renee talked about earlier in her presentation today was the management tools that are currently in the tool box.

Current tools include landing days by permit category, weekly landing limits, the use of carriers for Category A permits during June through September, and landing days only for October through December. Making any changes, adding you know new tools to that tool box would also require an addendum. With that I'll take any questions.

CHAIRMAN KELIHER: Any questions for Kirby? Dennis Abbott.

MR. DENNIS ABBOTT: With the lower sub-ACL has anyone done the math as to what the divisions of tonnage would be per bimonthly period at this time?

MR. ROOTES-MURDY: I have not, and I don't believe anybody else has off the top of our head.

MR. ABBOTT: Low?

CHAIRMAN KELIHER: I think low was the accurate description, yes. Are there any additional questions? We do have the task of allocating the Area 1A sub-ACL through the fishing season, or is there interest in waiting on that to see what the Council action is going to be? Oh, we have to set that one today.

We can either bimonthly or make a change. I do know there were a lot of comments in regards to concerns with the bimonthly over this season versus the normal process of using trimesters. I don't know if anybody else has had comments of that type made. Mr. Train, do you have a question?

MR. TRAIN: I have a motion, but I don't know if we need to set the quota before this comes in. I'm not sure where we are in the ABC category here in order. What is it you need now, and would the motion for an addendum be in place now or after we set?

MR. ROOTES-MURDY: As mentioned before, typically at this meeting the Board would approve the specifications as recommended by the New England Council. Because they have not been approved by NOAA Fisheries yet, this Board could wait to approve the sub-ACL that total ACL, until February, or today you could move to approve the 2020 specifications as recommended by the Council. That is something that could be decided today, or moved on. What has to be decided today is how you divvy up the quota, the sub-ACL for the 2020 fishing season. That is laid out in Amendment 3.

CHAIRMAN KELIHER: Steve, do you have a follow up on that?

MR. TRAIN: Not so much a follow up, but I hate making decisions based on not all the information. I understand we normally do it, but I think we should wait. We haven't got all the info. Then I think by the time we have all the info, we could have another tool. I guess I could move to initiate an addendum. If we're not out of time series order on this I'll make it now.

CHAIRMAN KELIHER: We need to deal with setting the periods first. Then based on that if you're interested in an addendum to address additional tools in the toolbox, you could make that after we finalize the process in which we're going to move forward with. He showed a slide with several options on how to proceed. We could mirror what we did last year, which is bimonthly periods, or we could go back to trimesters as we've done in the past. Doug Grout.

MR. GROUT: Realizing that we may initiate an addendum to try and put more tools in the toolbox, what I would suggest is that I have a motion to try and put some specifications in for now, until such time as we decide on this potential addendum that we're moving forward with. Essentially what it would be is to mirror what we did last year. If you would like me to read that motion into the record I would be happy to do that.

CHAIRMAN KELIHER: Why don't you go ahead and do that Doug.

MR. GROUT: Okay, I move to allocate the 2020 Area 1A sub-ACL bimonthly in a manner consistent with the options in Table 5 in Section 4.2.3.2 of Amendment 3 that is labeled no landings prior to June 1, with June as a one-month period. This results in the following distribution: Period 1(June), 16.4 percent, Period 2(July/August), 40.1 percent, Period 3 (September/October), 34 percent, Period 4 (November/December), 9.5 percent.

The fishery will close when 92 percent of the seasonal period's quota has been harvested, and any underages from one period may be rolled into the following period. If you're looking for the wording of that I can either e-mail it to you, or you can pull it up from last year's meeting and just change the year on it.

CHAIRMAN KELIHER: I think Max is pulling that up now. While he is finalizing that is there a second to that motion? Everybody wants to read it first.

MR. GROUT: I would add one other word after bimonthly and put periods in a manner consistent with the options.

CHAIRMAN KELIHER: All set, Doug?

MR. GROUT: Yes.

CHAIRMAN KELIHER: We have a motion on the Board. Has everybody had a chance to review the motion? Do we have a second for that motion? There is no second for the motion. It fails for lack of a second. Does anybody want to take a different shot? Dr. Pierce.

DR. PIERCE: Yes, I don't believe that the bimonthly approach was that useful. I believe it presented difficulties regarding monitoring the fishery and making decisions about opening and closing. I appreciate the fact that we used the bimonthly approach this year, however I wasn't satisfied with the bimonthly approach, and neither were a lot of individuals who had to live with that particular approach, in terms of opening and closing fisheries, cutting the number of days. **I would make a motion to return to the trimester approach, using the previously established trimester allocations**.

CHAIRMAN KELIHER: We have a motion by Dr. Pierce, do we have a second? We have a second from somebody way down in the end, from Joe, thank you. We have a motion and a second, discussions on the motion while it's being typed. Doug Grout.

MR. GROUT: Dr. Pierce, does this include the aspects of rollover into subsequent periods? Does it also include the aspect that we normally don't open the fishery until June 1, or are you intending to have it open January 1, because without that kind of details in the motion the fishery opens January 1?

DR. PIERCE: It would include the same provisions, the same details that we used when we had the trimester approach, which would mean we're not starting January 1, it would be the June 1 date, so as not to complicate matters and go back too far in time, where it didn't work very well. I believe this procedure worked well. Not everyone might agree with it, but I still believe that it's more favorably considered by the industry, and certainly by me.

CHAIRMAN KELIHER: Thank you, Dr. Pierce. Doug, is your concern about the ability to start with zero landing days to move fish later into the summer, because we would still have that ability under the trimester approach?

MR. GROUT: No, my concern was that I wanted to make sure it was clear, because when we set the trimester approaches we had more details in the motion. One of the aspects was that the fishery would not start until June 1, and without that it starts January 1.

CHAIRMAN KELIHER: Toni.

MS. TONI KERNS: David, if it was your intention to do it as we had in the past, I could help you out with some percentages and some language, if you need it.

DR. PIERCE: Yes Toni, I would appreciate that. I haven't got that information readily available.

MS. KERNS: We'll put it up on the board for you, and then you can read it.

CHAIRMAN KELIHER: Not to put words in your mouth David, does that cover what you were trying to do, as well as the seconder, Joe?

DR. PIERCE: Those were the right words in my mouth.

CHAIRMAN KELIHER: Good. I'll read it into the record. This has been approved and agreed upon by the maker of the motion and the seconder. Move to allocate the 2020 Area 1A sub-ACL seasonally with 72.8 percent available from June through September and 27.2 percent allocated from October through December.

The fishery will close when 92 percent of the seasonal period's quota has been harvested and underages from June through September may be rolled into the October through December period, motion by Dr. Pierce, seconded by Mr. Cimino. Are there any questions or comments on the motion? Mr. Train.

MR. TRAIN: For the same reason I didn't second Doug's motion, as I was trying to get clarification on whether if this passes will it preclude us from using any other tools we put in the toolbox if we do, at our May and June or July meetings?

CHAIRMAN KELIHER: That would not happen. If we initiate an addendum, the addendum passed and the Board voted in the affirmative, those tools would be available to the Board. Is there any additional, Eric Reid.

MR. ERIC REID: Are we going to roll over if there are any underages, or are we just going to think about it? This says we may roll it in. Are we going to roll it in or are we going to have to talk about it and then the season will be over before we make a decision? Should it be shall be rolled over or how is that going to work?

CHAIRMAN KELIHER: Toni.

MS. KERNS: It does roll every time. If you want to change the word to shall we can, but we have previously in the past if there has been something left over it automatically rolls over.

CHAIRMAN KELIHER: We have potentially another perfection that needs to be made here along with that one.

MR. ROOTES-MURDY: Dr. Pierce, just so you're clear. With this motion we don't often have definitive information saying that we're at 92 percent of the quota period, we go off of projected harvest, so we just want to make sure that that is clearly understood, and we can modify this motion to make sure it says projected harvest. Is that fine by you?

DR. PIERCE: That's fine by me if that's the way we've already done it, I assume that would be the case again.

CHAIRMAN KELIHER: Is that all right with the seconder of the motion, Joe is good? Do we need to add the word? Doug.

MR. GROUT: I believe the way we've done it in the past, and I'll let Renee clarify this or not, was that the final 95 percent is when it's projected. But is it that the 92 percent is when we reach it?

MS. ZOBEL: This has been a point of contention in the past. From a procedural standpoint, projected to be harvested would give us more control to not have an overage in a trimester.

CHAIRMAN KELIHER: There is adding "projected" and then "shall", from "may" to "shall" that has been brought up by Eric Reid. Is that also okay by the maker of the motion and the seconder? We've got heads nodding. Max, if you could change that as well. This is a final action so this is a roll call vote. I'm going to read the motion one final time, since we've perfected it. Before I do are there any additional questions? No need to caucus, I'm assuming, seeing none.

Move to allocate the 2020 Area 1A sub-ACL seasonally with 72.8 percent available from June through September and 27.2 percent allocated from October through December. The fishery will close when 92 percent of the seasonal period's quota has been projected to be harvested and underage from June through September shall be rolled in the October through December period. Motion by Dr. Pierce, seconded by Mr. Cimino, it's a roll call vote, Kirby.

MR. ROOTES-MURDY: I'll go down starting with Maine.

SENATOR DAVID MIRAMANT: Yay.

MR. ROOTES-MURDY: New Hampshire.

MR. GROUT: Yes.

MR. ROOTES-MURDY: Massachusetts.

MR. RAYMOND W. KANE: Yes.

MR. ROOTES-MURDY: Rhode Island.

MR. REID: Yes.

MR. ROOTES-MURDY: Connecticut.

DR. JUSTIN DAVIS: Yes.

MR. ROOTES-MURDY: New York.

MS. MAUREEN DAVIDSON: Yes.

MR. ROOTES-MURDY: New Jersey.

MR. JOE CIMINO: Yes.

MR. ROOTES-MURDY: New England Fishery Management Council.

MR. TOM NIES: Yes.

MR. ROOTES-MURDY: National Marine Fisheries Service.

MS. ALI MURPHY: Abstain.

CHAIRMAN KELIHER: Motion passes 8 in favor with 1 abstention and no null votes. All right Kirby, where are we then on the agenda? Mr. Train, do you have a motion that you were planning on making?

MR. TRAIN: If it's time, yes I do.

CHAIRMAN KELIHER: Unless there is additional questions I think now is the time.

MR. TRAIN: I think you may have a copy of it already if you want to put it up, and I would be happy to read it if you would like. That looks like the right one. **I move to initiate an addendum to expand the quota period options in Amendment 3 by adding options which address challenges experienced in low quota scenarios (frequent starting and stopping of fishing days, small amounts of quota left at the end of the year).**

The addendum should include, but does not have to be limited to, an option which allocates 100 percent of the Area 1A quota to the months of June-December. The addendum should also consider expanding the Small Mesh Bottom Trawl Fleet Days Out provision to all Category C and D permits.

CHAIRMAN KELIHER: Motion by Mr. Train, do we have a second? Second by Doug Grout, would you like to give any further information on the motion?

MR. TRAIN: I'll try to be brief. As Commissioner Pierce pointed out the start and stop fishery isn't good for anybody, and this would allow us to consolidate the fishery into a shorter time period and make it more efficient.

CHAIRMAN KELIHER: Ritchie White.

MR. WHITE: I certainly support this motion. You can see right now we presently have 295 metric tons left for the last period this year, which makes no sense at all. This would give us the ability to address a situation like that.

CHAIRMAN KELIHER: Are there any additional comments? Seeing none, I will quickly read the motion into the record. Move to initiate an addendum to expand the quota period options in Amendment 3 by adding options which address challenges experienced in low quota scenarios (frequent starting and stopping of fishing days, small amounts of quota left at the end of the year). The addendum should include, but does not have to be limited to, an option which allocates 100 percent of the Area 1A quota to the months of June-December. The addendum should also consider expanding the Small Mesh Bottom Trawl Fleet Days Out provision to all Category C and D permits, motion by Mr. Train, seconded by Mr. Grout.

Are there any objections to the motion? Seeing no objections the motion passes without objection, thank you. Is there anything else under Item Number 6, seeing none?

UPDATE ON MAINE ENFORCEMENT EFFORTS

CHAIRMAN KELIHER: Item Number 7 is an Update on Maine Enforcement Efforts. Major Beal, are you still in the room? Just not hiding any longer?

If you could have a seat at the public microphone, Major Beal is going to give a very brief update on the enforcement actions that we have dealt with in Maine pertaining to Atlantic herring. I just want to reiterate before he does that that there are many things that he will not be able to answer questions on, because there is still some ongoing investigative activity associated with this case. Major Beal.

MAJOR ROB BEAL: Thank you and good morning. I'll tell you that I'm a little nervous in being here, because I hear about the length of my probation on a daily basis from Commissioner Keliher.

MR. KELIHER: It may be longer, depending how you do.

MAJOR BEAL: Yes sir. As the Commissioner mentioned it's an ongoing investigation. It was essentially a one-month investigation to the herring fishery, with some oversight between Portland and Rockland Harbors. The investigation as a whole resulted in about eight charges, mainly targeted at one fishing vessel, the Western Sea.

We ended up with three DMR hail violations, three violations for exceeding the 160,000 pound weekly landing limit, and then we also had a wholesale dealer that was failing to report, and was also in violation of holding any herring permit. At the end of it, from just a single landing date, a single trip for September 8 and 9, we seized approximately 140,000 pounds of fish. That is generally the condensed version of our effort in Maine.

CHAIRMAN KELIHER: Thank you, Major Beal. Are there any questions to the Major? Dr. Pierce.

DR. PIERCE: I'm not sure if the Major can handle this one, but I'll ask anyways. But first of all, disappointed in the actions of the owner of the Western Sea, I've got great respect for him, worked with him for many years, so this was a great disappointment to me in terms of what has happened allegedly.

What are the choices or the options for penalties that would be considered, if indeed this moves forward and the operator is found guilty of this rule violation, monetary fine, suspension of permit? I know in my agency I'm rather liberal. Well I shouldn't say liberal, I tend to suspend permits or revoke permits, because these are very significant violations impacting the good work that we do as a Board. What is the nature of the penalties that might be used?

CHAIRMAN KELIHER: Thank you for that. These are all civil violations in the state of Maine under our civil codes. The fines are fairly minor, frankly. Major, you can remind me what the range of the fines are for those.

MAJOR BEAL: Yes, as the Commissioner mentioned they are all civil offenses, and the fine caps at $500.00, pretty insignificant.

CHAIRMAN KELIHER: The major penalty will come from license suspensions. There are three individuals who will go through that process. We are still in the process of determining whether that will be through our administrative process or suspensions after a conviction, two very different processes that we have in Maine.

A final decision has not been made, and a recommendation has not been made by Maine Marine Patrol yet, but we can suspend any and all licenses. We could take lobster licenses associated with this case too, and because of the severity I'm sure the Patrol will be considering those types of recommendations before they come to my office. There is also cooperation with NOAA OLE on this, so there could be additional actions taken by NOAA as well, in regards to permits. Are there any additional questions, Ritchie?

MR. WHITE: I have a comment. Do you want questions, or are comments appropriate? First I would like to commend the state of Maine for taking such an action. My understanding is it was quite a major effort to do this. The size of this overage in these low quota era is substantial, and I think brings great concern to the amount of law enforcement and/or regulations we have in place.

There are many rumors circulating around in the fishing industry that this was not a onetime event in the industry, not saying for this vessel. My suggestion would be that we send to the Law Enforcement Committee a request to do a white paper to analyze all our existing law enforcement efforts.

Then for them to look at whether we need anything additional from a regulatory standpoint or whether there needs to be some new initiatives or additional efforts to make sure this doesn't happen again going forward. There is some possible money available if states did need some additional resources to carry out any big efforts.

I talked to the Director and we do have Plus-up money for Area 3 spawning protection research, which we probably will not need now. He said it would be appropriate that we could use some of that money towards herring enforcement if that was needed, so that would be an additional tool that the Law Enforcement Committee could look at. That would be my suggestion, Mr. Chair, and I would make a motion if that's necessary.

CHAIRMAN KELIHER: I'm not sure it will be necessary. Are there any thoughts or comments on the points that Ritchie is bringing up? Basically if I understand it, Ritchie, it's just to remand this back to the Law Enforcement Committee to have them review practices and procedures associated with herring enforcement, correct? You suggested a white paper. Do you think we need to be as formal as a white paper, or could it just be a report back to this Committee?

MR. WHITE: Whatever Law Enforcement, whatever method they would deem to report back to us.

CHAIRMAN KELIHER: The Chair of the Law Enforcement Committee was whispering in my ear; "A report back would be great." I'm not sure we need a motion on this. Are there any objections to having Law Enforcement Committee review practices and procedures associated with herring enforcement? Seeing none, we'll make sure that that is brought to the Herring Committee for further discussion. Thank you for bringing that up.

Are there any additional questions or comments for Major Beal? If not Major, you can take one month off your four-year long suspension. Not suspension, excuse me. It was almost a suspension, probation. Just one of those slips that is probably more accurate when I say it. Thank you.

ELECT VICE-CHAIR

CHAIRMAN KELIHER: Item Number 8 is an election of Vice-Chair, this is an actionable item. We have a hand up, Dr. Pierce.

DR. PIERCE: I think as most people know I am retiring, therefore I cannot take on the role of Chair at our next business meeting. I just have a suggestion to make for consideration by the Board, and that is to have as my replacement, so to speak, a member of my staff who frankly does all the hard work on sea herring at this time, and has for quite a long time that is Dr. Catherine O'Keefe, known as Cate.

Cate is in the audience. Cate is a member of the New England Fishery Management Council Sea Herring Committee, acting as my proxy. She has been, I think, Maine and New Hampshire representatives. I thoroughly understand she has been involved in all the calls related to sea herring days, and other issues related to sea herring management at the Interstate level**. I would just make a suggestion to you, Mr. Chairman that instead of me as I depart that Dr. Catherine O'Keefe should be elected Vice-Chair.**

CHAIRMAN KELIHER: We have a nomination of Catherine "Cate" O'Keefe, who did not run out of the room at the suggestion. Eric Reid, Eric Reid has seconded that nomination. Any questions or comments on the nomination, now is your chance to get your digs in on Cate. Are there any objections, seeing none congratulations, Cate.

ADJOURNMENT

CHAIRMAN KELIHER: That brings us to other business. Is there any other business to be brought before the Herring Board? Seeing none, a motion to adjourn would be in order. Several motions to adjourn, the meeting is ended.

(Whereupon the meeting adjourned at 9:52 o'clock a.m. on October 28, 2019)

Atlantic States Marine Fisheries Commission

Atlantic Striped Bass Management Board

February 4, 2020
11:15 a.m. – 3:00 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order (*D. Borden*)	11:15 a.m.
2. Board Consent • Approval of Agenda • Approval of Proceedings from October 2019	11:15 a.m.
3. Public Comment	11:20 a.m.
4. Consider Addendum VI State Implementation Plans and Conservation Equivalency Proposals **Final Action** • Review of Implementation Plans and Conservation Equivalency Proposals (*M. Appelman*) • Technical Committee Report (*N. Lengyel Costa*) • Law Enforcement Committee Report (*M. Appelman*) • Consider Approval of State Implementation Plans and Conservation Equivalency Proposals	11:30 a.m.
5. Lunch Break	12:30 p.m.
6. Consider Approval of State Implementation Plans and Conservation Equivalency Proposals, *continued*	1:00 p.m.
7. Review and Populate Advisory Panel Membership (*T. Berger*) **Action**	2:50 p.m.
8. Other Business/Adjourn	3:00 p.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW
Atlantic Striped Bass Management Board Meeting

February 4, 2020
11:15 a.m. – 3:00 p.m.
Arlington, Virginia

Chair: David Borden (RI) Assumed Chairmanship: 02/20	Technical Committee Chair: Nicole Lengyel (RI)	Law Enforcement Committee Rep: Kurt Blanchard (RI)
Vice Chair: Vacant	Advisory Panel Chair: Louis Bassano (NJ)	Previous Board Meeting: October 30, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, NMFS, USFWS (16 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2019

3. Public Comment – At the beginning of the meeting, public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance, the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Consider Addendum VI State Implementation Plans and Conservation Equivalency Proposals (11:30 – 2:50 p.m.) Final Action

Background

- Addendum VI was approved in October 2019. The Addendum reduces all state commercial quotas by 18%, and implements a 1 fish at 28” to less than 35” recreational slot limit for ocean fisheries and a 1 fish at 18” minimum size limit for Chesapeake Bay recreational fisheries. The Addendum also requires the mandatory use of circle hooks when fishing with bait to reduce discard mortality in the recreational sector.
- States may submit alternative regulations through conservation equivalency (CE) to achieve an 18% reduction in total removals relative to 2017 levels.
- State implementation plans, including CE proposals, were due November 30th and available in **Briefing Materials**.
- The Technical Committee met to review implementation plans based on technical merit. A TC memo with comments on specific implementation plans, analytical uncertainties, and caveats will be available in **Supplemental Materials**.
- The Law Enforcement Committee meets January 23rd to review state implementation plans and provide comment for Board consideration (**Supplemental Materials**).

Presentations

- Review of implementation plans and CE proposals by M. Appelman
- Review Technical Committee report by N. Lengyel Costa

• Review Law Enforcement Committee Report by M. Appelman
Board Actions for Consideration • Approve state implementation plans and conservation equivalency proposals

5. Lunch Break (12:30 p.m. – 1:00 p.m.)

6. Consider Addendum VI State Implementation Plans and Conservation Equivalency Proposals, continued (1:00 p.m. – 2:50 p.m.)

7. Review and Populate Advisory Panel Membership (2:50 p.m. – 3:00 p.m.)
Background • Bob Humphrey from Maine has been nominated to the Striped Bass Advisory Panel (**Briefing Materials**).
Board Actions for Consideration • Approve Advisory Panel nomination

8. Other Business/Adjourn

Atlantic Striped Bass

Activity level: High

Committee Overlap Score: Medium (TC/SAS/TSC overlaps with BERP, Atlantic menhaden, American eel, horseshoe crab, shad/river herring)

Committee Task List

- SAS/TC – various taskings relating to management response to 2018 benchmark
- TC – June 15th: Annual compliance reports due

TC Members: Nicole Lengyel (RI, TC Chair), Kevin Sullivan (NH, Vice Chair), Alex Aspinwall (VA), Alexei Sharov (MD), Carol Hoffman (NY), Charlton Godwin (NC), Ellen Cosby (PRFC), Gail Wippelhauser (ME), Gary Nelson (MA), Heather Corbett (NJ), Jeremy McCargo (NC), Jason Boucher (DE), Kurt Gottschall (CT), Luke Lyon (DC), Michael Kaufmann (PA), Peter Schuhmann (UNCW), Winnie Ryan, Gary Shepherd (NMFS), Steve Minkkinen (USFWS), John Ellis (USFWS), Katie Drew (ASMFC), Max Appelman (ASMFC)

SAS Members: Gary Nelson (MA), Alexei Sharov (MD), Hank Liao (ODU), Justin Davis (CT), Michael Celestino (NJ, Chair), John Sweka (USFWS), Gary Shepherd (NMFS), Katie Drew (ASMFC), Max Appelman (ASMFC)

Tagging Subcommittee (TSC) Members: Stuart Welsh (WVU, Chair), Heather Corbett (NJ, Vice Chair), Angela Giuliano (MD), Beth Versak (MD), Chris Bonzak (VIMS), Gary Nelson (MA), Ian Park (DE), Jessica Best (NY), Carol Hoffman (NY), Gary Shepherd (NMFS), Josh Newhard (USFWS), Wilson Laney (USFWS), Katie Drew (ASMFC), Max Appelman (ASMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC STRIPED BASS MANAGEMENT BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 30, 2019

These minutes are draft and subject to approval by the Atlantic Striped Bass Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Move to approve proceedings from August 2019** by consent (Page 1).

3. **Main Motion**
   Move to approve Option 2 under Section 3.1 for equal percent reductions (Page 20). Motion by Pat Keliher; second by Ritchie White.

   Motion to Table
   Move to table the motion to discuss the TC memo for conservation equivalency criteria (Page 24). Motion by Adam Nowalsky; second by Eric Reid. Motion fails (Page 25).

   Main Motion
   Move to approve Option 2 under Section 3.1 for equal percent reductions.

   Motion to Substitute
   Move to substitute to approve Option 3 under Section 3.1 for unequal percent reductions (Page 25). Motion by Eric Reid; second by John Clark. Motion fails (Page 30).

   Main Motion
   Move to approve Option 2 under Section 3.1 for equal percent reductions. Motion by Pat Keliher; second by Ritchie White. Motion carried (Page 31).

4. **Main Motion**
   Move to approve Sub-Option 2-A2 1 fish at 28-35 inches for Section 3.1 for the ocean fishery (Page 31). Motion by Justin Davis; second by Mike Luisi

   Motion to Amend
   Move to amend to include a conservation equivalency proposal to achieve an 18% reduction in total removals relative to 2017 (Page 35). Motion by Adam Nowalsky; second by Chris Batsavage. Motion carried (Page 37)

   Main Motion as Amended
   Move to approve Sub-Option 2-A2 1 fish at 28-35 inches for Section 3.1 for the ocean fishery. Conservation equivalency proposals are required to achieve an 18% reduction in total removals relative to 2017. Motion carried (Page 37).

5. **Move to approve Sub-Option 2-B1 1 fish at 18 inch minimum for Section 3.1 for Chesapeake Bay. Conservation equivalency proposals are required to achieve an 18% reduction in total removals relative to 2017** (Page 37). Motion by Pat Geer; second by Martin Gary. Motion carried (Page 38).

6. **Move to approve Option B, requiring mandatory circle hook regulations for Section 3.2** (Page 38). Motion by Ritchie White; second by Sen. Miramant. Motion carried (Page 41).

7. **Main Motion**
   Move that states submit implementation plans by November 30, 2019. The Board will take action on implementation plans in February, 2020. All provisions of Addendum VI must be implemented by April 1, 2020 (Page 42). Motion by Andy Shiels; second by Ritchie White.

INDEX OF MOTIONS (continued)

ATTENDANCE

Board Members

Patrick Keliher, ME (AA)
Steve Train, ME (GA)
Cheri Patterson, NH, proxy for D. Grout (AA)
Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Mike Armstrong, MA, Chair
Raymond Kane, MA (GA)
Rep. Sarah Peake, MA (LA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Jim Gilmore, NY (AA)
Maureen Davidson, NY, Administrative proxy
Emerson Hasbrouck, NY (GA)
Joe Cimino, NJ (AA)
Heather Corbett, NJ, Administrative proxy
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Andy Shiels, PA, proxy for T. Schaeffer (AA)
Loren Lustig, PA (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Mike Luisi, MD, proxy for B. Anderson (AA)
Russell Dize, MD (GA)
Phil Langley, MD, proxy for Del. Stein (LA)
Steve Bowman, VA (AA)
Pat Geer, VA, Administrative proxy
Bryan Plumlee, VA (GA)
Chris Batsavage, NC, proxy for S. Murphey (AA)
Jerry Mannen, NC (GA)
Mike Blanton, NC, proxy for Rep. Steinberg (LA)
Marty Gary, PRFC
Derek Orner, NMFS
Mike Millard, USFWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Nicole Lengyel, Technical Committee Chair
Kurt Blanchard, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Caitlin Starks
Katie Drew
Mike Schmidtke
Maya Drzewicki

Guests

Sen. Thad Altman, FL (LA)
Peter Anderson, Windham, NH
Robert Atwood, NH F&G
Sue Berditine, ASGA
Delores Bodhdan, Hamilton, MA
Kalil Boghdan, MA DMF
Ellen Bolen, VMRC
Robert T. Brown, MWA
Victoria M. Brown, MWA
Thomas Candee, Exeter, NH
Cliff Chadwick, Hampton Falls, NH
Brian Coombs, Medford, MA
Roy Crabtree, NMFS
Kelly Denit, NMFS
Paul Diggins, SB CBA
Lynn Fegley, MD DNR
Zack Greenberg, PEW Trusts
Bob Groskin, Teaneck NJ
Doug Grout, NH (AA)
Joe Gugino, Winthrop, MA
Doug Haymans, GA (AA)
Peter Jenkins, Saltwater Edge
Scott Klase, Bedford, NH
Aaron Kornbluth PET Trusts
Kris Kuhn, PA Fish & Boat
Arnold Leo, E. Hampton, NY
Carl LoBue, TNC
Charles Lynch, NOAA
Tom McKelvey, Floral Park, NY
Nichola Meserve, MA DMF
Chris Moore, CBF
Glenn Normandeau, NH F&G
Conor O'Donnell, NH F&G
Patrick Paquette, MSBA
Dale Pike, CCA
Nick Popoff, USFWS
Alesia Reed, NMFS
William Rice, PRFC
Zak Robinson, Portsmouth, NH
Cody Rubner, Acton, MA
John Satterly, VSSA
Kyle Schaeffer, ASGA
Mike Spinner, Stripers Forever
Lauren Staples, NH F7G
Michael Toole, Stratham, NH
Jack Travelstead, CCA
Karen Villone, NH F&G
Mike Waine, ASA
Jenni Wallace, NOAA
Megan Ware, ME DMR
Robert Weathersby, NH
Peter Whelan, CCA
Chris Wright, NMFS

These minutes are draft and subject to approval by the Atlantic Striped Bass Management Board.
The Board will review the minutes during its next meeting.

The Atlantic Striped Bass Management Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Thursday, October 30, 2019, and was called to order at 2:35 o'clock p.m. by Chairman Michael Armstrong.

CALL TO ORDER

CHAIRMAN MICHAEL ARMSTRONG: Good afternoon folks, I would like to call to order the Atlantic Striped Bass Management Board. I'm Mike Armstrong from Massachusetts, your Chair. Sort of how I would like to run it today, as we know there is only really one agenda item, so we should be done in half an hour, hourish.

APPROVAL OF AGENDA

CHAIRMAN ARMSTRONG: My intent is I would like to keep the discussion on point, very heavily on point. Speaking multiple times may not be possible. We'll do it that way. You have the agenda. Are there any changes that people would like to see, additions? Seeing none, we approve it by consent.

APPROVAL OF PROCEEDINGS

CHAIRMAN ARMSTRONG: You have the proceedings from August, 2019, any amendments, changes, edits? Seeing none, we approve that by consent.

PUBLIC COMMENT

CHAIRMAN ARMSTRONG: At this point we have public comment. I can't stress enough that again, we are going to use up every minute of the time we have, likely. I would like to keep public comments to no more than one minute, and remember it is about things that are not being discussed today, okay? Robert Brown.

MR. ROBERT T. BROWN: My name is Robert T. Brown, President of Maryland Watermen's Association. Thank you for giving me a chance to speak amongst this Committee. First of all I want to state that nobody has done nothing wrong recreational or commercial to get us in this problem with these dead discards.

However, I want to speak to you a second about MRIP, and the data collection they have. You know the sports fishermen or recreational fishermen are counting how many fish they've got in their cooler. But when they're catching fish they are not counting how many discards they have, and keeping an accurate count on them.

If they don't have an accurate count on it they could throw some of this off. Back in 2014, we had a reduction of 25 percent on the ocean, and 20.5 percent on the Bay. This was to rebuild our spawning stock biomass, but yet we're still having a downward trend. Why? Well you know we had more spawning stock there than what we did in 1982. It is conditions in the water more than likely, you know it could be the temperature, it could be the water quality. That is the reason why that is not working. Also, we didn't have a dominant year in 2012, 2013 to 2014 recruitment. Without that recruitment it's going to be less coming to the spawning reaches. To get those spawning stock back up, what we have is they adjusted the 2015. The final dominant class we have is only like four years old now, and at four years old it is just starting to get on our spawning ground. It will be three or four years before a majority of them are there.

We need to give a time for them to come of spawning maturity. I have one good news is on the Chesapeake Bay and on the Potomac River and all the rivers. We have a large amount of small fish. We have them anywhere from 6 inches on up to 23-24 inches, and a lot of those will be migrating to the ocean this year to help with that spawning stock. Mr. Chairman, I done as quick as I could for you.

CHAIRMAN ARMSTRONG: One minute, 42 seconds. But who's counting? Me. Mr. Weathersby, Robert Weathersby. Robert, you have written down you're talking about conservation equivalency, which is something we're going to talk about. If your comments are very general in nature, we would be happy to take them.

MR. ROBERT WEATHERSBY: Just so I'm clear, Sir. Should any comments regarding conservation equivalency be held until that portion of this meeting?

CHAIRMAN ARMSTRONG: If you think it's towards what we're going to be discussing that would be appreciated.

MR. WEATHERSBY: With that I'll hold my slot until that time, Sir.

CHAIRMAN ARMSTRONG: Eighteen seconds, thank you. Zak Robinson.

MR. ZAK ROBINSON: My name is Zak Robinson; I'm a guide here in the waters just outside the hotel actually, this is my home. My business is Rising Tide Anglers, I've been on this water for 17 years, and I built my business on catch and release. I know it can be done. I'm here to voice my concerns about a few things that were not included in this agenda. Conservation equivalency is in part, but I would like to see it eliminated.

A unified coastwide fishery management plan for striped bass would eliminate the guesswork in the lawmakers and the fisheries management efforts, and allow our stocks to rebuild. All states one rule. Something needs to be done about release mortality. Circle hooks are going to help. They will help. We need a really intense education for the public, not on just circle hooks, but also on fish handling and proper release techniques. Thank you for hearing my comments.

CHAIRMAN ARMSTRONG. Thank you very much. Peter Jenkins.

MR. PETER JENKINS: Hello, my name is Peter Jenkins, and I'm the owner of the Salt Water Edge in Newport, Rhode Island, and Chairman of the American Saltwater Guide Association. We are an association of guides, small business owners, and recreational anglers who believe abundance drives participation, and participation drives sales. The Association hosted a raffle to encourage the public to send in written comments. We didn't have to agree with opposition, just participate. We were shocked by the disappointing number of comments we received, and tried to explain why. We started late, we didn't communicate effectively, and fisheries policy is complex. When I saw the supplemental materials for this meeting, I saw you received just over twice as many comments as we did. That begged another question. The ASGA surveyed its audience to understand why the apathy of recreational anglers with regard to Atlantic States Marine Fisheries and striped bass.

Their concerns came back loud and clear, and boil down to a lack of trust. Comments like the process is broken, only listen to special interest, and waste of time. This was sobering, given the striped bass is the most important recreational gamefish on the east coast, and they represent over 9 percent of the fishing effort overall in the United States. In short, millions of anglers pursue striped bass, yet something like 1,037 took the time to comment.

Like many of you I was in Mystic, Connecticut five years ago tomorrow, and most of us thought we set stripers on the road to recovery. Since that day both the striped bass and public confidence in United States Marine Fisheries has declined. We regularly hear for the lack of funding for better science that I think of all the time and money spent over the last five years on meetings like this, and going on the road to solicit public comments.

All this for the results we have today. As you can see in the supplemental materials, a very clear message from the recreational community as the vast majority voted for very specific options, the possibility of misinterpreting the public's desires and the facts outlined in your own document. Today, any other outcome than those documented in the supplemental documents, would serve you to track as correct. Thank you for your time.

CHAIRMAN ARMSTRONG: Thank you, Sir. Kyle Schaefer.

MR. KYLE SCHAEFER: Hello, my name is Kyle Schaefer. I'm a fly fishing guide here in Kittery Point, just a little bit north of where we are today, also a board member for the American Saltwater Guide's Association. I'll be quick. You know it feels that we've managed striped bass for extraction, where we are now left with a stock that it's incredibly hard to make a living.

As somebody that's in this industry trying to make a living doing so, not to mention the recreational anglers that are now losing the opportunity to spend money up and down the east coast to pursue this fish. You know my point is concise that I would love to see this fishery managed for abundance, where all the stakeholders are kept in mind, and we are not managing this fishery to a point where we can no longer access it and use the resource. Thank you.

CHAIRMAN ARMSTRONG: Thank you. William Rice.

MR. WILLIAM RICE: Thank you, Mr. Chairman, William Rice; I'm senior member of Potomac River Fisheries Commission. I would like to be brief, but I want to speak to you about accountability in the Chesapeake Bay Region. We have made strides by leaps and bounds since we entered back into the striped bass fishery off the moratorium in this field.

We are totally accountable, totally transparent, and we can pretty much document each fish almost as it comes out of the water. This is something that we're extremely proud of. In the past 47 years I've been involved with fisheries management, going back into the early and mid-1970s, where maybe our resources didn't' get the respect that they needed, and maybe we didn't have the capabilities of the managing tools that we have before us today. It would behoove us now, setting around the table, knowing how we can identify our problems, especially one as such an importance as the striped bass, not to move away and maybe do something not as sensible, but to attack the problem head on.

Even though it might not be the most popular thing to do everywhere, but our fishery is extremely important to everybody, the commercial people, the recreational people, and even the folks that don't even own a boat that expect to go to the grocery store and buy a fresh striped bass fillet. I thank you very much.

CHAIRMAN ARMSTRONG: Thank you. That concludes our public comment.

CONSIDERATION OF ADDENDUM VI FOR FINAL APPROVAL

REVIEW OF OPTIONS AND PUBLIC COMMENT SUMMARY

CHAIRMAN ARMSTRONG: Let's move into Consideration of Addendum VI for Final Approval. The first item will be handled by Max for Review of the Options and the Public Comment Summary.

MR. MAX APPELMAN: We had a little correction in Table 1 of the document. The recreational harvest column in Table 1, some of those numbers were incorrect. Those have been corrected, and in the version that's in meeting materials it's corrected in there, but if you're looking at an older version of the document those numbers are reported incorrectly.

I have a presentation of the Addendum itself and the public comment summary, and I broke it off into two parts. I'll start with a very broad overview of the document itself and the options, and then if it's okay with the Board Chair we can pause then, take any questions on the document itself, before I move into the comment summary.

But as a reminder, I'll also be giving the Advisory Panel report. Then we have Officer Kurt Blanchard with us from Rhode Island, the representative for LEC for striped bass. He'll be going over the LEC report, and then the Board will be taking final action. A quick overview of how we got here and what this Addendum aims to do.

Remember the 2018 benchmark stock assessment came out earlier this year, and the results indicate the stock is overfished and experiencing overfishing, which triggered two different actions. This draft addendum, Draft Addendum VI was initiated to address overfishing, and to reduce fishing mortality to the target in 2020.

The other trigger, just a reminder that there is a motion that comes back to this board in February that would consider an amendment that could address a rebuilding plan, as well as a number of other potential issues that are on the table. That will be back to the Board in February. Back to Draft Addendum VI, specifically the Addendum aims to reduce removals that being total numbers of fish by 18 percent relative to 2017 levels.

To achieve that it's proposing reductions to the commercial quotas, as well as changes in recreational bag limits and size limits. Also because recreational release mortality is such a big component of total mortality, the Addendum is also proposing the mandatory use of circle hooks when fishing with bait. This is a figure showing spawning stock biomass relative to the reference points. The solid black line is the threshold, the dash line being the target. Also on this figure is the recruitment values, those are in millions of Age 1 fish on the right hand axis. The take home here is that SSB reached a peak in 2003, and it has been on this downward trajectory since then.

Dropping below the threshold in 2013, and the decline has been a little more steep in the later part of the time series, in part due to fishing rates, which I'll show you in the next slide, but definitely also attributed to the poor recruitment that the stock has experienced over the last decade or so.

But also of note there are some strong year classes, lately 2011 year class everyone is aware of, and then the 2015 and 2016 recruitment estimates were also very high, or above average I should say. There is a lot of small fish out there. This is the figures showing fishing mortality, again relative to the reference points.

We have the black line again being the threshold, and the dash line being the target. The take home is that the F rate has been above the threshold for a number of years, and this Addendum is trying to bring that rate down to the dash line, down to the target 0.20. Here we're showing the contributions of the different sectors to total removals.

This is all in millions of fish. The bottom two colors there, the blue is commercial harvest, the red is the commercial dead discards, and then in the green we have recreational harvest, and the purple or whatever color that is, is recreational release mortality or dead releases. Again that's the fraction of all the released fish, the live releases that are assumed to die.

The assessment uses a 9 percent value there to calculate that release mortality. The big take home is that this is predominantly a recreational fishery. In 2017, about 90 percent of total removals came from the recreational sector, also highlighting that the commercial sector those landings have been rather stable from year to year, largely from the quota system that's in place.

Now I'm honing in on the recreational release component of mortality. This figure is showing total catch from year to year, and that is all in tens of millions of fish on the left hand side, and then the red line going across the top of the figure is the proportion of those fish that are thrown back. The take home is that this is predominantly a catch and release fishery as well.

It's no surprise really that so much of the mortality is coming from recreational releases. To put some context to this, in 2017 it was an estimated 38 million striped bass were released alive, which resulted in 3.4 million dead releases, or 48 percent of total removals in 2017. Now I know I went through that pretty quickly, but now we're moving into the management program options themselves.

This is really the first decision that the Board will have today, and that's to decide on Options 1, 2 or 3. The first option is status quo. By selecting this option fisheries will continue to operate under the provisions of Addendum IV, keeping in mind that Addendum IV is not designed to achieve an 18 percent reduction, relative to 2017 levels. Options 2 and 3 are designed to achieve that reduction. They apply the reductions somewhat differently, depending on which option you select, and you can see commercial quotas tied to those, as well as a suite of bag and size limit combinations for the ocean and for Chesapeake Bay, which I'll dive into a little in my next few slides. This is Option 2. This is what we've been calling the equal percent reduction. Here both sectors are reduced by 18 percent, so in proportion to what the landings were, what the removals were in 2017.

On the commercial side we achieve that 18 percent reduction in numbers of fish by reducing the quota by 18 percent. That is an 18 percent reduction from the Addendum IV quotas, the baseline quotas in that document. On the recreational side there is a suite, as I said, of bag limits and size limit combinations that achieve at least an 18 percent reduction in total removals.

That's accounting for harvest, your release mortality in order to achieve that overall reduction. You can see the overall reduction percentages on the right hand side there. I do want to remind the Board that these were developed on a coastwide or Bay-wide scale, and I also wanted to make a clarification.

Getting a lot of questions, doing all the hearings, and then the comments, what it means for a 28 to 35 inch slot limit for example if we look at Option 2. What that means is all fish below 28 inches would have to be thrown back, and all fish 35 inches or greater would have to be thrown back. The point being that a 35 inch fish would have to be released, and that has to do with how the MRIP link data is binned together.

Also highlighting that there are some asterisks tied to these, those are indicating further restrictions to the existing trophy fish seasons that were in place in 2017. If there are any specific questions about those I am happy to take them after the presentation. I'm going to move a little quicker now.

Again, all these options are designed in the exact same way. The big difference with Option 3 is that the allocation of the reductions is applied a little bit differently. Here the commercial quota is reduced by 1.8 percent, which means the recreational sector takes a 20 percent reduction in order to make up that difference.

The big difference with the recreational suboptions here is they're all designed to achieve at least a 20 percent reduction. Notice that some of them do achieve slightly more than that. You saw that on the previous slide as well. But the same rules apply, they are developed on a coastwide level or a Bay wide level, and the slot limits were all developed in the same way.

When we look at all those slot limits and bag limits, the recreational options, we need to keep in mind that there is a fair amount of uncertainty with these types of analyses. You know changes in effort, how anglers will respond to the approved measure, changes in the availability of fish; the size, the age structure of that population, and the distribution of those fish up and down the coast and in the respective regions.

These have very large impacts on what catch will be in a given year. Also pointing out again that these were designed to limit harvest, they are not designed to reduce release mortality simultaneously. The best way to really do that is to reduce your effort, reduce the amount of trips that are encountering striped bass, which brings me to conservation equivalency. This is a reminder that Addendum IV does maintain flexibility for states to pursue conservation equivalency to implement something different than the standard, while still achieving that same level of conservation.

The Technical Committee did develop criteria for CE proposals with Addendum VI. Our TC Chair is here, she'll go over that in the next agenda item. Also of note here, some of those suboptions that you saw, they do achieve more than the target percent reduction under that primary option.

That brings the question of what percentage will states be held to if they pursue conservation equivalency. We will need the Board to make that distinction today. Moving to the circle hook provision, again release mortality is such a big component of total mortality. That is why the Board is considering the use of circle hooks to address that.

There are three primary options here. Option A is status quo, so here there is no change to the provision. It maintains the recommendation that exists in Amendment 6, to continue to promote the use of circle hooks to anglers. Option B would be a requirement to implement regulations that require the use of circle hooks when fishing with bait in the recreational sector. The Plan Development Team did standardize the definition for circle hooks here.

We pulled that from a Commission document, but other parts of language, parts of the regulation that is left up to the state to work that out with its constituents to find something that works. I'm making note of that because if Option B is selected we will need some discussion, some guidance from the Board to the Plan Review Team when they're looking at implementation plans; to make sure that it's meeting the intent of the provision, also highlighting that the education component is certainly a part of Option B as well.

Option C would require states to promote the use of circle hooks, so as with Option A it is merely a recommendation. This would require it. This would make it a compliance requirement. Again intent there, the Plan Review Team would need some guidance from the Board on that if Option C was selected.

I think it's important to keep in mind there are a number of other factors other than hook type that can also affect release mortality, water temperature, air temperature, where the fish is hooked, how it's handled and things of that nature. It's also unclear how many anglers are already using circle hooks.

Quantifying those savings would definitely be difficult. It's hard to ignore the enforceability and compliance concerns with a mandatory circle hook requirement, who it would apply to, where would it apply, and when. Perhaps Kurt can go into a little more depth on that in the next presentation. Okay wrapping up with compliance schedules.

The Board will need to determine an effective date for these measures, keeping in mind that the next time this Board will meet will be in February of 2020. That is the earliest that the Board could review and approve implementation plans. Working backwards from there, if to be considered for approval at that meeting states would have to submit those programs, including conservation equivalency proposals by November 30th, and that is per the criteria laid out in the conservation equivalency guidance document, so keeping that in mind when the Board selects an implementation date.

Lastly, I just wanted to provide an overview of all the action items before the Board today. The way I see this going is the Board would first identify the primary option that being Option 1, 2, or 3, and then after that is decided moving into the recreational suboptions that are tied to that primary option. Note that there are no suboptions for the commercial quotas.

By selecting the primary option you are thereby selecting what the quota would be. Again regarding conservation equivalency, the Board will have to determine what percentage states will be held to. That will be another action item. Circle hooks again an action item; there might be a need for additional guidance there.

Then with the implementation date keeping the submission timeline for conservation equivalency and implementation plans in mind. That is the first part of my presentation, Mr. Chair. I don't know if you want to pause for questions on the document, or continue with the public comment summary.

CHAIRMAN ARMSTRONG: No let's questions on what you've seen so far. Mike Luisi.

MR. MICHAEL LUISI: Max, could you go back to either one of the slides that had under Option 2 or 3 the recreational measures? Yes that is good, thank you. I just want to make sure it's clear for the record and for the audience. It was presented in the Addendum, but it's not presented on this slide.

It has to do with the effect of each of those suboptions on release mortality. I wonder if you can just speak briefly to what each one of those options in both Option 2 and Option 3 suboptions. What effect on release mortality is there if any of those are selected?

MR. APPELMAN: Yes, it really would have cluttered up the slides, so I kind of left some parts out, but point taken. As I was saying, all of these are designed to limit harvest and limit total removals. They are not designed to reduce release mortality.

Under each of these options release mortality is projected to increase on the order of 3 to 4 percent for each of these options, which means there are bigger reductions in harvest that have to be taken in order to make up for that increase. But the math works out as such to achieve these total reductions. Those are the percentages that are up on the screen.

CHAIRMAN ARMSTRONG: I had, was it Pat? Did you have your hand up or Steve? Oh, Marty Gary.

MR. MARTIN GARY: That previous question covered mine, thank you.

CHAIRMAN ARMSTRONG: Jim.

MR. JAMES J. GILMORE: Max, essentially the implementation date, do we have to do all parts of this for the same implementation date? For instance, we pick one of the options or whatever, but I'm specifically looking at the circle hook. If we decided we had to implement whatever those measures were by hypothetically April 1, but the circle hook provision was something we wanted to delay. Is that possible under the Addendum?

MR. APPELMAN: That is absolutely within the purview of this Board, yes.

CHAIRMAN ARMSTRONG: Adam Nowalsky.

MR. ADAM NOWALSKY: This is a good slide to keep up for discussion. This slide highlights total removals according to the ocean fishery or the Chesapeake Bay fishery, but it doesn't detail what these removals reductions would mean to each individual state. Can you talk about what these options would mean, in terms of being disparate with regards to affecting different states differently, and how the justification is for that wide range of difference of impacts?

MR. APPELMAN: I'll just reiterate that they were developed on a coastwide level or a Bay wide level. The intent is that all states would implement the selected suboption, in order to achieve the projected reduction that is on the screen. Recognizing that the fisheries in the states contribute different levels towards that total reduction, so some will achieve less, some will achieve more. But if all states were to implement it, it would project to achieve that percentage up on the screen.

CHAIRMAN ARMSTRONG: Follow up, Adam?

MR. NOWALSKY: Are you able to provide for the Board and the audience what those different impacts would be on a state-by-state basis here today?

MR. APPELMAN: We have not done that analysis to show on a state-by-state level what each of these options would result in by state, no.

CHAIRMAN ARMSTRONG: Tom Fote, then Ritchie.

MR. THOMAS P. FOTE: I was under the understanding that we did do the numbers on what they would mean for each state. This reminds me of what happened years ago when we basically took on summer flounder when we first put the plans in place. All of a sudden we put a 14 inch size limit, so New Jersey and New York had to do nothing.

We rode on the backs of North Carolina, Virginia, and Maryland for a bunch of years. I want to know who's backs we're riding on, who is going to suffer the pain this time, and what states will not suffer the pain? Because it is very obvious that that is going to happen, and some of the data I've heard it's dramatically going to happen. I would like to have that information.

CHAIRMAN ARMSTRONG: Ritchie White.

MR. G. RITCHIE WHITE: Max, these figures were developed the same as any previous addendum on striped bass, so there is no difference in figuring out and coming up with these numbers as to how each state is impacted. This is done exactly like we've been managing striped bass from Day 1 of a coastal fishery. We look at the total coastal fishery as one entity, is that correct?

MR. APPELMAN: Yes, the methodology is the exact same as what has been used in the past.

CHAIRMAN ARMSTRONG: Phil Langley.

MR. PHIL LANGLEY: Yes, thank you Mr. Chair. My question was, I was curious. Was there any type of economic impact study done with any of these options?

MR. APPELMAN: There was no specific economic study done for this Draft Addendum.

CHAIRMAN ARMSTRONG: Dennis Abbott.

MR. DENNIS ABBOTT: Regarding Adam and Tom's point. Wouldn't there be probably quite a difference depending on what our choice was as to what the figures would be, how each state would be impacted? Wouldn't it be further the case that when the conservation equivalencies arrive at our door that again there would be varied impacts for all the states?

MR. APPELMAN: Yes. Each of these options is projected to achieve something different, and the impacts on a state-specific level would change, depending on which option you select. Some states have already done that homework themselves, and may have shared that with Commissioners around the table, but our Technical Committee has not gone down the path to see how that shakes out on a state-by-state level for each of these options. It's a coastwide FMP. That is why it proposes coastwide options.

CHAIRMAN ARMSTRONG: Loren Lustig.

MR. LOREN W. LUSTIG: Thank you Max for an excellent report. I did take note during your comments the use of the word uncertainty. I was hoping that you would describe for us the probability of success for these various options, success meaning of course achieving the desired goal as prescribed.

MR. APPELMAN: I'm going to let Katie Drew tackle that one.

DR. KATIE DREW: There are two components here. If we achieve the 18 percent reduction coastwide, then we'll have basically a 50 percent chance of achieving the target, which means that there will be a distribution of F rates around the target. We'll have basically over a 90 percent chance of being below the threshold, so we'll have a very high chance of overfishing and most likely achieve the F target and have a 50 percent chance of being at or below the F target.

However, when it comes to whether these specific measures will get you to that 18 percent reduction. That is not something we can quantify, in terms of how certain or uncertain are we, because we can't predict how angler behavior will change in response to these regulations, how other economic environmental factors will drive changes in effort next year. We saw basically a 20 percent reduction in catch from one year to the next under the same management regulations from 2017 to 2018.

If the fishery performs the same as it did before, we will achieve the reduction that we're looking for, and we'll have a very good chance of being below the threshold and a very good chance of being at the F target. However, what is the fishery going to perform the same way that it did in 2017 and 2016, sort of our baseline years? We can't quantify that uncertainty, and that is really what is driving our uncertainty about our management regulations here.

CHAIRMAN ARMSTRONG: Tom Fote.

MR. FOTE: Listening to your statement, Max. This is not the same as we usually do things. Some of the calculations were the same as we go forward, but every amendment I've been sitting here, when we come up with saying we're going to do an 18 percent reduction or a 25 percent reduction like the last time.

We took states and let them go from what their state had caught previously the year before, and took a 25 percent reduction off that states fishery. This is not what we're doing this time; it's a whole different ballgame of what you're doing. What you're saying is you are not going to look at states, so each state takes a 25 percent reduction, as a matter of fact some states will take a 40 percent reduction.

Some states will take an 88 percent reduction, or some states will take an 8 percent reduction. That's when the problem comes whether it's fair and equitable up and down the coast. You seem to be skirting that issue, and you say you don't have the information. Somehow I got some of the information. I'm just not happy that we're not putting it out there.

CHAIRMAN ARMSTRONG: Oh remind the Board that one of the goals that we voted on in Amendment 6 is uniform rules along the coast, and to have each state craft their own rules would be against what we voted for in the last amendment. This is just for your consideration as we go through. Any more questions, yes John McMurray.

MR. JOHN McMURRAY: Thank you for remembering my name, Mr. Chairman. Max, was there any effort to determine what year classes fall within these coastal slot limit options? I was asked that earlier, I didn't know the answer.

MR. APPELMAN: Again, I'm going to pass off the year class question to our science over here.

DR. DREW: We didn't look specifically at what year classes represent these slot limits in that sense, but we picked specifically the data to do this analysis on the basis of the 2011 year class. We know '14 and '15 were relatively strong year classes, and therefore we picked '16 and '17 as our reference years for these analyses, because the 2011 year class would be basically that age, were the same age that we expect the '14 and '15 to be in 2020. Using sort of the 2011 length frequency at that same age as they would be in 2020 as a proxy for the '14 and '15 year classes, which we did not have available to us when we did the 2015 measures. Did that make sense?

CHAIRMAN ARMSTRONG: All right Max, let's move on to your next section, which is the Public Comment Summary.

MR. APPELMAN: We did receive a lot of comments, a lot of unique comments, a whole plethora of alternative regulations that might work better for a particular state or region, more for the coast, a number of remedies for improving our law enforcement or better ways to address release mortality, improving data, and things of that nature.

I just want to point out that this overview is really to hone in on support for specific suboptions, the primary options and suboptions that were provided for public comment in the Draft Addendum, so just giving that overview of this document. I also want to really give a shout out to our newest colleague over here, Maya Drzewicki; she really did a great job tracking all the comments coming in, written through e-mail while I was out on the hearings. Thank you, Maya.

As far as the hearings go there were 21 different hearings held in all 14 jurisdictions. That would include D.C and Potomac River Fisheries Commission as well. Approximately 888 individuals attended those hearings, and you can see the breakout by region. As far as written comment, we had about 5,500 comments come in, 4,500 of those were received through seven different form letters.

Clearly a majority of those were from the form letters, and we also had 45 different organizations submit comment on Draft Addendum VI, which gives a remaining balance of about 1,000 individuals speaking out on the Addendum, ranging from recreational and commercial fishermen to general concerned citizens.

Regarding the primary options, Option 1 that was the status quo option that was the least supported. Some of the common themes there were that stock status in the fishery is really driven by environmental factors, that things like predation or forage or poor habitat should be addressed rather than fishing effort, or fishing I'm sorry.

That the issue is really the release mortality component and that can be addressed through education alone. Not supporting any of the options, because they all increase release mortality. Also noting that harvest did drop in 2018 and just a general distrust in the science as well. Option 2 was the most supported of the three options.

Some common themes there were that all sectors sort of benefit from this resource regardless of the disposition, so all sectors should share the responsibility of rebuilding and ending overfishing, identifying it as the most equitable way to implement the reductions, and pointing at Option 3 as an unbalanced approach to reduce removals.

Option 3, this was where the reductions are applied a little differently to the two sectors. This was the second most supported option. Reasons being there that there is already some high accountability and monitoring for the commercial sector, and I should have pointed out on the last slide that those that spoke in favor of Option 2 were predominantly from the recreational sectors, and those that spoke in favor of Option 3 were predominantly from the commercial sector. Again, pointing out that the commercial quotas there is high accountability there, there is high monitoring, there are payback provisions, and 18 percent reduction from a small component of overall removals won't do too much.

The fishery and stock status again is driven by recreational removals, and the last point being that to share the burden equally does not necessarily mean an equal percentage. Regarding the recreational suboptions, there were very few cases of consensus, if any, among sectors within a state, within a region, and certainly not across the entire coast.

That being said there were some commonalities of those that supported the higher minimum sizes versus the slot limits. Those in support of a higher minimum pointed out that past history similar size limit was used to rebuild the fishery, also the belief that this would lead to reduced effort, so it would do more to rebuild the stock as well.

Also highlighting or identifying the slot limits may put too much pressure on one or a few year classes, and that those impacts on the future population are somewhat unclear. Whereas, on the other side of the spectrum those that favored a slot size limit felt that this protected the larger females. It gave a small fish a chance to spawn as well, while still allowing some harvest.

Then a lot of voice from the party and charter sector, saying that a higher minimum size would be very difficult for business, particularly in regions where there aren't many large fish available. Having said all that, for completeness I will point out which options did get the most support. I know this table is probably hard to see. It is probably a lot easier to see in the summary in your meeting materials.

But these are the suboptions under Option 2, again Option 2 got the most support, and Option 2-A1 that is 1 fish at 35 inches, received the most support for the ocean fishery. Whereas Option 2-B1 that being 1 fish at 18 inches received the most support for the Chesapeake Bay. Then again for completeness, these are the suboptions under Option 3.

Again, because so much of the commercial sector was coming out and voicing support for Option 3 that is sort of where the comments ended, they didn't really provide much on the recreational suboptions there, but for completeness again, we had Options 3-A1 and 3-A2 sort of fizzle up to the top for the ocean, and then Options 3-B1, 3-B2, and 3-B4 sort of getting the same support for Chesapeake Bay.

Moving to the circle hook provision, there were three options here, again Option A would be the status quo. This received the least support.

Some of the comments we saw there were that circle hooks were sort of selected arbitrarily. There are a number of other terminal gear types, hook modifications, or fishing methods that could have been considered as well, pointing out that the benefits are hard to quantify, and that mandating the use of circle hooks is an overreach of authority. Those that came out in support of Option B, the mandatory requirement, generally felt that there is very little doubt in the science that circle hooks save fish.

Acknowledging that there are some enforcement challenges there, but there is a number of, you know we like to think there are a lot of law abiding citizens out there, so you put out a circle hook requirement most folks would follow suit. Also pointing out that some states already have these circle hooks on the books, and so other states should follow suit. A notion that if this is selected the Board should consider a phased in implementation timeline to allow tackle shops to go through inventory. I'm sure there are other circumstances to consider.

Option B would be requiring that education component, and those that came out in support of Option C, which was the second most supported – I don't know if I mentioned it, but Option B was the most supported – was really recognizing those enforcement and compliance challenges that we would encounter, recognizing the benefits there and the notion that education is really the answer here.

Again, we received a lot of comments, and we tried to group them and categorize some of those comments, find some common themes there, and 6 major categories filtered out. The first one was regarding conservation equivalency. There was a lot of support for conservation equivalency, the emphasis there being when used appropriately, and there was a lot of negative support on CE that it's not being used right, and that a lot of negative comments towards our Technical Committee and the process that they allow, the review process not being measurable.

Accountability is lacking from this. There is a lot of negative comment there. The second category was regarding poor data. There is a very low confidence in MRIP data and how it's used in the benchmark assessment, little support or confidence in the results coming out of that assessment, things with the release mortality rates.

Also pointing at the commercial discards that those are underestimates, and also pointing at the options in the document, a lot of belief that the recreational release mortality would actually be much higher than what is predicted. Regarding angler education, this received a lot of comments as well. There was a lot of support for angler education, not just on the circle hook component, but also on size limits in general, any regulations that are on the book, educating anglers of those.

Then also about proper fish handling that was a very common comment as well. Also comments regarding trophy fish and protecting those trophy fish, and these were really tailored towards the trophy fish season that exists in Chesapeake Bay, and any state that has regulations where a second large fish can be harvested.

There were a lot of concerns about law enforcement as well, and that there is a fair amount of poaching that is going on both in state waters and in the exclusive economic zone in federal waters. There are weak penalties in place for those violations, and just a general need for more officers out there, more funding so these guys and gals can do their jobs.

Then the last one being about gear restrictions, just pointing out that there are other restrictions that can be considered that also address release mortality and hooking mortality. Treble hooks came up a lot, banning gaffing, trolling, or even exploring barbless hooks. That was my last slide, so I'm happy to take any questions on the public comment summary as well.

CHAIRMAN ARMSTRONG: Questions. Tom Fote.

MR. FOTE: Could you put up the slide on participation at the public hearings, the numbers? I'm trying to figure out why we only had 888 people show up at the public hearings. I've seen this dramatic drop over the years. I know the Executive Committee was talking about it this morning, of how do we get the word out?

During the last 2015 Amendment we basically had at least, with three public hearings we had about 180 or 200 people show up. This time around I had less than 80. If I think about where we're going next year maybe for the annual meeting, we had a hearing there we had 1,100 people. We are miscommunicating with a lot of people that are not getting the measures, and I always basically attribute that to the newspapers.

There are no newspapers out there anymore, the people don't read them, and there are no fishing columns. They fired all the outdoor writers. It's very hard getting really to the common man that doesn't want to look at a smart phone all the time, or like me still has a flip phone, to get the message by not going on the internet and the hearings.

We're missing a lot of the people that used to show up to hearings that don't show up that particular segment of the anglers that fish from jetties, peers, and not looking at the internet in there. I don't know how we basically get back. Are you looking into the problem why the dramatic change?

I mean we used to have hearings in New Jersey when we did Amendment 4 that I had 1,300 people in three hearings. We're not just seeing those numbers. We're not seeing people get involved. I think part of it is they're also disgusted too with the whole process, because of summer flounder, black sea bass and a few others. But we really have a problem here.

CHAIRMAN ARMSTRONG: Mike Luisi.

MR. LUISI: A question, Max. The statement of the problem in this Addendum in my mind addressees, there are two parts to it. The one is the stock status, which you know overfishing is occurring stock is overfished. The other piece to the statement of the problem, which you go into some detail here, has to do with the magnitude of the release mortality in the recreational fishery.

With the exception of the circle hook discussion in this addendum, I'm wondering if you received any feedback from the public at any of these hearings about the issue of dead releases, and maybe questioned why this Addendum didn't take it the next step further to try to address that problem.

I'm just curious to hear whether or not the focus was solely on the options and the alternatives, or did you get any additional feedback about that dead discard problem, because we've discussed it at length here at the Board, just curious as to what you may have heard out there.

MR. APPELMAN: Yes. I'll say that we got a lot of people speaking out, not happy to see release mortality such a big part of the total. Part of it was just not understanding that catch and release fishing does contribute to deaths. That was definitely there. Then it always bled into the conversation of how we reduce release mortality.

That's when season closure would come up, and then getting into a discussion of why wasn't season closures part of this addendum, and you know how states can pursue that to reduce release mortality in their fisheries. Again, coastwide program, a coastwide season is very difficult to garner any support for. That is largely why we don't see it in these types of proposals. That is another big reason why conservation equivalency can be so effective.

CHAIRMAN ARMSTRONG: Jim Gilmore.

MR. GILMORE: Just for the record, I think Max enjoyed a rather robust turnout in New York after he left New Jersey, because we had quite a large group. I just mention that because as much as there was a significant number that came to that what we heard at the hearings, we actually held a second one up in the Hudson River. We got 40 individual on that which was a good turnout relatively to the size of that fishery.

However, the information we got is although there was a large number of it, after you started looking at the factor that we've got maybe 4,000 commercial fishermen in New York, we've got several hundred thousand recreational fishermen. Trying to normalize that input, boy it was difficult. For the record, or what we found out last week was we had a local council meeting, which is balanced between recreational and commercial fishermen.

When they decided to look at Option 2 versus Option 3, they tied. The commercial guys want Option 3; the recreational guys wanted Option 2. Sometimes the input, even though it's voluminous or it gets more voluminous, it may not be as more helpful now. Saying that I agree, and Tom was right.

This morning we talked about different ways of getting some more information through maybe surveys or things that will help us make our decisions, and remind everyone that this is a tool to help us make a decision, it is not the decision. I know some people at our hearing said, well if we all vote for this option we're good, right, and I said this isn't a vote. This is a public process that we're trying help guide our decision.

CHAIRMAN ARMSTRONG: I have John, Loren, and then Adam. John McMurray.

MR. McMURRAY: Given total written comment was over 5,000, it seems like we had comparatively few responses for the bag and size limit options. Do you have any understanding of why that happened?

MR. APPELMAN: I don't have a great answer there other than these commenters provided support for a particular primary option, and that's where the comment ended. If you'll look, some of those form letters with the big numbers of signatures didn't provide any indication of a particular suboption there. Again from the commercial side, you know that is sort of where we saw comment end as well with the primary option, and then not much for the recreational suboptions there.

CHAIRMAN ARMSTRONG: Mike to that point.

MR. LUISI: John, just to give you some perspective as to why what you stated may have happened. In Maryland we after reviewing the subalternatives, we're not confident that any of those subalternatives would work for us. We were very open at our hearings. We had 60, 70, 80 people at each one of them, but we were open up front that conservation equivalency was something that we were seriously considering. We focused the intent of those hearings just on the Options 1, 2, and 3 themselves and then kind of let it rest from there.

CHAIRMAN ARMSTRONG: Loren Lustig.

MR. LUSTIG: Again thank you, Max for your report. During your summary of public feedback, I found some very intriguing things to ponder. First of all I made note of you saying that some of the public feedback said that mandatory use of circle hooks is an overreach of authority. I would be delighted to know what the rationale is for anyone making that statement. In other words, is there any legal basis for that? I also took note that you said that some of the comments said that it would be difficult to enforce. I would be delighted to hear from our Law Enforcement Committee about that.

MR. APPELMAN: I can't really elaborate too much more on the overreach of authority. These were viewpoints and comments from those individuals that for the Board to come in and put a mandatory circle hook requirement on the books is simply an overreach of authority. I didn't catch the second part of your question though.

MR. LUSTIG: I agree with you by the way. I was struggling to figure out why a person would say that it was an overreach of authority, and I could not figure it out, personally how they could come to that conclusion. The second part of my question related to that it would be difficult to enforce. I'm wondering if our Law Enforcement Committee would agree with that. I tend to think that it would be pretty straightforward to enforce.

CHAIRMAN ARMSTRONG: I'm sure that will be brought up during your report.

MR. APPELMAN: I didn't want to give away too much, but I think LEC will agree with you.

CHAIRMAN ARMSTRONG: Adam Nowalsky.

MR. NOWALSKY: In the answer to my last question you made it clear that you're not able to provide us today with what those impacts are on a state-by-state basis of the varying options. But you did indicate that we knew that this was a total reduction, so we knew there would be different impacts on a state-by-state basis. Was that information given to the public at the public hearings?

MR. APPELMAN: Yes, I touched on that point at every hearing that I presented at.
CHAIRMAN ARMSTRONG: Go ahead, Adam.

MR. NOWALSKY: And for the hearings that you weren't at, was that included in the presentation that was given to states to present themselves with the explicit instruction to tell them to disseminate that information to the public?

MR. APPELMAN: All my PowerPoint's had a slide that these were developed on a coastwide level, and that all states were intended to implement that selected measure to achieve that reduction. I didn't attend the hearings that I didn't present at, so I don't know exactly how it was presented, but that material was standardized in my PowerPoint.

CHAIRMAN ARMSTRONG: Further questions about public comments. Tom Fote.

MR. FOTE: Yes I was at all the three hearings in New Jersey, and you put the slide up that said coastwide, but I assumed coastwide, I assumed that we were doing what we do all the time that we go back to the 18 percent and we do it state by state. I should not have been confused; I was confused on that because I didn't realize at that point the disparity that was going to go on between states.

Maybe it was naïve of me, but I did not. I don't think the public at my hearings had that idea to know they could possibly take a much greater reduction than the 18 percent. I think they assumed, because of the way it was presented that they were going to take an 18 percent reduction on their catch.

CHAIRMAN ARMSTRONG: I believe our TC Chair would like to respond.

MS. NICOLE LENGYEL: I just wanted to clarify for the Board that the procedure and the analyses conducted for Addendum VI were exactly the same as was done for Addendum IV. It was a coastwide analysis targeting one coastwide reduction. I think there might be some confusion, because when the implementation plans came along, because of the timeline and the quick timeline for turnaround, states were still going through their regulatory process.

They put forward implementation plans that had a variety of options, options that were in Addendum IV, conservation equivalency. That might be where the confusion is, but we followed the same procedure for this Addendum as Addendum IV. The other thing you might be thinking of is we did a performance of Addendum IV. That is where we broke out the percentage that each state ended up realizing after they implemented measures in 2015.

CHAIRMAN ARMSTRONG: Thank you Nicole.

ADVISORY PANEL REPORT

CHAIRMAN ARMSTRONG: We need to move on. If we could go on to the Advisory Panel report, Max.

MR. APPELMAN: While Maya brings that up on the screen, you know the AP met on October 16 near Baltimore. It was an in-person meeting. We had a fairly decent turnout, 10 individuals showed up; you can see them up on the screen there, the state that they represent and the sector that they represent. A pretty good spread across the coast. We had three individuals representing the commercial sector, seven representing the recreational sector. As far as the comments, it really echoes the broader public comment summary that I just went over. But for completeness regarding Option 1 there was no comment from the AP in support of Option 1, and the AP did not reach consensus in support of either Option 2 or Option 3. We had the commercial representatives in support of Option 3, and the recreational representatives in support of Option 2.

Regarding the recreational suboptions, they did not identify one strongly over the others, again because there is such little agreement among the different recreational sectors within a given state, within a region. Having said all that and sorry I have Option 3 up here first. As I was saying, the commercial representatives they support Option 3.

A lot of similar comments that we heard from the public comment summary, there is already strict quota monitoring and enforcement in place, the accountability is there, an 18 percent reduction in commercial quota would cause some serious hardship to these individual fishermen. Another notion that when the commercial sector takes a cut in quota harvest generally comes down to that quota level, until the management program is adjusted again.

But on the recreational sector those reductions don’t necessarily stay at that level, they continue to bounce around even without management action. Then lastly from those representatives, the recreational sector wouldn’t be expected to take cuts for overages from the commercial. Summary of the comment that we received from the recreational representatives was that the FMP doesn’t distinguish commercial versus recreational fishing mortality.

The equal reduction approach is the most appropriate. Also recognizing that 18 percent reduction from the recreational fishery is a much bigger volume of fish, so it is an equitable approach. That Option 3 would be more of an allocation question, and this Addendum is not focusing on allocations, and again that the AP doesn't support any one particular suboption strongly over the others, because of that lack of agreement.

Having said that some representatives did speak in favor of Option 2-A1 for the coast, there were others that supported Option 2-A3, but in general there wasn't really any strong push for either of the options or any of the suboptions, because of the statement that I said previously. Chesapeake Bay representatives didn't comment on the suboptions at all, again supporting the Bay jurisdictions to pursue conservation equivalency for the Bay.

The AP generally does support conservation equivalency when used appropriately. There was some discussion about support on some regional consistency there, particularly from the for-hire representatives in a multispecies context that different regulations across species complexes, but neighboring jurisdictions would make things very difficult. Regarding the circle hook provision, there was consensus here in support of Option B.

The AP generally recognizes the benefits of using circle hooks, recognizes the enforcement challenges there, but believes that circle hooks are a good thing. They do recommend that states collaborate when drafting language that they shouldn't be made in a bubble, if you will, within each state, then really focusing on that education component. They do believe that there should be a push for enforcement, if that strong enforcement effort isn't there the fear that anglers would revert back to non-circle hooks. A couple other general comments, one being that the Board should focus on the overall objective here to reduce fishing mortality down to the target. Looking for some better accounting for the commercial discards. I would like to see more discussion on season closures rather than just the bag and size limit options in the Addendum to achieve those reductions, also considering other terminal gear configurations to address discard mortality.

Noting that constant reductions, so this is referring to Addendum IV a few years back, now with this draft document and then with the potential amendment down the road makes it very difficult for business planning, and then also noting the proactive steps that Virginia has taken this year. That is it for my AP Summary Report on behalf of the AP, thank you.

CHAIRMAN ARMSTRONG: Questions for Max regarding the AP report. Pat Keliher.

MR. PATRICK C. KELIHER: Max, under the recreational comments I think it said there was a question of a reallocation between Option 2 and Option 3, a comment around that. Could you expand on that?

MR. APPELMAN: I think some of the representatives looked at this Addendum as a whole as an allocation question that Option 2 was equal taking the reductions and allocating them equally to both sectors proportionately, based on their landings in 2017, and Option 3 was changing that being a different allocation of the reductions to the different sectors.

LAW ENFORCEMENT COMMITTEE REPORT

CHAIRMAN ARMSTRONG: Further questions, seeing none, Law Enforcement Committee, correct? Could you supply us with your report?

MR. KURT BLANCHARD: The Law Enforcement Committee of the Atlantic States Marine Fisheries Commission convened a teleconference on September 20, 2019, to review and provide comments on proposed regulations regarding the recreational harvest of striped bass in state waters.

The following were in attendance, representatives from the United States Coast Guard, the state of South Carolina, Delaware, Massachusetts, Florida, New Jersey, and North Carolina, as well as participants from NOAA HMS, as well as staff from ASMFC. We took up two issues specifically, circle hooks and size and possession limits.

To the circle hook discussion, during this teleconference the LEC reviewed and commented extensively on the potential requirement for use of circle hooks in the coastal shark fishery. Subsequent to that discussion staff asked if the same comments and concerns would apply to similar provisions for the Atlantic striped bass draft addendum. The LEC members affirmed that their concerns apply equally to striped bass as follows.

The LEC reiterated the position, despite their recognized potential value of circle hook requirements to reduce release mortality in the recreational fishery, strict enforcement of the rule that depends on proving targeting or intent to catch striped bass with prohibited gear would be very difficult at best. Unlike in the shark fishery, gear and techniques for catching striped bass would be difficult to distinguish from that of other species. Implementation of a regulatory approach, such that is employed for shark fishing in Florida, would be much less effective. Therefore, if the Board were to implement such a requirement, the LEC emphasized the importance of using intensive education and outreach to garner support for the circle hook regulation.

If states are required to implement regulations regarding the mandatory use of circle hooks, the LEC recommends adopting standard definition of a circle hook, for example a definition as follows. A non stainless steel circle hook, a person targeting or harvesting sharks from Florida waters must use non stainless steel circle hooks when fishing with live or dead natural bait. Circle hooks mean a fishing hook designed and manufactured so that the point is not offset, and is turned perpendicular back to the shank to form a general circular or oval shape.

The LEC stresses the importance of all jurisdictions agreeing on standardized regulatory language, especially where states share common boarders and fishing areas. To the discussion of size and bag limits, staff reviewed the various options for size and bag limits in the Draft Addendum.

The LEC concurred with previous written comments provided in the memorandum dated January 26, 2015, among the points reiterated by the LEC were; a single size bag limit would apply for all recreational sectors, i.e. private anglers as well as for-hire sector. This will ensure the greatest enforceability on the water, dockside, or on land.

It was pointed out that it is common to have these two sectors comingling at boat ramps, docks, and marinas. Slot limits and trophy fish provisions are enforceable, but may raise unintentional violations. LEC members on the teleconference pointed out that there are relatively wide slot limits being proposed in Draft Addendum VI would help reduce unintentional violations.

Enforcement of bag and size limits as closely adjoining states would be greatly enhanced, if regulations are consistent across jurisdictions. The LEC appreciates the opportunity to review the proposals of the Atlantic Striped Bass Management Board, and to provide ongoing enforcement advice. Just in addition to this, this report was reviewed again yesterday, before the Full LEC, and the position still holds with the Full Committee reviewing it. Thank you.

MR. APPELMAN: I want to add quickly that we also had a back and forth via e-mail after the LEC webinar about the definition of circle hook that were used. The PDT used a definition slightly different than the example that was talked about in the LEC, but Kurt and I concur that it essentially means the same thing.

CHAIRMAN ARMSTRONG: Ritchie White.

MR. WHITE: Not a question but a comment. I attended the Law Enforcement meeting, and it was extremely helpful for me, because they discussed the number of scenarios that I would have thought would have resulted in an arrest, and they described how it would not have, and why. This does not change my support for mandatory circle hooks, but it certainly brings in expectations that you would have as to how aggressive it could be prosecuted. It was very helpful, and I thank Kurt for that.

CHAIRMAN ARMSTRONG: Bill Hyatt.

MR. WILLIAM HYATT: Kurt, I understand that your Committee would have concerns in cases where in the field you have to determine intent, and you stated that very, very clearly with regard to circle hooks. My question is if a circle hook regulation were applied more broadly, would those concerns disappear?

As an example I'll give, in cases where circle hooks are required for any bait fishermen using hooks larger than a certain size, i.e. a regulation that would remove the discretion, but still would make use of circle hooks under certain situations mandatory. Would those concerns disappear?

MR. BLANCHARD: We discussed several different scenarios, and how the circle hook provision could be enforced, and what would make our ability to prosecute cases more consistent. To your point, we discussed where it would apply to different fisheries, and one example we used was in the reef fisheries down in the Gulf.

You're dealing with a variety of different species, but in area fisheries and specific to a certain region, i.e. the reef. Something like that is enforceable, and the feedback from our Gulf partners, as well as the state of Florida with our group confirmed that. They felt very strong about that and that it's very enforceable.

When you start to bring that fishery up the coast, and you say specifically to one species that is where the difficulty comes in, because we cannot prove that you're targeting striped bass versus bluefish or another species. I know up in the northeast we definitely have that problem. We were trying to come up with a solution to help support this, and prove that or support the element or the assumption that the position is to have a standardized rule to elevate the use of circle hooks, versus the educational component.

We continue to fall back on the educational component. We feel pretty strongly about that and even from our position some of the data that we're seeing, and I use the example that Max presented in the public hearing comments. There were over 4,000 people that supported the rule making process to have a standardized law to support circle hook use.

What I deciphered from that, was you had two other areas where there was minimal response or belief. That tells me that the majority of folks are using circle hooks already, so the buy in to that is already there. I think a push on the educational, and I would hope it would get this to the level that we need to reach our benchmarks.

CHAIRMAN ARMSTRONG: Go ahead, Bill.

MR. HYATT: Just a follow up to make sure I've got you clear. You're saying education is paramount, but if a rule could be applied more uniformly across species, as opposed to targeting certain species, it could be acceptable.

MR. BLANCHARD: It would probably be better accepted. You're still running the situations, for example just because you have a species on board, we would have to prove before a court that you used that device to catch that fish. Was it a treble hook, were you using artificial worms or whatever? How do we prove that unless observed? The manpower or the time that goes into those observations, and let's face it it's not going to be a mock patrol boat out there making these observations, it's going to be covert capacity, which is manpower intensive to support this.

Then you take it to the next level, and you need to prosecute this. What we learned up and down the coast is the majority of our recreational fisheries and commercial fisheries are going before our district courts, so there is a criminal standard there. You're presenting a case on a circle hook into a district court, the same judge is hearing cases of domestic violence, larceny, DOUIs, and oh by the way this gentleman is here or this gal is here for a circle hook violation. Those are some of the hurdles that we need to get over to support this.

CHAIRMAN ARMSTRONG: Tom, I saw your hand up but I'm going to reserve comment until we come back to circle hook discussion.

CONSIDER FINAL APPROVAL OF ADDENDUM VI

CHAIRMAN ARMSTRONG: We have about an hour and a half left, which is pretty daunting. It is show time; we are back to the Addendum. Is that where we're at, Max? We need to do this in a very orderly process, or we're not going to get out of here in time.

We've broken it down. There will probably be six motions that we need possible amendments and such. The first one we need a motion on the primary option, which are we going to take, 1, 2, or 3? Then according to whatever we decide then, and they're mutually exclusive. We then have to go to the suboptions, one for the ocean in a motion, Chesapeake Bay separate.

Then we need to talk about conservation equivalency and what standards we're going to hold that may or may not need a motion, probably will need a motion. Then we need to talk about circle hooks, and then we need to talk about the implementation dates. There are the six motions there and we'll try and blast through. Let's open up discussion. The main motion that starts this off will be which option? Pat Keliher.

MR. KELIHER: Under Section 3.1 Proposed Management Options, I would move Option 2 for equal percentage reductions.

CHAIRMAN ARMSTRONG: Second by Ritchie White. In discussion we will very orderly, we're going to limit multiple comments from individuals, we simply have to do that. Would you like to speak to the motion, Pat?

MR. KELIHER: Yes. There was a point that Max reiterated for me that was brought up by the AP in regard to non-equal reductions as it pertains to allocation, and I think there is a fairness issue, and I know everybody we're not going to have full support for this. But I think there is a fairness issue that needs to be dealt with here, and Option 2 certainly does that. It also gives flexibility to develop alternative regulations through conservation equivalencies, including allocation between sectors. I think states and jurisdictions have that ability.

CHAIRMAN ARMSTRONG: Did I see Ritchie? Steve Train.

MR. STEPHEN TRAIN: Could I ask is it possible while I say I oppose this to get Figure 3 up on the screen, while I explain why I oppose this motion from our data. From the Addendum, Figure 3 that was in the data today, he just had it. Figure 3 pretty much explains why I will probably oppose any motion that starts with Option 2. Most of the removals and most of the discards, most of the mortality is not coming out of the commercial sector, and hasn't for a long time. I would oppose this motion, and probably any other under an equity scenario that starts with Option 2. As a disclaimer, we do not have a commercial fishery in Maine.

CHAIRMAN ARMSTRONG: Further comment. Adam Nowalsky.

MR. NOWALSKY: The difficulty I have right now is that this motion in particular uses the phrase equal percent reductions. I understand that as it pertains to Section 3.1 that relates specifically to recreational and commercial. I understand that. But if that is the sentiment that we're going to pursue, equal percent reductions, it is difficult for me to know how to move forward with this motion and a number of other motions, if we're not going to have the conservation equivalency discussion sooner versus later.

I would ask the Chair for some direction here, perhaps we could have that discussion now. As I understand the analysis that we've done in New Jersey, the majority of the recreational options in the document are going to provide a significantly higher percent reduction for New Jersey than other states.

Now that may be how it's been done in the past, but that doesn't mean we need to continue doing that and we can't do better now. I would ask for some direction here. What can we do to resolve the question about how states will need to take reductions under conservation equivalency? I appreciate the guidance.

CHAIRMAN ARMSTRONG: Essentially changing the agenda and that is the will of the Board, but before we take comment on that I would like to know what happens to this motion if we go into a different conversation?

MS. TONI KERNS: You can table this motion and take up the motion on conservation equivalency, if that is what you want to do, or take up a discussion on conservation equivalency, and then come back to this motion, which will require a vote of the Board to table, either consent of the Board.

If there is no objection you could table the motion until after a discussion on conservation equivalency. If you need to vote on it then the only thing that would be debatable is the timeframe, after conservation equivalency is discussed, and then you would just come back to this motion, if that is the intent of the Board.

CHAIRMAN ARMSTRONG: Pat Geer.

MR. PAT GEER: I want to agree with what Adam was saying, because I think everything we're doing here revolves around the conservation equivalency. If we're going to create a vote, I mean in Virginia we've already put several recreational actions in play. We did that last month. We need to know what we're going to be able to do conservation wise. We want to be able to use those measures to adjust our commercial catch as well. In our state it's about 62 percent recreational, 38 percent commercial. We would like to almost a modification of 18 percent, where our recreational not taking 1.8, but we're taking a higher amount but not 18 percent. Higher than 1.8, but not 18 percent, because of what we've done recreationally. I really think we need to have this discussion first.

CHAIRMAN ARMSTRONG: Further discussion, John Clark.

MR. JOHN CLARK: I'm just a little confused here. Are we saying that through conservation equivalency Options 2 and 3 don't really matter, it's going to be up to each state to decide how they want to divvy up the reduction, because that's not what we took out to the public? The public heard Option 2, which were equal percent reductions to each sector. Option 3 was proportional reductions to each sector. Now we're making it sound like these options are no longer in play.

CHAIRMAN ARMSTRONG: Correct me if I'm wrong, Max. The original intent of this particular item is the Technical Committee wants guidance. Many of these options as you see were targeting either 18 or 20, but the actual results, in the Bay if you go from 2 to 1 fish it's 29. The question is when a state crafts its conservation equivalency does it have to match the option that's picked at 29 percent, or do you go with the 18 percent? Is that correct, Max?

MR. APPELMAN: I think there is a couple moving parts here now.

CHAIRMAN ARMSTRONG: But I understand that it seems like some people are not talking that.

MR. APPELMAN: I'll confirm that yes. We definitely, I mean my vision was that after the options were selected we would then know which percentage we were talking about, which ones we would be choosing from that we would hold states to for conservation equivalency. The other part, John is that the Board did approve language at the last Board meeting to include a blanket statement that the allocation of the reduction between the sectors could be changed through conservation equivalency, so that is built in there under both Options 2 and Options 3.

MR. CLARK: Yes I understand that Max. But I'm just saying that it just seems like at that point then Options 2 and Options 3 are identical when you get to a conservation equivalency for a state. Is that actually what we're looking at here, because both options are getting the same reduction overall, it's just different how they divide it between the sectors? These are like defaults, and then each state can say, well we'll take our conservation equivalency reduction mostly out of the recreational side, or mostly out of the commercial side, depending n the state.

MR. APPELMAN: Essentially yes. Options 2 and 3 are both designed to get us to the same spot.

CHAIRMAN ARMSTRONG: Mike Luisi.

MR. LUISI: I agree that we need to have the discussion regarding conservation equivalency, and the way I see it it's that we need to know as states what that ultimate target is, as far as what the total removals need to be in a conservation equivalency proposal. The way that I read the addendum, it states that we need to achieve an 18 percent reduction in total removals.

I'm not sure why we're even having the discussion. The goal is to achieve an 18 percent reduction in total removals. How a state chooses to do that may require more burden to the recreational fishery, and less to the commercial fishery. But at the end of the day at the bottom of the spreadsheet, the total removals have to be reduced from the 2017 baseline.

Now, I've heard something just this morning that has really upset me, and that has to do with what Adam brought up before about the effect of a coastwide regulation to each state that there would even be a consideration that a state as Mr. Nowalsky stated, would have to craft measures under conservation equivalency to achieve a 40 percent reduction, while others would achieve an 8 percent reduction.

It isn't something that I think this Board needs to even discuss at this point. The FMP coordinator stated that the analysis hasn't even been done, so how are we as states expected to have a discussion on something where I have no idea what a slot limit or a minimum size requirement would have as an effect to our current regulation in Maryland. It could be 80 percent change, for all I know.

The analysis isn't done. But that would mean that I would have to go home and craft measures on a conservation equivalency program to achieve an 80 percent reduction. That should be off the table. What we should focus on is whether or not this Board wants to make the target 18 percent of total removals, or should it be the target that is part of the line that you select when you pick your suboption.

If the suboption achieves a 21 percent reduction, but we're striving for 20 on the recreational fishery under Option 3, do we have to go to 21 now, or do we use 18 percent total removals as the baseline for all of these conservation equivalency programs? That would be my opinion, Mr. Chairman that we keep it simple to those two points, and then we can move on from there.

CHAIRMAN ARMSTRONG: Toni.

MS. KERNS: Just to help the Board along hopefully, maybe. For each of the motions that you make, I would say that conservation equivalency is allowed under that motion, unless the Board specifically says it is not allowed. The Plan will allow you to do that. I think that helps you with this first one.

For the second one when you get to the individual options, the Board should state in their motion so that as you debate the motion if it is a 20 percent reduction for the option that you choose then you could say under conservation equivalency the plans have to reach a 20 percent reduction. If you want it to have to just stick to the coastwide 18, then say it needs to stick to the coastwide 18.

CHAIRMAN ARMSTRONG: That is actually very helpful. Andy Shiels.

MR. ANDREW SHIELS: I'm glad John Clark raised this question, because I was thinking the same thing, and although I heard compelling discussion since, I'm very concerned about the public side of this. When we have our meeting we were the first state to hold a meeting, and I have the decision tree that Max had on the board, it was the handout.

The very first decision we need to make today, and we're stumbling over the very first decision. The way that I understood that this was presented was that it was Option 1, keep it the same, Option 2, split between the sectors, or Option 3, have a different choice. When this was presented, it was not presented with oh, and there is this thing called conservation equivalence. It's really detailed and we have to take our time to explain it, and every state could be different.

What I thought we were deciding, and what the public reflected was 50 percent commercial, 50 percent recreational. We're going to share the burden percentage wise. I thought that is what we were telling the public and what they commented on. We have heard very quickly that a conservation equivalent can be done state by state, and the state can decide to split the sectors.

I didn't understand that. I need conservation equivalence for Pennsylvania to make our regulations work for us, so I'm not against that. But what I'm against is I think we promoted to the public, you had a two-tiered, two-headed decision to make. The majority of people chose Option 2, and I think they believe that that meant commercial and recreational were both coming down at equal percentage, even though the total numbers of fish would be different. Hearing the conservation equivalent fine tuning means that is not in actuality what is going to happen.

I would like to know is that what the public believes they heard, and is that legit, considering that is what we went out to them with? Did all the extra fine details about conservation equivalence get explained like I think I'm explaining them now, and I think what I heard, so they can make the public opinions that they have? I'm not picking on any of the groups, I'm just trying to get to the point that what did the public understand we were doing here?

CHAIRMAN ARMSTRONG: Adam, clear this up for us.

MR. NOWALSKY: No, I'm not going to be able to do that Mr. Chairman, as much as I would love to. It seems to me that by consent we've gone down the road of having discussion about conservation equivalency, so I guess we don't need a motion to table this at this point to take up the discussion. If that is in fact there we are, I would like to have the TC go through their memo, and explain to us what each of these items means, and if we have to accept this memo as policy.

If you don't feel we can just do that now by request, then I will make a motion to table the motion that's before us in order to get us specifically to that memo. To the point that we've heard here, Number 5 in the memo under recreational options, states may allocate the total required reduction differently between regions and sectors.

It's clear in the memo what we're talking about. That is the TCs recommended proposal. I think we now need to as a Board know whether we're going to accept that. Mr. Chairman, I would like to see us get to the discussion of the memo. If we're there, please tell us. If not then I will make the motion to table to get us there.

CHAIRMAN ARMSTRONG: Yes, Dennis Abbott.

MR. ABBOTT: At the moment we do have a motion on the board and that's what we're discussing, and if Adam wants to stop us from at this point to get into a technical discussion, we need to table this right now. If we don't want to table it, we have to move on with our business.

MR. APPELMAN: I just want to pause for a second, because I don't think the criteria that we would go over in the TC memo really gets to what you're asking for, Adam, and that is for an answer to what percentage states are going to be held to for conservation equivalency before we start selecting these options. What they're going to go through is what kind of data you can use and things like that. We need the guidance from the Board beforehand.

CHAIRMAN ARMSTRONG: It's clear we need to table this or not that is the will of the Board, we either do it by consensus. Is there an objection to tabling this and moving to? I see objections, we need a motion. Adam Nowalsky.

MR. NOWALSKY: Move to table the motion to discuss the Technical Committee memo for criteria for conservation equivalency.

CHAIRMAN ARMSTRONG: Is there a second? Eric Reid seconds it. Discussion, Adam.

MR. NOWALSKY: As a point of order Mr. Chairman, I don't believe there is any discussion on a motion to table.

CHAIRMAN ARMSTRONG: Thank you. Do we need to caucus? Two minutes.

MR. ABBOTT: Request a roll call vote.

CHAIRMAN ARMSTRONG: A roll call vote has been requested. Prepare for a roll call vote.

MR. APPELMAN: Okay, Maine.

MR. KELIHER: No.

MR. APPELMAN: New Hampshire.

MR. WHITE: No.

MR. APPELMAN: Massachusetts.

MR. RAYMOND W. KANE: No.

MR. APPELMAN: Rhode Island.

MR. REID: No.

MR. APPELMAN: Connecticut.

DR. JUSTIN DAVIS: No.

MR. APPELMAN: New York.

MR. GILMORE: No.

MR. APPELMAN: New Jersey.

MR. JOE CIMINO: Yes.

MR. APPELMAN: Pennsylvania.

MR. SHIELS: No.

MR. APPELMAN: Delaware.

MR. CLARK: No.

MR. APPELMAN: Maryland.

MR. LUISI: Yes.

MR. APPELMAN: District of Columbia is not present, Potomac River Fisheries Commission.

MR. MARTY GARY: Yes.

MR. APPELMAN: Virginia:

MR. GEER: Yes.

MR. APPELMAN: North Carolina.

MR. CHRIS BATSAVAGE: Yes.

MR. APPELMAN: National Marine Fisheries Service.

MR. DEREK ORNER: Abstain.

MR. APPELMAN: U.S. Fish and Wildlife Service.

U.S. Fish & Wildlife Service: Abstain.

CHAIRMAN ARMSTRONG: The motion fails, 5 in favor, 8 opposed, 2 abstentions brings us back to the motion, discussion Eric Reid.

MR. REID: Do you want me to apologize in advance? I probably should. Given the discussion that we just had, and you know I'm hearing very different things about what may happen within each state, and they are not equal percent reductions**. I'm going to make a motion to substitute. Move to approve Option 3 under Section 3.1 for unequal percentages reductions.**

The reason for that I mean normally I would have different rationale, but my rationale is in order to accomplish conservation equivalency in the discussion we just had, the discussion is about unequal percentages, or not necessarily the ones that are in the document, but unequal percentages in general. My opinion would be that if we were to approve the first motion that would be off the table, so that is why I'm making this motion.

CHAIRMAN ARMSTRONG: Do we have a second, point of information?

MR. GEER: Point of information. I'm wondering if we should have something in there as long as the total reductions are equal to 18 percent.

MR. APPELMAN: That's how the calculations were done, so total reductions needed 18 percent across both sectors. That is factored in to both of these options.

MR. GEER: Okay.

CHAIRMAN ARMSTRONG: Essentially as I read it we're just substituting Option 3 for Option 2, is there a second? John Clark, discussion, John McMurray.

MR. McMURRAY: Option 3 would place 99 percent of the conservation burden on a sector that accounts for only 90 percent of the mortality. There is something not right about that. This is a shared resource; all sectors should share in the burden to end overfishing. As Pat mentioned, I think this is ineffectively an allocation reallocation based on one year of data.

That is not the way to make an allocation decision. I would also point out that the commercial reductions are based on quota, not harvest, and so could on the water actually result in an increase. The entire point of this Addendum is to decrease fishing mortality. Lastly by this reasoning and we started to get into it. You could require states that don't account for a lot of fishing mortality to take smaller reductions, and I don't think we want to go down that road.

CHAIRMAN ARMSTRONG: Further discussion. Mike Luisi.

MR. LUISI: I support the substitute motion to approve Option 3, and the reason that I do is that while I understand the concept of equal in Option 2, when it really boils down to it, the effect of the alternatives when applied are very much different to the actual individual within the different sectors. Yes, the equity in Option 2 is only a number, but the effect is much different. As an example, the difference on the coastal recreational measure between Option 2 and Option 3 is a1 inch difference in the minimum size. It's also a 1 inch difference in the top maximum size limit in the slot, when that provision is applied to a recreational angler, whether that angler is a catch-and-release angler or somebody who may want to harvest a fish to eat. That 1 inch difference means so very little to the ability of that angler to have access to that fishery, and to go on a fishing trip. Charterboats, I can't imagine would be affected by a 1 inch difference.

They're still going to be able to sell the trips, whether it's 35 or 36 inch minimums, or if it's a slot the 1 inch difference in the slot, I can't imagine that it's going to make a difference on selling trips. Now on the other hand you spin it over to the commercial side. There is very much a difference to the individual fisherman when you apply either a 1.8 or an 18 percent reduction to that individual. In the state of Maryland we have an ITQ fishery.

Each one of our thousand permit holders had an individual quota that is essentially theirs. Quota right now, a pound of striped bass quota is selling on the market through the transfer process, for between $18.00 and $20.00 a pound for the permanent transfer of striped bass quota from one individual to the other.

I know a great many individuals that have spent thousands if not tens of thousands of dollars to acquire quota for their business to support their families, and to make a living on the water. There is a much bigger difference in taking 1.8 percent from that person and taking 18 percent of their quota from that person. They are not equal, and that's why I support Option 3, and I hope the rest of you can as well.

CHAIRMAN ARMSTRONG: Ritchie White.

MR. WHITE: I need clarification on Option 2, because I was under the understanding that Maryland, and they let us know this that they were going to sign the total mortality reduction to the recreational fleet and not the commercial fleet. I wasn't aware that they were not able to do that under Option 2. Is that the case? I don't think it's a question for Maryland. Would this Addendum allow Maryland under a conservation equivalency, Option 2, to have them take the full reduction in mortality on the recreational sector along?

MR. APPELMAN: Yes, Option 2 or Option 3.

MR. WHITE: Follow up. Then I don't understand the problem of why we have to go to Option 3. If most of us want to have an equal reduction, we pass that and any state that wants to adjust that has the ability to do that under conservation equivalency. I don't understand all of a sudden this move to Option 3.

CHAIRMAN ARMSTRONG: To that point Mike, briefly.

MR. LUISI: I'll be very brief. Ritchie, we've been very open in the fact that we would like to implement a conservation equivalency, but we are limited to that conservation equivalency to the Chesapeake Bay. We don't have the information available to us on the coast. We have a coastal and a Chesapeake Bay commercial fishery. In order for us to minimize the impact to the commercial fishermen, Option 3 is our only way to achieving that on the coast, because if Option 2 is selected then we would need to take an 18 percent reduction on our coastal ITQ permit holders. I will say, on the flip side of all of this, a state could decide if Option 3 is selected that they would prefer to do it the way Option 2 is laid out. But the impact on us with Option 2 is more than what we can – I would rather have a starting point of Option 3 – and then if a state wants to reduce its commercial harvest equal to that of its recreational harvest they have every right to do so, as long as they achieve an 18 percent reduction in total removals.

CHAIRMAN ARMSTRONG: Pat Keliher then John Clark.

MR. KELIHER: Mr. Chairman, two of the three people I'm going to dinner tonight have either spoken against my motion or made a motion to substitute, so if you would like to go to dinner tonight.

CHAIRMAN ARMSTRONG: Via the bar.

MR. KELIHER: I do have the red bull, because it may be long here today. In all seriousness, I'm trying to understand the motion to substitute. I'm not sure I agree with Mike. If Option B is chosen a state can still choose to reallocate their 18 percent between sectors. I feel like those flexibilities are in place for both Option 2 and Option 3, and as such I'm going to be voting against the motion to substitute.

CHAIRMAN ARMSTRONG: John Clark.

MR. CLARK: I seconded this motion. I would have preferred calling it sector proportional percent reductions, but a lot of the reasons that are brought up by Mike Luisi, we have an ITQ fishery in Delaware, and it's a small commercial fishery. We catch the quota every year, and beyond just the commercial fishermen we have a lot of people in Delaware who are not represented here that like to eat striped bass.

In particular I know our commercial fishermen really target Easter week as a big market for striped bass. That is another factor to consider in this of course, but I think getting back to the options. I know from this conversation we've had here it seems that a lot of states are planning to just no matter what option is chosen, divvy the reductions up between sectors how they see fit. But for a lot of states I know I was looking at this more as more simple that we choose an option, and I wouldn't have to go back and come up with a conservation equivalency.

That is one of the reasons I think for many states that Option 3, or if they prefer Option 2 would work, because they wouldn't have to now go back and start looking at all the different numbers and say, "Well this is how we get to 18 percent for our state." Plus, it gets us further and further away from one of the stated goals, which was to have uniform regulations up and down the coast. Anyhow that is my reason for supporting 3.

CHAIRMAN ARMSTRONG: Marty Gary.

MR. GARY: A question for the maker of the motion. Eric is the motion meant to read that it is Option 3, meaning a 20 percent reduction to the recreational sector and 1.8 to the commercial? The way that could be interpreted is it could be anything that's unequal. I'm just looking for clarification. Is that actually the way? Is your intent that it was supposed to be the 20 and 1.8 as it's listed in the Addendum?

MR. REID: No actually my intent was to provide the flexibility to the states should they do something under CE. I think I said that. But that is my point. Option 2 says equal percent reductions. That's what it says. My opinion is if in fact states want to use CE, then you have to have a motion that says you can do that. The original motion from my ex dinner companion doesn't do that. It doesn't do that. That is why I did it. I appreciate that.

MR. APPELMAN: I want to clear the air a little bit here. That flexibility exists under both Option 2 and Option 3. The Board had approved adding that language at the August meeting to both options.

CHAIRMAN ARMSTRONG: Senator Miramant.

SENATOR DAVID MIRAMANT: I wasn't clear on why Maryland believes it can't use the CE on both the coastal and Bay that they believe there is a restriction. I don't get that. Could you please clear it up if you can?

CHAIRMAN ARMSTRONG: Mike.

MR. LUISI: Let me see if I can. I'm not much on the technical side of things. However, the coastal fishery, if a recreational regulation is selected for the coastal fishery and we want to create. We would have to do two conservation equivalency programs; one for the Chesapeake Bay and one for the coastal fishery, given that there are two separate commercial quotas.

If we decide to deviate from an equal percent reduction, we would have to describe how our recreational measures were going to account for that difference. We don't have any information in Maryland. It's such a small recreational fishery on the coast that we're unable to use our own Maryland data to craft a conservation equivalency measure on the coast.

We can do it in the Bay, because we have all kind of information on catch in the Bay, but our catch has been so low recently on the coast, we don't have any information to provide to change the rule so that it accounts for. We can go to the Technical Committee and say, our change to the recreational measures accounts for the difference in that reduction on the commercial side.

The only way for us to be able to go home and apply a lesser reduction to the commercial fisherman, which is what our intent is, not zero but a smaller reduction, is to start as a base as with Option 3. Then if the state wants to do more than that they have the flexibility to add more reduction to the commercial fishery if they choose to. It's the only place we can start, which is why I've supported the motion. I hope that helped.

CHAIRMAN ARMSTRONG: Roy Miller.

MR. ROY W. MILLER: I hearken back to comments made by Andy Shiels earlier that when this went to public hearing in our state the options I thought were fairly cut and dried. Option 2 was 18 percent for both sectors. Option 3 was 20 percent for the recreational sector, 1.8 percent reduction for the commercial sector. Somehow we have evolved this afternoon along different lines, and I'll tell you what I don't like about it. If this motion were to pass as Max characterized it and others have characterized it that throws a ball back in Delaware's court.

In other words, we're going to have to have that discussion at home, how we divide the striped bass reductions among the commercial and the recreational sectors, and honestly I don't want to have to have that discussion, pitting our commercial fishermen against our recreational fishermen.

Our laws are designed around implementing the management plans approved by the Atlantic States Marine Fisheries Commission. That is the regulatory authority we were given. If we don't get guidance from ASMFC, we're on shaky ground legally in our state when we go to public hearing.

CHAIRMAN ARMSTRONG: We need to move on this question. There have been great comments on both sides. Are there any further comments that can solidify last comments? Joe Cimino.

MR. CIMINO: I think something important here, because either of these options, we keep talking about conservation equivalency. My understanding is one thing that the Technical Committee through a couple of the meetings on this have come up with is what states do not have enough data to do conservation equivalency, and if that is true can we hear what states those are, because they're going to be impacted by either of these options.

MR. APPELMAN: It's kind of hard to answer that question, I think. I mean there is data that exists to do these types of reductions for every state.

CHAIRMAN ARMSTRONG: All right I'm going to call the question.

MR. NOWALSKY: Point of order, Mr. Chairman.

CHAIRMAN ARMSTRONG: I'm sorry where did that come from? Adam Nowalsky.

MR. NOWALSKY: This was one of the major topics under public comment, and I would ask that we hear from the public before this question is voted on around the table.

CHAIRMAN ARMSTRONG: It's the pleasure of the Board. As Chair, we have 6,000 comments on this already, point of order, Dennis Abbott.

MR. ABBOTT: Yes it's a simple one. Some of us don't hear so well, and maybe the audience also might be having difficulty. I would like to hear everyone's comments. John McMurray you're a low talker, Joe Cimino, you're a low talker if you don't have the microphone close. I would ask everybody; get closer to the microphone so everyone can hear you, because we do want to hear what you have to say. I do, and I'm sure everyone else does.

CHAIRMAN ARMSTRONG: Mr. Leo, I will take one brief, because I don't want you to have a stroke.

MR. ARNOLD LEO: Thanks. The point has been made pretty clear that Option 2, reducing the commercial landings by 18 percent does very little to help solve the problem of overfishing, the commercial landings being only 10 percent of the total landings. However, that 18 percent applied to the commercial fishery in New York State has a very significant impact. Presently a commercial striped bass fisherman in New York State gets about 220 tags. Each tag allows a striped bass to go to market.

You're going to take away one-fifth of his quota, one-fifth of his tags that actually equals in monetary terms between $2,400.00 and $3,000.00. Now that is about what he has to pay to make his installment payments on his truck. I would consider that to be a very significant impact, whereas I think as Mr. Luisi has made the point, the impact on the recreational fisherman's actual ability to go out and catch a fish or two fish is very little impacted, whether he gets an 18 or a 20 percent reduction.

CHAIRMAN ARMSTRONG: Thank you, Mr. Leo. I prefer to call the question. Seeing heads nod. Let's caucus.

MR. WHITE: Roll call vote requested.

CHAIRMAN ARMSTRONG: We have a roll call vote requested. On the motion to substitute, Max a roll call, please.

MR. APPELMAN: Maine.

MR. KELIHER: No.

MR. APPELMAN: New Hampshire.

MS. CHERI PATTERSON: No.

MR. APPELMAN: Massachusetts.

MR. KANE: No.

MR. APPELMAN: Rhode Island.

MR. REID: No.

MR.APPELMAN: Connecticut.

DR. DAVIS: No.

MR. APPELMAN: New York.
MR. GILMORE: Yes.

MR. APPELMAN: New Jersey.

MR. CIMINO: No.

MR. APPELMAN: Pennsylvania.

MR. SHIELS: No.

MR. APPELMAN: Delaware.

MR. CLARK: Yes.

MR. APPELMAN: Maryland.

MR. LUISI: Yes.

MR. APPELMAN: Potomac River Fisheries Commission.

MR. GARY: Yes.

MR. APPELMAN: Virginia.

MR. GEER: No.

MR. APPELMAN: North Carolina.

MR. BATSAVAGE: Null.

MR. APPELMAN: National Marine Fisheries Service.

MR. ORNER: Abstain.

MR. APPELMAN: U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service: Abstain.

MR. APPELMAN: North Carolina was that a null or a no?

MR. BATSAVAGE: That was null, N-U-L-L.

CHAIRMAN ARMSTRONG: The motion fails, 4 yes, 8 noes, 2 abstentions, 1 null, back to the main motion. Brief discussion, all right let's go to a vote. All in favor raise your right hand.

MR. ABBOTT: A roll call vote, please.

CHAIRMAN ARMSTRONG: There has been a call for roll call. A minute for caucus, I'm sorry there was a nature break needed by the roll caller. All right prepare to roll call.

DR. DREW: Maine.

MR. KELIHER: Yes.

DR. DREW: New Hampshire.

MS. PATTERSON: Yes.

DR. DREW: Massachusetts.

MR. KANE: Yes.

DR. DREW: Rhode Island.

MR. REID: Yes.

DR. DREW: Connecticut.

DR. DAVIS. Yes.

DR. DREW: New York.

MR. EMERSON C. HASBROUCK: No.

DR. DREW: New Jersey.

MR. CIMINO: Yes.

DR. DREW: Pennsylvania.

MR. SHIELS: Yes.

DR. DREW: Delaware.

MR. CLARK: No.

DR. DREW: Maryland.

MR. LUISI: No.

DR. DREW: PRFC.

MR. GARY: No.

DR. DREW: Virginia.

MR. GEER: Yes.

DR. DREW: North Carolina.

MR. BATSAVAGE: Yes.

DR. DREW: National Marine Fishery Service.

MR. ORNER: Yes.

DR. DREW: U.S. Fish and Wildlife Service.

U.S. FISH AND WILDLIFE SERVICE: Yes.

CHAIRMAN ARMSTRONG: The motion passes 11 to 4. All right let's move quickly that is Motion 1 of 6 needed. It brings us to the suboptions that we need to move to. We would like to go with the ocean first. Justin.

DR. DAVIS: I move to approve Sub-Option 2-A2 under Section 3.1, 28-35 inch slot limit for the ocean recreational fishery.

CHAIRMAN ARMSTRONG: Second. I'm sorry where was the second, Mike Luisi? Would the motioner like to discuss?

DR. DAVIS: I'll start off by acknowledging that I think everybody around this table recognizes we've gotten a very strong signal from the public they want us to take strong conservation action on striped bass. I think I'm probably in the same boat as everyone around the table that I got more e-mails and calls about this than I've gotten about just about anything, since I've been involved on the Commission.

I think we need to acknowledge that any of the options we're looking at in this document, whether they be the slot limit options or the minimum length options across Option 2 or 3, all call for anywhere from a 43 to a 52 percent reduction in harvest. To me that is a substantial course correction to make in one year to essentially cut harvest in half in a fishery. I think whatever option we go with, we're meeting the mandate we've gotten from the public to engage in a substantial course correction for this fishery.

Given that all these options will sort of provide an equivalent, more or less reduction in harvest, I think it's left to this Board to decide which one of these options best fits the fishery we have right now, or the status of the stock provides the best way forward or the best management philosophy. I remember being shocked when one of my staff members who were working on the PDT brought it to my attention that an 18 percent reduction in removals for the stock was going to equate to a 50 percent reduction in harvest. At first I thought that couldn't be right, and made him rerun the numbers. But really I think it underscores one of the major challenges we're facing in this fishery, which is discard mortality. We should acknowledge that none of these options we're about to talk about deal with that issue.

I think that is a major issue that this Board has to deal with. The circle hook requirement could be a good start, but I would like to see the Board give this more thought down the road potentially in an Amendment process. I have real concerns that a high minimum length limit is only going to increase the level of discarding and the amount of discard mortality we're experiencing for the stock.

I know that on paper all of the options will provide sort of a about equivalent increase in release mortality, anywhere from 3 to 5 percent. But I have concerns, and I've put this on the record before at a previous meeting that the size structure data that was used to formulate these options, the 2016-'17 data, while it does capture the strong 2011 year class.

We're in a situation now where we have two strong year classes starting to recruit into the fishery. I think that we're sort of underestimating the catch of smaller fish that we're going to experience in coming years, and so I think we're underestimating the amount of release mortality we might be adding with a high minimum length limit. That is one of my concerns.

Another is I guess what seems to be an emerging theme today, which is disproportionate impacts on different sectors or different states. We're treating the fishery as sort of this one consistent fishery across the whole coast, for the purpose of formulating these reductions, but I think we know that size structure of fish can vary, availability can vary across the coast year to year, and that also sort of be motivation to fish for different sectors within the fishery is tied more to harvest for some fishermen than others.

We've heard a pretty clear signal from the for-hire sector, from some other recreational anglers that the opportunity to harvest fish is still important to them. They recognize we need strong conservation, but they want us to still provide some reasonable opportunity for harvest. I think that the slot limit option provides that.

I'm concerned that a high minimum length limit will just be too exclusionary for certain sectors, or certain regions, depending on the availability of fish in their area. Finally I'll just close with, you know I think from a fishery management sort of philosophy standpoint, just stepping back and not thinking about the percentages in the table.

Really what we're sort of doing next year is we're asking anglers to release half the fish they would have otherwise kept. We have to make a decision; do we want them to release the large fish over 35 inches or the fish between 28 and 35 inches? I feel like from a fisheries management standpoint there is abundant evidence out there that older, larger fish are really important to the productivity of the stock.

It's those fish which are most desirable for anglers; it's also those fish that comprise the spawning stock biomass, the depleted state of which is our main concern here. I think from a philosophy standpoint it really behooves this Board to send a signal to the angling public that it's important to return those large fish to the water and protect those older, larger fish. Those are all the reasons that I support a slot limit for the ocean recreational fishery. I recognize that a high minimum length limit would also provide substantial conservation for the stock, but I just feel like the slot limit is the best way forward at this point.

CHAIRMAN ARMSTRONG: Ritchie White then Tom Fote then Mike Luisi.

MR. WHITE: I'm going to oppose this motion. I'm going to support the motion that had the most public input, both throughout all the public opinion, and also state of New Hampshire, and I'm going to be supporting A1.

CHAIRMAN ARMSTRONG: Tom Fote.

MR. FOTE: We said it this morning or at lunch. I'm going to give you a little bit of a history lesson again. When we basically in the original plan to rebuild this stock, what we basically did was protect the '82 year class until it spawned, because it was a big year class until it went through the system, because I know, because every year I had to go to Trenton and get a bill passed, because we did it by legislation back then, and raise it up another inch or two inches at a time.

We basically didn't open the fishery until almost 95 percent of those females had been the size to where they could spawn. Well right now we're doing just the opposite. We hammered the 2011 year class before they got out of the Bay. It was a misappropriation; we didn't realize the catch was going to be big. We did it. We are now hammering the 2011 year class, and this is in place for two or three years, the 2015 year class. The two year classes we're depending on to go up, to basically come up into the maturity.

Again, my science that I've looked at over the year says that the big fish don't go in every year, and there is always a disagreement whether the young females that are 34 or between those size limits are actually more productive in the fishery, because their eggs survive better, because they have less PCBs in them.

It's always a controversy, which is better at more producing fish. I don't like either one of the options to tell you the truth, because then we're going to be hammering the big fish. But what are we doing? Are we protecting the year classes as they moved along that actually did rebuild the stock, or are we trying a new plan that I think is just going to have the opposite effect? I can't support this motion.

CHAIRMAN ARMSTRSONG: Mike Luisi.

MR. LUISI: Justin Davis, he basically said everything that I had planned to say regarding this alternative for the slot option. All things considered here, we have two ways to go. They both really accomplish the same thing, and the conservation effort is extreme based on how much reduction in harvest that we're looking at. I'm supportive of one of these tools being implemented, I just can't. By going with the 35 inch minimum size limit in the state of Maryland on our coast, which our fishery in the ocean is almost nonexistent, the only fishery we have left is a small fishery in our back Bays area behind our Barrier Islands. The only thing that would allow for any harvest at all and that 28 inch minimum size limit in the Bay is almost impossible to catch. To allow for any harvest at all and to allow for any charterboat operation in our coastal fishery to continue fishing, the only choices we have is the 28 inch minimum size to the 35 inch slot, so I'm going to support this.

CHAIRMAN ARMSTRONG: John McMurray.

MR. McMURRAY: Dennis, is this sufficient? Good. Again I want to point out that overall public comment was 2-1 in favor of 35 inches, and I would point out that the TC does acknowledge discards, and it was listed out with each option even though it wasn't on the slide, and it was anywhere from 4-6.

I think one of them was 7 percent, but the TC has been very clear from the beginning that that large size limit far outweighs that 4-6 percent total reduction in fishing mortality. What this does is this targets a very narrow band of year classes, 7 or 8 inch. Part of my question earlier was and I have to be honest, I didn't understand your answer.

What I was getting at was what year classes are going to fall within this slot limit, because that is significant. I mean we're running the risk of putting a lot of pressure on the 2011s or the 2015s, and that is really what we're trying to protect. I can't look at this option and seriously believe that it's going to reduce fishing mortality, because you're going to have a whole lot of guys focusing effort on this 28 to 35 inch fish.

I understand the rationale, and I understand the part of the public that supported this. They want to have the opportunity to take home a fish, and I get that. But the entire reason that we're doing this, Addendum is to keep people from taking home as many fish as they had. This doesn't really achieve the objective that we're trying to achieve here. I'll leave it at that for now.

CHAIRMAN ARMSTRONG: Jim Gilmore.

MR. GILMORE: I'm not going to go into a lot of the comments I've heard made. The one thing I will say is that I didn't get any clear signal on this thing, because we got a lot of conflicting signals on it. But I'll just give you my perception on this. Right now the one thing that we did hear and this is up and down the coast that there was a success story years ago, and we raised the size limit, and it worked.

Everything else is sort of a maybe it will go, maybe it won't. But raising the size limit to a higher level with one fish worked. The stock came back and it came back like gang busters. That is what rings in my head as being a place to be going. On top of that remember if we go to that larger fish, it's different up and down each one of the states, but in New York we are leaning more towards that larger fish, because it worked.

Secondly, because we're going to do conservation equivalency to take care of some of those smaller sectors. The Hudson River Fishery is small. We have a mode split, and we think we can maybe use that larger size limit, but still accommodate those parts of the fishery. We do both. We maybe don't have a big economic impact, but we also rebuild the stock as quickly as we can. At this point I'm opposed to the motion.

CHAIRMAN ARMSTRONG: Adam Nowalsky.

MR. NOWALSKY: For states that choose to pursue conservation equivalency with this option, what will the TC review the proposal and come to their recommendation for the Board whether to approve it or not? Will it be that their CE proposal achieves the percent reduction in harvest that's in the table? Will it be that the state achieves the percent reduction in removals, or will it be that the state achieves the percent reduction in harvest or removals that we don't know the answer is to, based on some analysis of what their percentage is of the coast?

MS. LENGYEL: That is guidance that the TC is looking for the Board to. We would like an answer from the Board as to what percent conservation equivalency proposals will be held to.

MR. NOWALSKY: When are we going to have that discussion, Mr. Chairman?

CHAIRMAN ARMSTRONG: It's been suggested that you make a motion to amend and insert that percentage into this motion. Go ahead, Toni.

MS. KERNS: It's the pleasure of the Board on how we would like to take this up. You can either add it to this motion or you can take it up in a separate motion after it's been finalized, but either way we do need to give direction to the TC.

CHAIRMAN ARMSTRONG: Nicole, could you clarify what the options would be right now?

MS. LENGYEL: There are several options. As Mr. Nowalsky pointed out the overall coastwide reduction needed to get F back to the target in 2020 is 18 percent. The option in the motion that is up on the screen has a projected reduction of 19 percent, and there is also an additional option that has been discussed here at the Board that under each selected option a state's individual reduction will vary state to state.

As has been pointed out, the Board does not have those individual reductions in front of them at this time. If the Board chose to go with that route and have states held to whatever reduction their state would have had under the selected option, the states would have to go back and calculate what that reduction would be, and then submit a proposal that met that reduction.

CHAIRMAN ARMSTRONG: Is that clear to everyone? That is the discussion we need to have or we include an explicit option into this. Adam.

MR. NOWALSKY: I will move to amend to include or a CE proposal to achieve an 18 percent removal.

CHAIRMAN ARMSTRONG: Is there a second, second by Chris Batsavage? Let's get it up on the board.

MR. APPELMAN: Adam, can I look for a little bit more clarification that we're talking about an 18 percent reduction in total removals relative to 2017?

MR. NOWALSKY: Yes. I didn't even thing that was an option for discussion. I thought the document was pretty clear we were doing all of our evaluation on 2017, whether we agree with that at this point, I felt that decision was made. Yes that is what I think we would be looking at.

CHAIRMAN ARMSTRONG: We have a second by Chris Batsavage. Would you like to speak to the motion, Mr. Nowalsky? Adam, did you want to speak to this?

MR. NOWALSKY: I think it's pretty clear what we're trying to make clear here.

CHAIRMAN ARMSTRONG: Joe, I had you on the list. Have things changed? You're all set. Steve Bowman. We're going to speed things up.

MR. CIMINO: As Jim Gilmore pointed out, you know for some of the states it wasn't clear exactly what the preferred option. But it was clear in New Jersey that no one liked any of these options. These options are going for a reduction in F, and I'm surprised my low talking fellow Commissioner didn't get to the point where we need to be looking at rebuilding this fishery.

Whatever option we chose, I hope that we're having a very quick discussion and a motion on getting that Amendment back, because we don't know really what these options are doing for spawning potential. I'm concerned that because we were only shooting for 18 percent, we're talking about several year classes in this slide that can be vulnerable for quite some time if we don't really reevaluate this soon. I'll leave it at that.

CHAIRMAN ARMSTRONG: I have Steve Bowman.

MR. STEVEN G. BOWMAN: Mr. Chair, all I had was a point of order, and if it's okay it's fine. Normally when you get a move to amend it's an amendment that's accepted by the maker of the motion. If the rules are a little bit different here and I misunderstood that that's fine.

I just want to make sure when this motion goes through, as much conversation we've had on it, it's made in a correct form. I don't know if this should be a substitute motion, or move to amend with a second based on the existing motion is appropriate. That was just my concern. That's all it is, and if it's good to go according to parliamentary procedures it's good to go.

CHAIRMAN ARMSTRONG: I'm getting the nod that it's okay in this form. Mike Luisi.

MR. LUISI: I'll be very brief. I support the motion. I think of the three options that Nicole referred to, I think this is the only really viable option. I actually presented at one of the hearings, and spent no time discussing that the total removals in the table would be something that we would have to achieve if that selection was made in a conservation equivalency proposal.

But the public in Maryland did not hear that nor would I feel comfortable in suggesting an option where an analysis hasn't even been completed yet. I think this is what we have. I think it's clear it is part of the discussion at the background information and the statement of the problem in the Addendum, and I think this is what we need to support.

CHAIRMAN ARMSTRONG: I may have missed someone, but I've got Jay McNamee next.

DR. JASON McNAMEE: I'll start off by saying with the conservation equivalency approach here for striped bass; we've got a mathematical issue. Conservation equivalency you're either all in or you're all out. You can't piece it out when we went in with a coastwide calculation. That being said, I think Commissioner Luisi is right in that we don't have any other information to go by. Because of that I'll support the amended part of the motion.

I do also agree with I think it was Commissioner Cimino who said this needs to be added to the Amendment discussion, because conservation equivalency can't work like this. We are not going to achieve our goals. I'll acquiesce, because I think we need to take action and move this Addendum. I don't want it to get stalled because of a technicality at this point.

But I think it's an important discussion that we need to have. We either want to go to some state-by-state management system for striped bass, or we are going to do coastwide management, and it can't be somewhere in between. Then one final thing, Mr. Chair, I do support the original motion as well made by Commissioner Davis.

You know I think we talk about slot limits and protecting spawners all the time, in particular with this fishery I think we have an opportunity to test that here. I liked the fact that in Rhode Island we got a lot of support for the slot limit, and there wasn't watering down of that slot limit with plus a trophy or plus some other measure. I liked it.

I would like to see it pass. However, I could be okay with either the slot limit or the minimum size, but I'll just offer that there is a cohort issue whether you jack the minimum size, fish continue to grow. You're going to have to deal with it at some point. These are dynamic systems. You may have bought another year or two with the 35, but you're going to run into the same problem that folks have been talking about with the slot limit, with the minimum size at some point as well.

CHAIRMAN ARMSTRONG: I hope we all note that we could have avoided a lot of heartburn that we're having right now if we had fully defined how we do conservation engineering. I guess that is for the next amendment. Further comments on the motion to amend, seeing none, let's go to the vote, caucus for a minute.

Are we ready to vote? All in favor raise your hand, opposed, abstention, and null. The motion passes 11 in favor, 2 opposed, 2 abstentions. We will amend the main motion. Let me read the newly amended motion into the record. Move to approve Sub-Option 2-A2, 1 fish at 28-35 inches for Section 3.1 for the ocean fishery.

Conservation equivalency proposals are required to achieve an 18 percent reduction in total removals relative to 2017. Are we ready to vote? Do we need to caucus, no? All in favor raise your hand, opposed, abstention, and null. The motion passes 12 in favor, 1 opposed, 2 abstentions. Moving on to Chesapeake Bay, would anyone care to put a motion for Chesapeake Bay? Pat Geer.

MR. GEER: Here we go let's make this quick. Move to approve Sub-Option 2-B1, 1 fish 18 inch minimum for the Chesapeake Bay Fishery. I wanted to do the same verbiage for the conservation that was up there, if we can get that in there as well.

CHAIRMAN ARMSTRONG: Is there a second, Marty Gary, discussion, Pat Geer?

MR. GEER: We kind of took a very proactive approach in our state. We've been working since March to try to look at this. We actually approved a 1-fish bag limit with a 36-inch maximum, so we've done away with our trophy fish. We've already instilled this in our state. It gave us the greatest savings.

Everything else would have had to be cobbled together with multiple items. With discussions with our Secretary and our Commission and all our staff, we felt it was hard. But as Justin pointed out, we had to make hard decisions and we decided that we were going to go with the 1-fish bag limit. It gave us a substantial savings.

CHAIRMAN ARMSTRONG: Further comment, Mike Luisi.

MR. LUISI: This one is kind of awkward for me, in the fact that for the last few years we have worked in Maryland extremely hard to implement measures that reduce discard mortality. We've reduced our minimum size by an inch, and we implemented mandatory circle hook requirements with chumming and live lining.

It's very difficult for me then to support an option, although we hope not to have to implement this option. I've been clear that conservation equivalency is something that we're strongly considering using seasonal closures as a mechanism for achieving a desired result. It's very difficult for me to say yes, this is a great one.

We're going to have a 1 fish at 18 inch limit that if we have to implement it, will eliminate our charterboat fleet in the Chesapeake Bay. They can't sell trips for 1 small fish. Also, this option increases the release mortality by 4 percent. It goes against the grain of what our state has been preaching and working really hard on.

I'm not sure what I'll do when it's time to vote, but I would say that we could support it, because Virginia has also been working really hard, and this really is the only option of the four that could even possibly work. I may have to abstain on this vote. I just put that on the record, given the awkwardness of the application of this measure in our state.

CHAIRMAN ARMSTRONG: Further discussion. Seeing none let's vote. All in favor raise your hand, please. Sorry, caucus two minutes. **All right let's vote. All in favor raise your hand, please, opposed, abstentions, and null. The motion passes 12 in favor, 3 abstentions**. Now the next consideration is the discussion we were supposed to have of conservation equivalency by incorporating it into the prior two motions we have addressed the concerns of the TC. We of course will want to bring it up under the Amendment talk in the next coming meetings. We can bypass this discussion right now, which brings us to circle hooks. Does anybody want to start the discussion or make a motion? Tom Fote.

MR. FOTE: I need to get close so you can actually hear me. I guess it might be a problem hearing me. Circle hooks, they work. You don't gut hook fish with circle hooks. It should be anywhere we can get catch and release fishermen, even the regular fishermen that use them is productive. It's going to save a lot of fish.

How do we go about it that's the problem? I spent a lot of time trying to talk to Kurt. I spent a lot of time talking to my law enforcement, even gone to the point of thinking if we can't force this because they could be fishing for something else, then why don't we just since bluefish are overfished, since weakfish are in the crapper, and we just say if you're fishing for any of those three and using bait, you need to do it.

Again he says, well I'm fishing actually for menhaden, and I want to pull him in. But that is how the judge will basically look at it, and it's just complicated. I think we go as far as we can. I would make it mandatory, but I know it's going to be a problem. That's why I'm debating, but I would support mandatory.

I also find it really one of the things that was disheartening at my public hearing is the guys that want us to go to, because they are all catch and release fishermen the ones that were speaking, they wanted me to go to about 45 percent reduction, because they need more catch and release fish. But they also did not want circle hooks, because they want to snag and drop.

I said, "Wait a minute, you're going to want to snag and drop?" For people that don't know what I'm talking about. If the bunks are sitting about 100 feet, 200 feet off there they take the rod, put a bunker snag on, throw it out as far as they can, snag a bunker with a treble hook with a piece of led in it, and then let it sit out there, the striped bass will get it. I say unlike what I used to do is pull them in and basically put a circle hook, and then put them back out again.

But that's what they're doing. I say how can you do something like that? It was different when you were basically taking one of those fish home to eat, because if you had a gut hooked fish you would take that and then quit doing it that way. But that's not what they're doing. It was disheartening for me to hear that at my public hearing. Yes, I support mandatory. I don't know if somebody wants to make a motion. I'll let more conversation before I make a motion.

CHAIRMAN ARMSTRONG: Ritchie White.

MR. WHITE: Move to approve Option B.

CHAIRMAN ARMSTRONG: Second by Senator Miramant.

MR. WHITE: I'll speak to it if I may.

CHAIRMAN ARMSTRONG: Go ahead Ritch.

MR. WHITE: As I said there was extensive discussion in Law Enforcement, and I think Kurt talked about benefits, even though enforcement is going to be extremely difficult, but he talked about the benefits of having it in law, because 90 percent of the people if it's in law will do it. It's the small percent that create problems, probably regardless if it's in the law or not. Please correct me if I'm wrong, Kurt.

MR. BLANCHARD: That was the discussion.

MR. WHITE: That's the basis of this. It is hard to enforce, but if we can get most people to abiding by it then we've done our job.

CHAIRMAN ARMSTRONG: Pat Keliher.

MR. KELIHER: I support the motion. I think Deputy Chief Blanchard really stated it well yesterday about the compliance issues. Maine has had mandatory circle hooks for several years now. We have a very high compliance rate. When we're not seeing compliance, we're usually dealing with it from an educational standpoint.

The officers are, and occasionally writing a warning and then changing behaviors that way, without writing tickets and dealing with the challenges that Kurt spoke to earlier with the courts. I think beyond this conversation, somebody ought to talk to the incoming Chairman about a broader conversation about circle hooks across the board. We're talking about them everywhere now, and maybe we need to have that broader conversation.

CHAIRMAN ARMSTRONG: Justin Davis.

DR. DAVIS: I'll also speak in support of the motion. Certainly as I mentioned earlier, I'm concerned about the issue of discard mortality of this stock. I think this is a good first step, hopefully one of many. I'm wondering if we need to consider an implementation deadline for this, because I don't believe, certainly from Connecticut's standpoint.

We could probably not craft regulations and implement them on the same timeline that we're going to be required to implement the other regulations we're going to adopt pursuant to this Addendum. I guess I'm looking for some direction from the folks up front there if we should consider an implementation deadline.

MR. APPELMAN: Yes I think Jim asked a similar question earlier. It is up to the Board if they want to have the same implementation timeline for all the measures approved today, or separate timelines, implementation dates for different pieces of the Addendum, this would be a good candidate for a second timeline.

CHAIRMAN ARMSTRONG: Yes, we put in circle hooks and we shoved it off a year for all the reasons we all know. Bait and tackle shops need to get rid of current stock, et cetera. We need to educate the public, so that is a reasonable thing to add. Jim Gilmore.

MR. GILMORE: That was my question was the same issue, the implementation date on the circle hooks. To your point, Mr. Chairman, I think giving some time to implement this. I think Kurt said yesterday, I was listening also, was that the majority of the fishermen if they know it's a rule will abide by it, and you get some just voluntary compliance just because they know it's the rule.

If we phase that in I think probably more protection of the resource while we're letting the for-hire industry get rid of their stock or whatever. Whatever we need to do, I think we need to identify a date, but is that something that we need to today or is that something that we can push off until the February meeting?

MR. APPELMAN: My goal is to get that today. We will have to set implementation date after we deal with circle hooks, and that is when that can come up again. But yes I would like to get that today.

CHAIRMAN ARMSTRONG: Okay and we don't need to put that as an amendment now, we can talk about it as part of the implementation schedule at the end, five minutes from now. Representative Peake.

REPRESENTATIVE SARAH PEAKE: A question about Option B. In the middle of the paragraph is says states have the flexibility to develop regulations that address specific needs of their fisheries. I guess my question is will that allow states the flexibility to exempt certain sectors from the circle hook requirement?

MR. APPELMAN: When the PDT put this measure together in the document that was one of the struggles that we had. We learned from other states going through this process that it's very difficult to get a blanket statement there to apply to all anglers, and the PDT there was no way we were going to be able to create that language ourselves.

Because of that that is why you see that flexibility in there. If this option were to pass, we would need some guidance, the Plan Review Team, on where those exemptions could apply, what fraction of total catch you are addressing with your circle hook provision, something that we can use to say yes this meets the intent of the provision.

REPRESENTATIVE PEAKE: Thank you and I don't mean to imply that I'm not supportive of circle hooks, but there may be in very small well defined sectors for a variety of reasons we might want to take a look at. I want to make sure we have that flexibility within this option.

MR. APPELMAN: Yes again the intent is to allow. We standardized the definition of circle hooks that's about as much as the Plan Development Team could do; allowing states flexibility to work with their anglers, work with their sectors to craft a language, a regulation that would work for the majority of anglers out there targeting stripers.

CHAIRMAN ARMSTRONG: John McMurray.

MR. McMURRAY: Yes I support the motion. I think it's a no brainer, with the understanding that this will not help discard mortality on paper. We're stuck with a 9 percent regardless. But it's the right thing to do, and I think it will have a real effect on the water in reducing discards. I do understand the compliance concerns, but say what you want about Mike in Maryland, but they did show us that high level of compliance can be achieved, and I think with the right educational component here we will have a high level of compliance.

CHAIRMAN ARMSTRONG: Joe Cimino.

MR. CIMINO: I think that's a good time to follow up. I also support this, and I think one of the main reasons for me is that it will get this information out into the public better than anything else we can do. But reading the option it mentions educational stuff is encouraged. Max's presentation sort of suggested that there will be an educational component to it, so I'm just trying to get some clarity. Does Option B have any educational requirements, and if so what would states be held to for that?

MR. APPELMAN: As far as a compliance criteria, no. It is encouraging anglers to use that provision. I think the intent is that if a state is going to put a regulation on the book, there would have to be some sort of education criteria there already. By default states would be doing that.

CHAIRMAN ARMSTSRONG: Mike Luisi.

MR. LUISI: I just want to speak to the point of flexibility. I'm glad it came up and it was discussed, because as you all know we implemented mandatory measures a few years ago for circle hooks, and we found challenges in that. We found challenges in trying to get a circle hook regulation put through our process with bait as a general term, due to how many other fisheries are happening in our area of the Bay with bait.

What we did was we made an attempt to try to achieve, you know let's try to hit 95 percent of those people fishing during a certain time of year with a certain method. I would hope that as it has been discussed and written, it is more important I think to get the regulations on your books, and be able to be flexible around how that rule applies.

Then through the Amendment perhaps we can tighten that up. Maybe it could be more broadly applied to all bait fisheries. But I think right away if we had trouble, I'm sure other states are going to have trouble with that too. Flexibility is a key here for the first few years of mandating this hook.

CHAIRMAN ARMSTRONG: Senator Miramant, final word.

SENATOR MIRAMANT: That was part of what I wanted to say was the getting it on the books is an education, because 99 percent of the people I know check the regulations for the New Year, because they know something will change. They noted that it's in place, but I think that the, I didn't say this just because of this, but I think there is a real bait and switch issue going on with giving a year to keep selling something that will be illegal if you give a year. You're saying here, come buy all these hooks up to benefit the sellers, so you have something that you have to throw away in a year, or be tempted to use and break the law. I don't think it should be delayed. It should go on the books right away, and that will be an education.

CHAIRMAN ARMSTRONG: Let's move the question. We're ready to vote. All in favor of the motion raise your hand. Thank you, opposed, abstention, and null, the motion passes unanimously. Okay one more item.

MR. APPELMAN: Before we leave this topic, I do want to say. You know we've been talking about this flexibility, and again the Plan Review Team is going to review these proposals, implementation plans, and have to make a call on whether it meets the intent of this. I would like to have some sort of consensus around this table.

It could be as simple as any regulation on the book would meet the intent here, no matter who it applies to or as complex as you want to make it, but can we just have a minute of discussion giving some guidance to the Plan Review Team about intent for these circle hook provisions.

CHAIRMAN ARMSTRONG: Roy Miller.

MR. MILLER: Mr. Chairman, to provide some guidance I would just direct us to Paragraph 3 of Section 3.2, Circle Hook Provisions. I think that says a lot of what we need to specify in the way of intent.

CHAIRMAN ARMSTSRONG: Pat Keliher.

MR. KELIHER: Yes I agree. I think Section 3.2 overall gives very good guidance. This is about circle hooks for the use of bait, both cut and live. There needs to be an educational component to this from a timing standpoint. I think the biggest issue is when we're going to initiate overall. I differ a little bit from my seatmate on the timing, but I'm not sure what more you would need based on what are under 3.2. I think it's pretty comprehensive.

MR. APPELMAN: I'm just going to probably end this conversation pretty quickly. You got some guidance from Toni in the idea that we'll look at these implementation proposals for the circle hooks provisions and come back in February, recognizing that there is probably going to be, perhaps there might be a delayed implementation with that. We can get some more feedback from the Board at that time.

CHAIRMAN ARMSTRONG: Let's go to implementation schedule. I think there are two parts; one is the whole Addendum, and then one for the circle hooks. Max, what feedback do you *need* for that?

MR. APPELMAN: We need specific dates for when implementation plans will be due, recognizing that the conservation equivalency Guidance Document specifies a period. We've sort of put that in there as default, it would be November 30, but that needs to be in a motion. Also, when the Board would review implementation plans. Again, the intent has been for February, 2020. We would need that in a motion. Then the date by which these measures would become effective, the date that states need to implement those measures. That date also needs to be in a motion.

CHAIRMAN ARMSTRONG: In addition to the circle hook implementation. If the Board feels it should be a different time than the main implementation. We will help you craft that motion, would anyone like to throw their hand up? Andy, thank you.

MR. SHIELS: Let start with the plans. I think you said November 30th. I make the motion that the plans are due November 30, and you can Wordsmith the rest of it.

CHAIRMAN ARMSTRONG: I'll wait until it's up there to ask for a second. We have a second, Ritchie White, sight unseen, awesome. Andy you said and the other language that we talked about, correct?

MR. SHIELS: Yes I did.

CHAIRMAN ARMSTRONG: Do you have a comment on the circle hook implementation part?

MR. SHIELS: For Pennsylvania it was interesting, because our anglers were volunteering to do circle hooks, even if we didn't require it. In order for us to take action on this, it would be much simpler for Pennsylvania to roll everything that we talked about today into a single action. We're prepared to do circle hooks for 2020. I'm looking at this; our season is going to be open depending on the conservation equivalence, the months of April and May. Typically March is when striped bass are on the move, so I'm hoping we can get things done in February, and everybody gets their stuff in order by March. That would be what I would be thinking, but I certainly would listen to others on that.

MR. APPELMAN: Andy I'm sorry, was the implementation date in there as well?

MR. SHIELS: I was looking for an implementation. I was asked specifically about circle hooks. I would like that to be in 2020. I don't know what month that needs to be, but I would rather it be in 2020 than 2021.

CHAIRMAN ARMSTRONG: I believe your intent was to include an implementation date for the entire Addendum of March 1, 2020? That is what Max had mentioned.

MR. SHIELS: Yes, in order to catch that fishery before things start happening up and down the coast.

MR. APPELMAN: Andy, are you good with the wording up there?

MR. SHIELS: Not quite. My intent, and certainly this will be debated I'm guessing, but my intent was that the circle hook requirement is implemented beginning in the 2020 fishing season, not at the end of the 2020 fishing season, March 1. Obviously that is going to be an administrative challenge for many, but that is the motion, and I expect that somebody might want to change that.

MR. APPELMAN: Could I make a suggestion that you're looking to fully implement the provisions of Addendum IV by March 1, or whatever that March date was.

MR. SHIELS: When you say fully implement.

MR. APPELMAN: I'm sorry; I'm trying to squeeze in the last bit of this implementation motion, which is for all the other measures that have been approved today, or selected, also need an implementation date. If you're looking for early 2020, by 2020 I would assume you meant for all the provisions as well.

MR. SHIELS: I'll ask for clarification. Since my understanding was when we started this whole process many months ago that adjustments to everything had to be done in the year 2020. Changes had to be made in the year 2020 in order to affect the change that needed to be done. I don't know if that needs to be the beginning of 2020, the end of 2020.

To be true in the spirit of what the guidance was for the striped bass fishery, because it was overfished and overfishing was occurring, I'm trying to get some dates up front, to make sure we don't slip. But if you tell me that we're all good some time in 2020 that the group can agree that they can make, because that is true to the spirit of what we are charged with. I'm open to that.

MR. APPELMAN: The way I've been explaining this is that it has been the intent of the Board that these measures would become effective January of 2020. That has been the intent of the Board. Now it's time for the Board to specify a date. Whether that changes a few weeks or months to accommodate processes that have to play out that is up to you guys to decide. But we need a specific date now.

MR. SHIELS: That being the case, given what I had said previously and the fact that February, 2020 is in there. I would suggest that March 1st be the date.

MR. APPELMAN: I just want to get it clear on the record. You're not just referring to the circle hook provision; you are referring to all the provisions that have been selected in this document.

MR. SHIELS: Yes, and you promised me you would write all this language if I raised my hand.

MR. APPELMAN: I made no such promise.

CHAIRMAN ARMSTRONG: I promised, I did, and they didn't do it. Has it evolved okay with you, Ritchie? Jason McNamee.

DR. McNAMEE: We're talking about the motion here, Mr. Chair?

CHAIRMAN ARMSTRONG: Yes, I believe we have a finely crafted motion now.

DR. McNAMEE: Okay so March 1st I think would be a little tight for Rhode Island, and I would prefer it to be April 1st. Would that be an amendment that I would be offering?

CHAIRMAN ARMSTRONG: Don't ask me. I got in trouble earlier today about this.

MR. SHIELS: I haven't read this into the record yet, so it's not really a motion, right? I am happy with April 1st, I can certainly agree to that.

CHAIRMAN ARMSTRONG: That would be fine by my rules.

MR. SHIELS: I can agree to that.

CHAIRMAN ARMSTRONG: Yes. Do you have a suggested?

MR. McNAMEE: April 1st.

CHAIRMAN ARMSTRONG: Jim Gilmore.

MR. GILMORE: Mr. Chairman for the circle hook provision, I would like to amend to have that date be January 1, 2021.

CHAIRMAN ARMSTRONG: Is there a second to that? John Clark. Would you care to speak to that?

MR. GILMORE: Again, we've heard very clearly from, and this was one of the clear things we did hear at the hearings was that we have bait and tackle industry, we have the party boat whatever, and they essentially need to get up to speed on this. Mike Luisi put it clear that this is not as simple as writing some new rules and throwing them out there.

Kurt again had said at the meeting is that if you put it in that this is a requirement, you're going to start getting compliance gradually. It's an educational thing that we were going to do. Remember, one of the options was just to make this as an advisory thing or an optional thing, just that we would recommend it. This is doing both. It is kind of phasing it in so that it will be a requirement, but it gives industry or whatever the opportunity to do that over a one year period.

CHAIRMAN ARMSTRONG: Further discussion. Who do we have, Joe Cimino and then Mike.

MR. CIMINO: To just the Senator's concerns, there are other reasons for this. For a state like New Jersey, what we have authority to do by notice is different than some of these things, like the circle hook requirement. It would be set on a different timeline for us as a regulatory change. This I think gives us the flexibility to make sure we're in compliance.

CHAIRMAN ARMSTRONG: Mike Luisi.

MR. LUISI: I'll support the circle hook piece, but I also wanted to speak to when Addendum VI must be implemented by April 1st. Based on what our intent will be, and hopefully the approval of a conservation equivalency proposal in February. Those actions that we're going to be suggesting will not be able to be in place by April 1st. It will most likely be more like midsummer. I'll say that but I'll also state that the early season actions that we're going to put in that proposal, we've already begun the process of implementing those now.

Our spring trophy fishery will be taken care of. The reductions that we're recommending will be done already. But I just would hope that the Board would allow for, as long as we're actively working to get rules in place by April 1st. I think that has always been kind of the common theme that the rules don't have to be on your books, as long as you're trying to get there through whatever process the state uses. I would hope that if we can clarify that I can support the motion.

CHAIRMAN ARMSTRONG: The Chair is thankful you are not amending the Amendment. John Clark.

MR. CLARK: I just wanted a clarification. Now the implementation plan by November 30th that includes conservation equivalency proposals, some of the things that were talked about earlier like changing the percentages? I'm not saying we're going to do that but that is a very aggressive timeline to not just come up with different proposals, but to actually look at how it would affect different sectors of the fishery. I'm just curious. That's mighty fast.

CHAIRMAN ARMSTRONG: Further discussion. Senator Miramant.

SENATOR MIRAMANT: When any of these are short term, it's just like the states having a law that they put on right away and then they don't write tickets, they let a year go where they're just issuing warnings or watching progress. It seems like the Board would be watching that same for a state that is trying to get the information, trying to work on it, misses the date a little bit. We're not going to convene the ASMFC to sanction a state that's working towards the goal and misses by a little, correct or not?

CHAIRMAN ARMSTRONG: Toni.

MS. KERNS: I mean that's the prerogative of the Board. I think there are parts of this such as the submission of the implementation plans, meaning the conservation equivalency proposals have a timeline, because the TC has to review that information in order to provide you guidance for the February Board meeting.

Some of these timelines are very definitive and hard, in order to give the amount of time that's needed to do a thorough review of these proposals. We recognize that this is going to be a quick turnaround, and will be difficult for the states. But in order to have regulations implemented by the beginning of next year, or the beginning of next year's fishery, it's the way we need to make it be.

CHAIRMAN ARMSTRONG: Okay, I think we can vote on this. Let's vote on the motion to amend the circle hook implementation date to a year later. All in favor okay opposed, abstention, and null. The motion passes 11 in favor, 2 opposed, 2 abstentions.

CHAIRMAN ARMSTRONG: Back to the main motion, are we ready to vote as amended? Let's amend it up there first, I guess. I need to read this into the record, I believe. Move that states submit implementation plans by November 30, 2019. The Board will take action on implementation plans in February, 2020. Circle hook requirements must be implemented by January 1, 2021.

All other provisions of Addendum VI must be implemented by April 1, 2020. Are we ready to vote on this motion? Do you need to caucus? **No. All in favor raise your hand, opposed, abstention, and null. The motion passes unanimously.** We have one final motion we need, is that correct, to accept the entire Addendum as amended, as approved sorry. John Clark.

MR. CLARK: I just had one thing to bring up. It's an issue that affects Delaware that came up at the last Board meeting, where there was language that was in the Draft to exempt a few small recreational fisheries from conservation equivalency, because they were not included in the calculations to develop thee 18 percent reduction scenarios. I know that that was changed at the last meeting.

This raises a very strange situation for us now, because we're being asked to do conservation equivalency about fish that have already been counted by the PDT in the calculations to develop the options that we just voted for. This will lead to double counting the same fish. I'm just saying I understand why the Board did what it did at the last meeting, but I just think that looking at this rationally, it's a very small fishery.

It's ridiculous to ask us to do conservation equivalency for striped bass that have already been accounted for by all the calculations that were done to develop these options. I just wanted to put that out there as we go ahead with this, because I think that is something that would be contrary to the ISFMP Charter there, because it's not fair to ask a state to double count a fish. I just wanted to put that out there before we finalize this.

CHAIRMAN ARMSTRONG: They're conferring. Is this to this point, Cheri? Thank you.

MR. APPELMAN: I think the Board made a clear decision that even though those calculations did account for those smaller fish still being harvested that it decided that all states on the recreational sector would have to come forward with conservation equivalency if they didn't want to implement the selected suboption. The calculation, Delaware would still have to submit a proposal to achieve that selected reduction in that particular fishery.

MR. CLARK: If I could just follow up on that Max. If we accept the option that was chosen, with Option 2, you know the slot that was just put forward. Our summer slot fishery has already been accounted for in the calculations.

What would we have to do then? Are you saying we would have to calculate everything back out again?

Yet like I said, those fish have already been accounted for. As far as I'm concerned, if we accept the slot limit provision that was approved right now, and we keep the summer slot fishery, we are still within the provisions of the plan in terms of what we would actually be harvesting in our state.

MR. APPELMAN: Yes I understand what you're getting at. The assumption of, it was a noncompliance assumption really. I mean when this was done back in Addendum IV, the assumption was that there would be a hundred percent compliance. This time the PDT went the other route and said that is probably not a fair assumption.

We're going to assume the same level of noncompliance, meaning all fish not just in Delaware, up and down the coast that were below the minimum size that that harvest would still occur. It's not secluding just the fish from Delaware; it's really all those fish across the coast.

MR. CLARK: Oh I understand that but I'm just saying that the reason it was put in, and as an explanation in the previous Draft that was presented to the Board before the August meeting, was because those fish were accounted for. As I've said, I've seen the calculations and all that. We did all the work done to justify that fishery back in, what was that 2008, Roy, 2009?

We have continued to document that it is a resonant male fishery in Delaware Bay. It's a small fishery, and as I said I'm just saying in this case to do a conservation equivalency for those fish just seems like adding needless work to our state and to the Technical Committee.

DR. DREW: I think the Board, so from the TCs perspective yes. The TC said technically those fish are sort of already accounted for in the calculations of the coastwide level, and that was why we put that forward the way it was. The Board had already decided they don't like that justification and that rationale, and so have said that you guys have to submit a conservation equivalency plan if you want to keep that small summer slot.

If you want to bring that decision back up to the Board, now potentially would be a time to do it. If you want to try this in February, you can try it then. If you want to submit a conservation equivalency plan for that small slot limit, and say it's not going to change the harvest beyond what you would expect under the 28 to 35 inches, you can submit that. But the TCs hands are tied in how we would interpret this by the direction of the Board. If the Board wants to come back on that issue they can.

MR. CLARK: In that case may I ask the Board. I understand why the motion was made as it was. But I think it was a one-size-fits-all. The entire noncompliant fishery removals that were projected forward were about 5 percent, right? Out of that the summer slot fishery we have is probably maybe 10 percent of that 5 percent. We're talking a small fishery, but in Delaware Bay in the summer as we've talked about with the weakfish.

They're not there anymore. We have these small resident striped bass, and as I said before that was taken out of the Draft Addendum that would have just gone forward. I'm just looking for the Board here. If there is support for us to continue that given how minor it is, I would be fine to make a motion right now to do that, but if the Board would rather wait until the next meeting that is fine also.

CHAIRMAN ARMSTRONG: Given the hour is it possible to wait until February?

MR. CLARK: Yes I just wanted to bring it up before everything was finalized, just to let everybody know that this I think is an unintended consequence of what was done with this Addendum. Thanks.

CHAIRMAN ARMSTRONG: Thank you for that. Cheri Patterson.

MS. PATTERSON: Yes, I would like to make a motion to have the Board approve Addendum VI to Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass as amended today.

CHAIRMAN ARMSTRONG: Got it, do we have a second? Who wants to be the second, David Borden? It's about time you raised your hand. Is there any objection to this motion? Seeing none, Addendum VI is approved. I'm sorry, hold on. No objection, it passes without a roll call vote. Is there any business additionally to come before this Board? Tom Fote.

MR. FOTE: I was serious before when I said that maybe we should be doing the circle hooks for bluefish. When I go to my Marine Fisheries Council, I'm actually going to make a proposal that we basically put it in for bluefish, weakfish, and striped bass; mainly because bluefish the chucking fishery a lot used to be there, and it would be much better off with circle hooks so we wouldn't be gut hooking the bluefish.

Since bluefish is actually in a worst case scenario than I think striped bass is right now, we should be protecting them and weakfish is down the tubes altogether. This way it will make it easier for enforcing, maybe not perfect, but at least it can't say they are fishing either one of those three species, they all require circle hooks if you're fishing bait.

REVIEW CRITERIA FOR DEVELOPMENT OF CONSERVATION EQUIVALENCY PROPOSALS

CHAIRMAN ARMSTRONG: I guess we're not done with conservation equivalency. We have a very brief item here, at least a presentation.

MS. LENGYEL: I will be presenting the TC criteria for conservation equivalency for Addendum VI. I will just add as a brief background, conservation equivalency allows states to develop alternative measures to address specific state or regional differences, while still achieving the same level of conservation for the resource.

Currently several states implement CE programs. Draft Addendum VI maintains this flexibility. The Board has had discussions about this already today. All CE proposals are subject to TC review and Board approval, so these will be going to the TC in the next couple of months, and then for Board approval in February.

Who needs to submit a CE proposal? For recreational measures if you're deviating from any of the Board's selected suboptions, states must submit a state-specific analysis using state-specific data, demonstrating the proposal meets the required reduction relative to 2017 levels, which the Board has decided is 18 percent.

Data sources, the TC has said that MRIP data will be the default data source to be used for any CE proposal, and that the years to be used will be 2016 and '17 for all size-related analyses, and 2015 to 2018 for any seasonal and mode-based analyses. Analyses to be used shall follow the standard procedures for size and bag limit analyses that the TC has used in developing Addendum VI options. Other analyses will be reviewed on a case-by-case basis, and confidence intervals may be considered by the TC.

However, the TC generally requires point estimates to be at or above the required reduction, and the TC has recommended that any state that comes forward with a proposal with confidence intervals, come forward with a second proposal based on point estimates, in case the first proposal is not endorsed by the TC.

For noncompliance, the TC has set to assume the same level of noncompliance that occurred in the data years will occur in 2020. For post release mortality, CE proposals are to use 9 percent as a default, and if states use alternative estimates for CE savings it has to be supported by the scientific literature, although the use of circle hooks would not allow for extra savings through conservation equivalency, as the Board has just made that a mandatory requirement.

For closed seasons, using closed seasons to achieve the required reductions will be evaluated on a case-by-case basis. The TC has commented that seasonal closures less than two weeks are unlikely to be effective, but didn't specify any minimum closures as criteria. For commercial measures Draft Addendum VI accounts for previously implemented commercial CE proposals, therefore states do not need to resubmit if maintaining current commercial size limits.

Only if a state chooses to modify its existing commercial size limits would it need to submit a state-specific analysis, and adjust its quota relative to the new Addendum VI baseline quota. States may allocate the total required reduction differently between regions and sectors, as long as the total statewide reduction is at least equal to the total required reduction. Again, this is not a TC criteria, this is set in Addendum VI. With that we can take any questions.

CHAIRMAN ARMSTRONG: Any questions for Nicole? To be clear, these are the criteria that you can pass on to your TC folks. Jason McNamee.

DR. McNAMEE: Maybe not a question about the information. I supported all of it, and so I wonder is that what we need to do is just say that we support the criteria that were developed by the TC?

MR. APPELMAN: Yes this was just information. I had a feeling that some folks would have some questions about this stuff, but we had pretty lengthy conversations about conservation equivalency already, and I think that cleared the air about a lot of it. This is just informational.

MS. KERNS: It would be good to get concurrence by the Board. It doesn't need to be a motion, but just that the Board is agreeing, as outlined in the guidelines in the Conservation Equivalency Proposal the TC can set or can give guidance to the Board for how the data should be supplied in conservation equivalency proposals, and we just want to have concurrence from the Board on what the TC has outlined.

CHAIRMAN ARMSTRONG: Okay, so is everyone clear on that? The TC has given us the criteria that they will use to evaluate proposals, and hopefully we can have consensus that this is good. Emerson.

MR. HASBROUCK: I think we all concur.

ADJOURNMENT

CHAIRMAN ARMSTRONG: Do we concur with the concurrence? Heads are nodding. We are at the point of is there any other business, please. We are adjourned.

(Whereupon the recording ended at 6:12 o'clock p.m. on October 30, 2019)

Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 22, 2020

To: **Atlantic Striped Bass Management Board (Board)**

From: **Max Appelman, Fishery Management Plan Coordinator**

RE: **State Implementation Plans and Conservation Equivalency Proposals with Addendum VI to Amendment 6 to the Interstate Fishery Management Plan**

Addendum VI to Amendment 6 was approved in October 2019. The Addendum reduces all state commercial quotas by 18%, and implements a 1 fish at 28" to less than 35" recreational slot limit for ocean fisheries and a 1 fish at 18" minimum size limit for Chesapeake Bay recreational fisheries. States may pursue alternative regulations through Conservation Equivalency (CE) to achieve an 18% reduction in total removals relative to 2017 levels. Addendum VI also requires the mandatory use of circle hooks when fishing recreationally for striped bass with bait to reduce release mortality in recreational striped bass fisheries. States and jurisdictions were required to submit implementation plans, including any CE proposals, by November 30 for technical review.

The Technical Committee (TC) met December 17-18, 2019, in Arlington, Virginia, to review technical merit of state implementation plans and develop consensus recommendations for Board consideration. Some follow-up work was requested and reviewed via conference call on January 15, 2020. A summary of proposed state measures that were accepted by the TC based on technical merit are provided in the following tables. This is followed by each state implementation plan ordered from north to south. To avoid duplication, only the revised state implementation plan is included if a state needed to resubmit its proposal following TC review.

A TC memo outlining analytical uncertainties and caveats, as well as providing specific comments on each state's proposed measures, will be included in Supplemental Materials.

M20-005

Table 1. Proposed 2020 recreational fishery regulations for Atlantic striped bass by state. No predicted reduction calculated if implementing the Addendum VI measure. Numbering of options matches the convention used in state implementation plans for cross referencing, when possible.

Option	Predicted Reduction	Mode/Region	Size Limit	Bag Limit	Open Season	Other
Maine						
ME-1	Add VI	All	28" to < 35"	1	All Year	
New Hampshire						
NH-1	Add VI	All	28" to < 35"	1	All Year	
Massachusetts						
MA-1	Add VI	All	28" to < 35"	1	All Year	
Regional Proposal (Rhode Island/Connecticut/New York)						
REG-A	-20.9%	All	28" to < 35"	1	All Year	Predicted reductions account for Hudson/ Delaware River removals from New York.
REG-B	-20.1%	All	30" to < 40"	1	All Year	
REG-C	-20.0%	Private/Shore	30" to < 40"	1	All Year	
		For Hire	28" to < 37"	1	All Year	
Rhode Island						
RI-A	Add VI	All	28" to < 35"	1	All Year	
RI-B	-25.7%	All	32" to < 40"	1	All Year	
RI-C	-19.0%	Private/Shore	32" to < 40"	1	All Year	
		For Hire	30" to < 40"	1	All Year	
Connecticut						
CT-A	Add VI	All	28" to < 35"	1	All Year	

Table 1, continued. Proposed 2020 recreational fishery regulations for Atlantic striped bass by state.

* NY-8 is any of NY-1 – 7 with a 31" min size for the for-hire sector where captain and crew may no longer keep a fish.

^ NJ-R1 and NJ-R2 achieve at least a 35.9% and 34.9% reduction depending on which bonus program measure is selected. Additional closure days added for Raritan Bay to achieve required reduction in some cases (see New Jersey proposal for details).

Option	Predicted Reduction	Mode/Region	Size Limit	Bag Limit	Open Season	Other
*** New York Ocean**						
NY-1	Add VI	All	28" to < 35"	1	5.1 - 11.30	Predicted reductions account for Hudson/ Delaware River removals. Also considering options 1-8 with no season change (4.15 – 12.15). This results in slightly smaller predicted reductions.
NY-2	-21.0%	All	28" to < 38"	1	5.1 - 11.30	
NY-3	-25.5%	All	30" to < 40"	1	5.1 - 11.30	
NY-4	-20.0%	All	30" to < 42"	1	5.1 - 11.30	
NY-5	-21.7%	All	32" to < 44"	1	5.1 - 11.30	
NY-6	-20.3%	All	28" to < 35" or > 44"	1	5.1 - 11.30	
NY-7	-19.9%	All	34" min	1	5.1 - 11.30	
NY-8	-18.7%	For Hire	31" min	1	5.1 - 11.30	
New York Hudson River - North of George Washington Bridge (River Mile 12)						
NYH-1	-5.2%	Hudson River	18" to < 28"	1	4.1 - 11.30	Achieves at least 18% reduction when combined with any ocean measure
NYH-2	-6.6%	Hudson River	18" to < 28" or > 44"	1	4.1 - 9.30	
NYH-3	-6.7%	Hudson River	18" to < 28"	1	4.1 - 9.30	
New York Delaware River						
NYD-1	-	Delaware River	28" to < 35"	1	All Year	See note above
^ New Jersey						
NJ-R1	-35.9%	All	24" to < 28"	1	All Year^	Closed 1.1 - 2.28 in all waters except Atlantic Ocean and 4.1 - 5.31 in the lower DE River and tributaries
NJ-R2	-34.9%	All	24" to < 29"	1	All Year^	
NJ-R3	Add VI	All	28" to < 35"	1	All Year	
NJ-R4	-46.0%	All	28" to < 34"	1	All Year	
NJ-R5	-27.0%	All	35" min	1	All Year	
Pennsylvania - Delaware Estuary and River						
PA-1	Add VI	DE Estuary	28" to < 35"	1	1.1 - 3.31, 6.1 - 12.31	
	-19.0%	DE Estuary	21" to < 24"	2	4.1 - 5.31	
	Add VI	DE River (Non Tidal)	28" to < 35"	1	All Year	

Table 1, continued. Proposed 2020 recreational fishery regulations for Atlantic striped bass by state.
† Charter captains cannot keep a fish for personal consumption under all of Maryland's proposed measures.

Option	Predicted Reduction	Mode/Region	Size Limit	Bag Limit	Open Season	Other
Delaware						
DE-1	-18.0%	Ocean	28" to < 38"	1	All Year	Catch and release only on spawning grounds 4.1 -5.31
DE-2	-20.0%	Ocean	28" to < 35"	1	All Year	
DBAY-1	-	Bay, River, Tribs	20" to < 25"	1	7.1 - 8.31	
Maryland Ocean						
MD-1	Add VI	Ocean, All	28" to < 35"	1	All Year	Achieves required reduction when combined with any Chesapeake Bay option
† Maryland Chesapeake Bay						
MD-2a	-20.8%	All	35" min	1	5.1 - 5.15	No targeting March - April and during July closure
		All	19" min; only 1 fish > 28"	2	5.16 - 7.4 and 9.1 - 12.6	
		All	19" min	1	8.1 - 8.31	
MD-2b	-20.6%	All	35" min	1	5.1 - 5.15	No targeting during July closure
		All	19" min; only 1 fish > 28"	2	5.16 - 7.4 and 9.1 – 11.30	
		All	19" min	1	8.1 - 8.31	
MD-2c	-20.7%	All	35" min	1	5.1 - 5.15	No targeting April and during July closure
		All	19" min; only 1 fish > 28"	2	5.16 - 7.9 and 10.1 - 12.6	
		All	19" min	1	8.1 - 9.30	
MD-2d	-20.7%	All	35" min	1	5.1 - 5.15	No targeting April and during August closure
		Private/Shore	19" min	1	5.16 - 8.16 and 9.1 - 12.10	
		For-hire	19" min; only 1 fish > 28"	2		

Table 1, continued. Proposed 2020 recreational fishery regulations for Atlantic striped bass by state.

Option	Predicted Reduction	Mode/Region	Size Limit	Bag Limit	Open Season	Other
District of Columbia						
1	Add VI	All	18" min	1	5.16 - 12.31	
Potomac River Fisheries Commission						
TROPHY-1	20.5%	Spring	35" min	1	5.1 - 5.15	Downstream of Rt. 301 bridge
PRFC-1	20.5%	Fall	20" min	2	5.16 - 7.6 and 8.21 - 12.31	No direct targeting during closed July and August closure
PRFC-2	20.5%	Fall	20" min	2	5.16 - 6.30 and 9.1 - 12.31	
PRFC-3	20.5%	Fall	20" min	2	8.8 - 12.31	
PRFC-4	20.5%	Fall	20" min	2	5.16 - 6.6 and 11.18 - 12.31	
Virginia						
VA-1	-23.4%	Ocean	28" to <= 36"	1	1.1 - 3.31 and 5.16 - 12.31	Also considering allowing 1 fish/ person/year @ >36" in all areas (does not affect calculations).
		Bay	20" to <= 36"	1	5.16 - 6.15 and 10.4 - 12.31	
North Carolina						
NC-1	Add VI	Ocean	28" to < 35"	1	All Year	

Table 2. Proposed 2020 <u>commercial ocean fishery</u> regulations for Atlantic striped bass by state. Numbering of options matches the convention used in state implementation plans for cross referencing, when possible. H&L = hook and line; GC = general category; FFT = floating fish trap.

Option	Proposed Change in Quota	Gear/Region	Size Limit	Quota (pounds)	Open Season	Other
Maine, New Hampshire, Connecticut, Pennsylvania, District of Columbia						
No commercial fishery, no reallocation of commercial quota						
Massachusetts						
MA-2a	Add VI	H&L	34" min	713,246	6.23 - 12.31 or until quota reached. Mon and Thurs only. 2-fish or 15-fish limit depending on permit.	
MA-2c-1(a)	-18%	H&L	28" min	658,260		
MA-2c-2(a)	-18%	H&L	35" min	735,240		
MA-2c-3(a)	-18%	H&L	28" to < 35"	454,027		
Rhode Island						
A	-18%	GC	34" min	90,822	5.20 - 6.30, 7.1 - 12.31	61% of state quota
		FFT	26" min	58,067	4.1 - 12.31	39% of state quota
New York						
NY-A	Add VI	All	28" to < 38"	652,552	6.1 - 12.15 or until quota reached. Limited entry permit only. 6-8" stretched mesh for GN	
NY-D1	-18%	All	24" to < 36"	622,122		
NY-D2	-18%	All	26" to < 38"	640,718		
New Jersey (no commercial fishery, reallocate quota to recreational sector)						
NJ-C1	0%	H&L	24" to < 28"	215,912	1 fish/person/day. Opening 5.15 or 9.1. Limited number of permits issued to ensure quota not exceeded	
NJ-C2	0%	H&L	24" to < 29"	218,464		
NJ-C3	0%	H&L	35" min size	459,898		
NJ-C4	0%	H&L	24" to < 28" OR >= 43"	215,912		500 trophy permits
NJ-C5	0%	H&L	24" to < 28" OR >= 43"	215,912		1000 trophy permits
NJ-C6	0%	H&L	24" to < 29" OR >= 43"	218,464		500 trophy permits
NJ-C7	0%	H&L	24" to < 29" OR >= 43"	218,464		1000 trophy permits

Table 2, continued. Proposed 2020 <u>commercial ocean fishery</u> regulations for Atlantic striped bass by state. H&L = hook and line; GN = gill net; TRL = trawl.

Option	Proposed Change in Quota	Gear/Region	Size Limit	Quota (pounds)	Open Season	Other
Delaware						
DE-1	-18%	GN	28" min	113,021	2.15 - 5.31 (Nanticoke River closes 3.30), 11.15 - 12.31	Drift nets only 2.15 - 2.28, 5.1 - 5.31; no fixed nets in DE River. No trip limit.
		GN (Spring)	20" min			
		H&L	28" min	5,948	4.1 - 12.31	200 lbs/day trip limit
DE-2	-1.8%	GN	28" min	135,350	2.15 - 5.31 (Nanticoke River closes 3.30), 11.15 - 12.31	Drift nets only 2.15 - 2.28, 5.1 - 5.31; no fixed nets in DE River. No trip limit.
		GN (Spring)	20" min			
		H&L	28" min	7,124	4.1 - 12.31	200 lbs/day trip limit
Maryland						
MD-3a	-1.8%	TRL, GN	24" min	89,094	1.1 - 5.31, 10.1 - 12.31	
Virginia						
VA-1	-9.8%	Ocean	28" min	125,034	1.16 - 12.31	9" max mesh size for GN
North Carolina						
NC-1	-18%	Ocean	28" min	295,495	12.1 - 11.30	

Table 3. Proposed 2020 commercial Chesapeake Bay fishery regulations for Atlantic striped bass by state. When possible, numbering of options matches the convention used in state implementation plans for cross referencing. H&L = hook and line; GN = gill net; HS = haul seine; PN = pound net.

Option	Proposed Change in Quota	Gear/Region	Size Limit	Quota (pounds)	Open Season	Other
Maryland Chesapeake Bay						
MD-4a	-1.8%	GN	18" to < 36"	1,445,394	1.1 - 2.29, 12.1 - 12.31	
		H&L, HS			6.1 - 11.30	
		PN			6.1 - 12.31	
Potomac River Fisheries Commission						
PRFC-1	-1.8%	GN	18" min	349,405	1.1 - 3.25, 9.9 - 12.31	36" max, 2.15 - 3.25
		PN		127,748	2.15 -3.25, 6.1 - 12.15	
		H&L		81,959	1.1 - 3.25. 6.1 - 12.31	
		Misc.		13,749	2.15 -3.25, 6.1 - 12.15	
Virginia Chesapeake Bay						
VA-1	-7.7%		18" min	983,393	1.16 - 12.31 (28" max 3.15 - 6.15)	7" max mesh size for GN

Atlantic Striped Bass Addendum VI Implementation Plan Template

Implementation Plans are due November 30, 2019

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Maine	**28" minimum to less than 35" total length**	**1 fish**		**Status quo (see language in Section 1)**

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Maine	**NA**	**NA**	**NA**

Section 1: Coastal Recreational Fishery

Maine intends to maintain current striped bass closed areas and seasons. Language from Maine's regulations regarding seasons are included below and a full copy of the state's regulations are appended to this implementation plan.

42.03 Striped Bass - Closed Area and Closed Season

A. Except as provided in 42.03 (B), from the 1st day of December to June 30, inclusive, it is unlawful for any person to take and retain any striped bass from the tidal waters of the Kennebec River inside and upstream of a line drawn from the outer extremity of Cape Small to the outer extremity of Salter Island, thence to the outer extremity of Cape Newagen and including Merrymeeting Bay and tributaries, the tidal waters of the Sheepscot River, Androscoggin River, Sasanoa River, and all other tidal tributaries of the Kennebec River. From July 1 through November 30, statewide regulations apply to this area.

B. Special Hook and Release Season/Area. From May 1 to June 30, it shall be lawful to fish for striped bass in the waters described in 42.03(A) with a hook and line and single hooked artificial lures. Any striped bass caught during this special season/area fishery shall be immediately released and returned alive, without further injury, to the waters from which they were taken.

C. Waters Seasonally Closed to the Use of Bait. From May 1 to June 30, inclusive, it is unlawful to possess or use bait while hook and line fishing for any finfish species in waters described in 42.03(A). During this closed season (May 1 to June 30), possession of hook and line fishing gear and bait on waters described in 42.03(A) is prima facie evidence of violating this regulation. For purposes of this section, "bait" is defined as any live or dead marine organism, or part thereof.

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)

NA

Section 3: Coastal Commercial Fishery
Maine does not have a commercial striped bass fishery.

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)
NA

Section 5: Circle Hook Requirements
Maine already requires the use of circle hooks when using bait to fish for striped bass. The language specific to circle hooks is below and a full copy of the state's striped bass regulations are appended to this implementation plan.

1. *Method of Taking*

C. It is unlawful to use any hook other than a circle hook when using bait. For purposes of this chapter the definition of circle hook means "a non-offset hook with a point that points 90º back toward the shaft of the hook".

Exception: Rubber or latex tube rigs will be exempt from the circle hook restriction as long as they conform with the following: the lure must consist of a minimum of 8" of latex or rubber tubing with a single hook protruding from the end portion of the tubing where bait may be attached. Use of treble hooks is not allowed with these rigs.

Section 6: Timeline for Implementation
It is expected that new striped regulations needed to come into compliance with Addendum VI will implemented in mid-March 2020. More specifically, Maine DMR plans to notice a proposed rule change for striped bass recreational measures in early January. Approval of the proposed regulations by the DMR Advisory Council will occur in early March 2020. DMR will then file the final rule immediately after the Advisory Council meeting. New regulations are effective 5 days after the Department's filing. This timeline will meet the April 1, 2020 compliance date set by the Striped Bass Board and will ensure new regulations are in place ahead of the Maine recreational fishery. Circle hook requirements for striped bass are already codified in Maine regulations.

CHAPTER 42

STRIPED BASS

TITLE INDEX

DEPARTMENT OF MARINE RESOURCES

Chapter 42 - Striped Bass

42.01 Statewide Striped Bass Size Restrictions, Harvest Methods

1. Method of Taking.

A. It is unlawful to fish for or take striped bass in territorial waters, except by hook and line. It is unlawful to use a gaff to land any striped bass.

B. It is unlawful to use multiple (more than two) barbed or barbless treble hooks on any artificial lure or flies while fishing for striped bass in territorial waters.

C. It is unlawful to use treble hooks when using bait.
The following becomes effective January 1, 2013:
It is unlawful to use any hook other than a circle hook when using bait. For purposes of this chapter the definition of circle hook means “a non-offset hook with a point that points 90º back toward the shaft of the hook”.

Exception: Rubber or latex tube rigs will be exempt from the circle hook restriction as long as they conform with the following: the lure must consist of a minimum of 8” of latex or rubber tubing with a single hook protruding from the end portion of the tubing where bait may be attached. Use of treble hooks is not allowed with these rigs.

D. Any striped bass legally taken from the territorial waters shall be immediately released alive into the water from which it was taken, or killed at once. Any striped bass killed becomes part of the daily bag limit in accordance with Chapter 42.02.

2. Size Restrictions.
It is unlawful to take or possess striped bass which are less than 28 inches long total length. It is unlawful to possess striped bass unless the fish are whole with head on and are 28 inches or greater.

42.02 Striped Bass - Limits, Personal Use

It is unlawful for any person to fish for, take or possess striped bass in or from territorial waters, except for personal use. The sale of wild striped bass caught for personal use or by commercial fisheries in other States or jurisdictions is prohibited in the State of Maine.

It is unlawful for any person to take or possess more than one (1) striped bass each day which may be 28 inches in total length or greater.

Exception for Hybrid Striped Bass:

This Section shall not apply to the possession and sale of hybrid striped bass under the following conditions:

1. Hybrids (*Morone saxatilis* x *Morone chrysops*). Whole aquaculture raised striped bass shall have a tag or label affixed to each fish container holding fish.

2. Fillets. Fillets from aquaculture-raised hybrid striped bass shall have the skin attached.

3. Tags and Labels. All tags and labels affixed to containers of whole aquaculture-raised hybrid striped bass and filets from aquaculture-raised hybrid striped bass shall be clearly marked "Hybrid Striped Bass" and provide the following information:

a. State of origin
b. Name and address of shipping and receiving dealers
c. Permit number of shipping and receiving dealers
d. Date shipped
e. Net weight of container

4. Nomenclature. It is unlawful for any person to market, promote, advertise, or sell whole hybrid striped bass or hybrid striped bass fillets as "striped bass." Only the term "hybrid striped bass" shall be used when marketing, promoting, advertising, or selling at retail hybrid striped bass and hybrid striped bass fillets.

42.03 Striped Bass - Closed Area and Closed Season

A. Except as provided in 42.03 (B), from the 1st day of December to June 30, inclusive, it is unlawful for any person to take and retain any striped bass from the tidal waters of the Kennebec River inside and upstream of a line drawn from the outer extremity of Cape Small to the outer extremity of Salter Island, thence to the outer extremity of Cape Newagen and including Merrymeeting Bay and tributaries, the tidal waters of the Sheepscot River, Androscoggin River, Sasanoa River, and all other tidal tributaries of the Kennebec River. From July 1 through November 30, statewide regulations apply to this area.

B. Special Hook and Release Season/Area. From May 1 to June 30, it shall be lawful to fish for striped bass in the waters described in 42.03(A) with a hook and line and single hooked artificial lures. Any striped bass caught during this special season/area fishery shall be immediately released and returned alive, without further injury, to the waters from which they were taken.

C. Waters Seasonally Closed to the Use of Bait. From May 1 to June 30, inclusive, it is unlawful to possess or use bait while hook and line fishing for any finfish species in waters described in 42.03(A). During this closed season (May 1 to June 30), possession of hook and line fishing gear and bait on waters described in 42.03(A) is prima facie evidence of violating this regulation. For purposes of this section, "bait" is defined as any live or dead marine organism, or part thereof.

CHAPTER 42

STRIPED BASS

INDEX

EFFECTIVE DATE:
May 15, 1989

AMENDED:
June 11, 1990
May 10, 1992 – Section 1 and 3
May 25, 1994 – Section 3
August 9, 1995 – Section 2
April 21, 1997 – Section 1 and 2
September 15, 1997 – Section 1 and 3
April 23, 2000 – Sections 1, 2 and 3
December 20, 2010 – Sections 01 and 02
April 16, 2013 – Section 01 (1)(C)
May 13, 2015 – Section 01 (2); 2

Atlantic Striped Bass Addendum VI Implementation Plan for New Hampshire

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
NH	**28”-35”**	**1**	**Gaffing and culling are prohibited**	**Jan 1 – Dec 31**

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
NH	**NA**	**NA**	**No Commercial Fishery**

Section 1: Coastal Recreational Fishery

“Option 1a.) A one fish bag limit and a slot size limit of 28” minimum size to less than 35” total length may be implemented for the ocean fishery without further analysis. The same fishing seasons as in 2017 is required.”

New Hampshire will be modifying current recreational striped bass fishing rules to meet Option 1a’s requirements for all state waters by May 1, 2020 (see proposed rules):

- One fish per day (current rule)
- No closed season (current rule and no variation from 2017)
- Length limit of greater than 28”and less than 35“ (current rule minimum of 28” in length).

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)

[Not Applicable]

Section 3: Coastal Commercial Fishery

“Option 2a.) Implementation of an 18% reduction from the Addendum IV quotas. The reduced quotas in Addendum VI account for previously approved CE programs, therefore, states do not need to submit for CE if they choose to maintain 2017 size limits in its commercial fisheries. “

Current New Hampshire rules prohibit the sale of striped bass regardless of origin (See current rules, Fis 603.08) and does not currently utilize any of its allocated commercial quota for striped bass. These rules will remain unchanged for the 2020 fishing year, and the reserved allocated quota will reflect the 18% reduction.

<u>Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)</u>

[Not Applicable]

<u>Section 5: Circle Hook Requirements</u>

The New Hampshire Fish and Game Department will begin the process of implementing rules requiring the use of circle hooks if fishing with bait in the striped bass fishery in state waters (see proposed rules). The rulemaking process in New Hampshire will be initiated in December and should be in place prior to the beginning of the 2020 fishing season (April 1, 2020).

As a part of public education and outreach campaigns, the New Hampshire Fish and Game Department has in recent years distributed informational brochures about the benefits of the use of circle hooks to recreational anglers along with a packet of circle hooks. It is our intent to continue to distribute these brochures and hooks in 2020 and we will provide access to digital copies of the brochure on our website, at public events, and at the Region 3 Office.

<u>Section 6: Timeline for Implementation</u>

The New Hampshire Fish and Game Department has initiated new rules (see proposed rules) in the striped bass fishery in state waters; 1 fish daily bag limit, slot size limit of 28”-35”, and mandatory use of circle hooks, if fishing with bait. The rules should be in place by April 1, 2020, prior to the beginning of the NH’s striped bass fishing season (approximately May 1, 2020).

Current rules:

Fis 603.08 Striped Bass.

(a) No person shall take, possess, or transport striped bass less than 28 inches in total length. Striped bass shall have head and tail intact while on or leaving the waters or shores of the state except as follows:

(1) A person may possess up to 2 striped bass fillets so long as they also possess the fish rack that the fillets came from with the head and tail intact and the rack measures at least 28 inches in total length;

(2) A person may possess up to 2 striped bass fillets without the fish rack that the fillets came from so long as each fillet measures at least 28 inches in length; and

(3) Any striped bass fillet shall have the skin still attached for the purpose of identification of the fillet as striped bass.

(b) No person shall possess more than the daily creel limit of 1 fish.

(c) There shall be no closed season for the taking of striped bass.

(d) The sale of striped bass shall be prohibited regardless of origin.

(e) The taking of striped bass shall be prohibited by netting in any form except that striped bass may be landed by the use of a hand held dip net.

(f) The taking of striped bass by gaffing shall be prohibited.

(g) No person shall cull any striped bass taken from or while on the waters under the jurisdiction of the state.

Proposed rules:

PART Fis 601 CHAPTER DEFINITIONS

Adopt Fis 601.041, to read as follows:

Fis 601.041 "Non-offset circle hook" means a hook used for angling with bait where the point and barb are turned perpendicularly back to the shank to form a circular shape. If this hook is laid on a flat surface, all parts of the hook lie flat on the surface, rather than the point and barb being angled away from the shank in either direction.

PART Fis 603 RULES FOR CERTAIN FIN FISH SPECIES

Readopt with amendment Fis 603.08, eff 11-1-18 (Doc #12655, EXEMPT) to read as follows:

Fis 603.08 Striped Bass.

(a) No person shall take, possess, or transport striped bass unless the fish is at least 28 inches in total length and less than 35 inches in total length. Striped bass shall have head and tail intact while on or leaving the waters or shores of the state except as follows:

(1) A person may possess up to 2 striped bass fillets so long as they also possess the fish rack that the fillets came from with the head and tail intact and the rack measures at least 28 inches in total length and less than 35 inches in total length;

(2) ~~A person may possess up to 2 striped bass fillets without the fish rack that the fillets came from so long as each fillet measures at least 28 inches in length; and~~

~~(3)~~ Any striped bass fillet shall have the skin still attached for the purpose of identification of the fillet as striped bass.

(b) No person shall possess more than the daily creel limit of 1 fish.

(c) There shall be no closed season for the taking of striped bass.

(d) The sale of striped bass shall be prohibited regardless of origin.

(e) The taking of striped bass shall be prohibited by netting in any form except that striped bass may be landed by the use of a hand held dip net.

(f) The taking of striped bass by gaffing shall be prohibited.

(g) No person shall cull any striped bass taken from or while on the waters under the jurisdiction of the state.

(h) Any person taking striped bass with bait from the waters of the state by angling shall only use corrodible non-offset circle hooks.

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Acting Director

Charles D. Baker
Governor
Karyn E. Polito
Lieutenant Governor
Kathleen Theoharides
Secretary
Ronald S. Amidon
Commissioner
Mary-Lee King
Deputy Commissioner

MEMORANDUM

TO: Max Appelman, ASMFC Striped Bass Plan Coordinator

FROM: Daniel McKiernan, Acting Director

DATE: November 29, 2019

SUBJECT: **Massachusetts Atlantic Striped Bass Addendum VI Implementation Plan**

This memorandum serves to provide you with the Division of Marine Fisheries' plan to implement the mandatory provisions of Addendum VI to Amendment 6 of the Interstate Fishery Management Plan for Atlantic Striped Bass. The Division will adopt Addendum VI's slot limit for the recreational fishery, presents a number of options for the commercial fishery's 18% quota reduction, and has a pre-existing circle hook requirement that will be amended if the requested variances are not approved. Regarding the commercial fishery, because the Technical Committee has not yet decided if conservation equivalency should maintain SPR or F, we have provided both analyses where appropriate. The data used in the analyses are presented at the end of this memo. Please contact Dr. Michael Armstrong with any questions.

Section 1: Coastal Recreational Fishery

Massachusetts' current regulations include a one fish/person/day bag limit, 28" minimum size in total length (TL), and year-round season throughout the state's marine waters.

Option 1a: *Implement a slot limit of 28" minimum to less than 35" TL (and maintain all other measures).*

No additional analysis is needed.

Section 2: Coastal Commercial Fishery

The options below consider changes to Massachusetts' annual quota and size limit only, currently 869,812 pounds and 34" minimum in TL.

Additional rules include but are not limited to a hook & line only requirement, open fishing days of Monday and Thursday beginning on the first open fishing day on or after June 23 until the quota is taken (otherwise December 31), and a 2-fish or 15-fish possession limit depending on the type of permit held. DMF may consider revision to the season, open days, and possession limits for 2020 to better utilize our quota; such revisions to these non-compliance measures are outside the scope of this implementation plan.

Option 2a: *Reduce Massachusetts quota by 18% (and maintain the 34" TL minimum size limit).*

No additional analyses required. 2020 quota = 869,812 * 0.82 = 713,246 pounds.

Option 2b: *Reduce Massachusetts quota by 18% and amend the size limit assuming the baseline quota represents landings for a minimum size of 28" TL.*

Justification: Under Amendment 6, the quotas listed in Table 10 were developed assuming a 28" size limit. Massachusetts' quota was 1.159 million pounds. When adopting that quota, Massachusetts did not move to the smaller size limit but has maintained a 34" minimum size limit since 1996. Under the larger size limit, more quota should have been assigned; thus, Massachusetts has been far more conservative than required over time. The unrealized quota is calculated below using SPR, YPR (see Appendix 1) and the F_{target} of 0.30 from Amendment 6. Massachusetts believes we should be able to revert to the FMP standard of 28" without taking additional reductions because we were overly conservative. Implementing more conservative regulations on an optional basis should not negatively affect a state in the future.

Option 2	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Amend 6	Min 28 TL	0.3	1-15	Yes	100	1.579	20.23	0.459	1,159,750
34" Option	Min 34	0.483	1-15	Yes	100	1.579	20.23	0.490	1,238,077
								Difference	78,327

Option 2b-1: 28" minimum size limit TL

For 2020, the quota at 28" minimum size would be: 1,159,750 * 0.75 *0.82 = 713,246 pounds (Amendment 6 quota * Addendum IV reduction * Addendum VI reduction).

Option 2b-2: 35" minimum size limit TL

This increase in the commercial size would create distinct commercial (35"+) and recreational (28–35") fisheries separated by size, facilitating enforcement efforts.

If the goal of conservation equivalency is to maintain the same spawning potential as the baseline case, then increasing the size limit to 35" would allow Massachusetts to increase its quota from the 2020 baseline at 28" (713,246 pounds) because the stock could be fished at a higher rate to achieve the same SPR.

Option 2b-2	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	28"	0.197	1-15	Yes	100	2.299	29.44	0.445	713,246
	35"	0.34	1-15	Yes	100	2.299	29.45	0.492	788,578

If the goal is to maintain the target F of 0.197, then the quota would increase slightly from the baseline, and there would be an increase in SPR:

Option 2b-2	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	28"	0.197	1-15	Yes	100	2.299	29.44	0.445	713,246
	35"	0.197	1-15	Yes	100	3.205	41.04	0.451	722,863

Option 2b-3: 28" minimum to less than 35" slot limit TL

If the goal of conservation equivalency is to maintain the same spawning potential as the baseline case, then moving to a 28–35" slot would decrease quota because the stock could be fished at a higher rate but within a smaller slot:

Option 2b-3	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	28"	0.197	1-15	Yes	100	2.299	29.44	0.445	713,246
	28-35"	0.45	1-15	Yes	100	2.298	29.42	0.321	514,499

If the goal is to maintain the target F of 0.197, then moving to a 28–35" slot limit would decrease considerably the quota within a smaller slot, and SPR would increase:

Option 2b-3	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	28"	0.197	1-15	Yes	100	2.299	29.44	0.445	713,246
	28-35"	0.197	1-15	Yes	100	4.492	57.52	0.201	322,163

Options 2c*: Reduce Massachusetts quota by 18% and amend the size limit assuming the baseline quota represents landings for a minimum size of 34" TL.*

If Massachusetts cannot revert to the FMP standard of 28" without penalty for being more conservative and must assume the baseline quota represents landings at the state's current minimum size, the above options are recreated below starting from a 34" minimum size.

Option 2c-1: 28" minimum size limit TL

If the goal of conservation equivalency is to maintain the same spawning potential as the baseline case, then decreasing the size limit to a 28" minimum would decrease the quota to 658,260 pounds.

Option 2c-1	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	34"	0.197	1-15	Yes	100	2.905	37.208	0.454	713,246
	28"	0.146	1-15	Yes	100	2.907	37.22	0.419	658,260

If the goal is to maintain the target F of 0.197, then the quota would decrease slightly from the baseline, and there would be a decrease in SPR:

Option 2c-1	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	34"	0.197	1-15	Yes	100	2.905	37.208	0.454	713,246
	28"	0.197	1-15	Yes	100	2.299	29.44	0.445	699,107

Option 2c-2: 35" minimum size limit TL

This increase in the commercial size would create distinct commercial (35"+) and recreational (28–35") fisheries separated by size, facilitating enforcement efforts.

If the goal of conservation equivalency is to maintain the same spawning potential as the baseline case, then increasing the size limit to 35" would allow Massachusetts to increase slightly its quota from the 2020 baseline at 34" (713,246 pounds) because the stock could be fished at a higher rate to achieve the same SPR.

The quota calculations are shown below:

Option 2c-2	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Quota
Base (2020)	34"	0.197	1-15	Yes	100	2.905	37.20	0.454	713,246
	35"	0.234	1-15	Yes	100	2.904	37.19	0.468	735,240

If the goal is to maintain the target F of 0.197, then the quota would decrease slightly from the baseline, and there would be an increase in SPR:

Option 2c-2	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Quota
Base (2020)	34"	0.197	1-15	Yes	100	2.905	37.20	0.454	713,246
	35"	0.197	1-15	Yes	100	3.206	41.05	0.451	708,533

Option 2c-3: 28” minimum to less than 35” slot limit TL

If the goal of conservation equivalency is to maintain the same spawning potential as the 34” minimum size baseline case, then moving to a 28–35” slot would decrease quota because the stock could be fished at a higher rate within the smaller slot:

Option 2c-3	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	34"	0.197	1-15	Yes	100	2.905	37.208	0.454	713,246
	28-35"	0.359	1-15	Yes	100	2.907	37.21	0.289	454,027

If the goal is to maintain the target F of 0.197, then moving to a 28–35” would decrease considerably the quota within the smaller slot, and SPR would increase:

Option 2c-3	Size Limit	F	Age Range	Plus Group	Oldest	SPR	%SPR	YPR	Base Quota
Base (2020)	34"	0.197	1-15	Yes	100	2.905	37.208	0.454	713,246
	28-35"	0.197	1-15	Yes	100	4.492	57.52	0.201	315,776

Section 3: Circle Hook Requirements

Massachusetts has already adopted regulations that mandate the use of circle hooks in the recreational striped bass fishery effective January 1, 2020 (see below). The definition of circle hook is consistent with Addendum VI. However, our requirement provides exceptions for anglers fishing aboard for-hire vessels, or when using an artificial lure or weighted treble hook designed to be trolled, cast and retrieved, or vertically jigged with natural bait attached.

Per the language of Addendum VI granting states “flexibility to further specify details of the regulation to address specific needs of the state fishery,” DMF requests approval to maintain these exemptions. The exception for anglers fishing aboard for-hire vessels reflects their minimal contribution to the total recreational catch of striped bass in Massachusetts (<2.5% in each year of 2014–2018 according to MRIP data) and their higher retention rate of caught fish (29% on average for 2014–2018 compared to 6% for private anglers). The gear exemptions maintain allowance for commonly used techniques like tube and worm and snag and drop, which generally do not result in gut-hooked striped bass. (Due to timing, DMF will propose the elimination of these exemptions at public hearing this winter in the event they are not approved by ASMFC, or if DMF opts to roll any of them back.)

Current Regulatory Language

322 CMR 6.07: Striped Bass

(2) Definitions.

Circle Hook is defined as a fishing hook designed and manufactured so that the barb of the hook is not offset from the plane of the shank and bend and is turned perpendicularly back towards the shank to form a circular or oval shape.

(5) Recreational Management Measures.

(f) Mandatory Use of Circle Hooks. Effective January 1, 2020, private recreational anglers fishing for striped bass or in possession of striped bass shall use circle hooks with whole or natural baits. This shall not apply to any artificial lure or weighted treble hook designed to be trolled, cast and retrieved, or vertically jigged with natural bait attached.

DMF promotes responsible angling techniques, including the use of circle hooks, in print and online media, including our annual saltwater fishing guide, DMF website, and educational pamphlets. Our fishing clinics use circle hooks exclusively and each participant takes home a mini tackle kits which included circle hooks. Educational materials are distributed at various trade shows, seasonal fairs, and fishing clinics throughout the year. A new striped bass circle hook card promotion began in 2019 in which size 8.0 Offshore Angler hooks were attached to informational cards and distributed at these types of public events.

Section 4: Timeline for Implementation

DMF will present a suite of proposed options to comply with Addendum VI to the state's Marine Fisheries Advisory Commission (MFAC) in December. These options are expected to go to public hearing in late winter. The Division's recommendations will be presented to the MFAC for approval by late March. All rule changes are expected to take effect by early spring of 2020, prior to the start of the fishing seasons in Massachusetts, with one possible exception: if the circle hook requirement is to apply to all recreational anglers, the effective date will be January 1, 2021.

Appendix 1. Data used to estimate quota changes

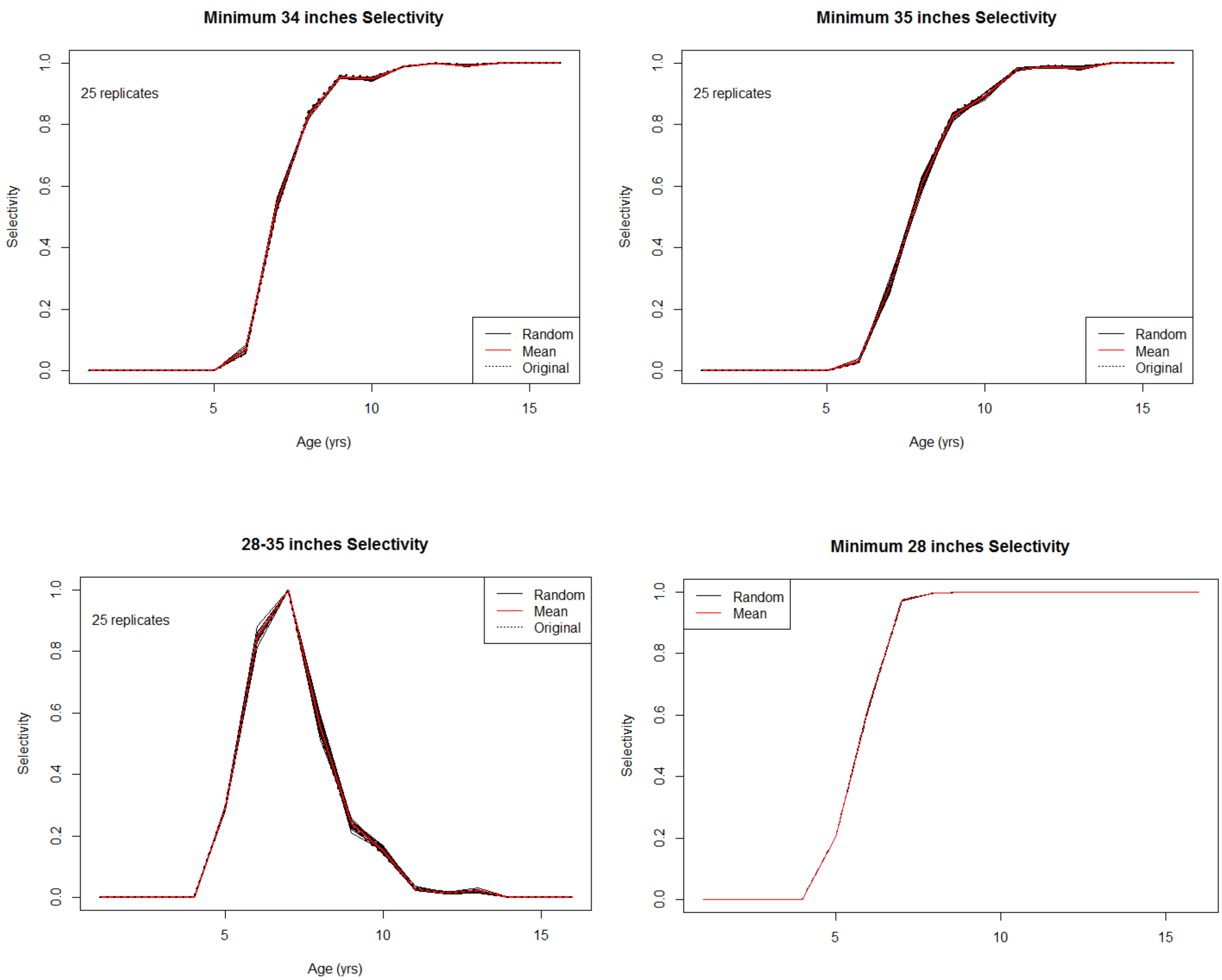
To develop selectivity curves for the proposed regulation, an age-length key was assembled using 2016-2017 MA age data from recreational and commercial samples (Appendix Table 1). The proportions represent the proportion at length (total length in inches) within an age. Selectivity curves are produced by summing the proportions within an age over the length intervals excluding those below or above the size limits. Note that number of fish (nl) from size 33-42 inches were primary from the commercial samples.

Appendix Table 1. Original age-length key derived from 2016-2107 recreational and commercial length-age samples

len	nl	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
10	12	0.047809	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	26	0.103586	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	35	0.139442	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	46	0.179283	0.006993	0	0	0	0	0	0	0	0	0	0	0	0	0
14	47	0.167331	0.027972	0.011765	0	0	0	0	0	0	0	0	0	0	0	0
15	46	0.139442	0.076923	0	0	0	0	0	0	0	0	0	0	0	0	0
16	45	0.091633	0.132867	0.035294	0	0	0	0	0	0	0	0	0	0	0	0
17	41	0.051793	0.174825	0.035294	0	0	0	0	0	0	0	0	0	0	0	0
18	41	0.043825	0.160839	0.082353	0	0	0	0	0	0	0	0	0	0	0	0
19	34	0.01992	0.125874	0.082353	0.010471	0.010309	0	0	0	0	0	0	0	0	0	0
20	40	0.007968	0.153846	0.117647	0.026178	0.005155	0	0	0	0	0	0	0	0	0	0
21	34	0.007968	0.076923	0.105882	0.052356	0.010309	0	0	0	0	0	0	0	0	0	0
22	41	0	0.013986	0.188235	0.109948	0.010309	0	0	0	0	0	0	0	0	0	0
23	41	0	0.027972	0.152941	0.08377	0.041237	0	0	0	0	0	0	0	0	0	0
24	46	0	0.013986	0.094118	0.120419	0.056701	0.011236	0	0	0	0	0	0	0	0	0
25	46	0	0.006993	0.058824	0.151832	0.056701	0	0	0	0	0	0	0	0	0	0
26	46	0	0	0.035294	0.109948	0.097938	0.011236	0.004854	0	0	0	0	0	0	0	0
27	47	0	0	0	0.13089	0.103093	0.011236	0	0	0	0	0	0	0	0	0
28	46	0	0	0	0.109948	0.103093	0.02809	0	0	0	0	0	0	0	0	0
29	47	0	0	0	0.052356	0.159794	0.033708	0	0	0	0	0	0	0	0	0
30	44	0	0	0	0.026178	0.092784	0.11236	0	0	0.004505	0	0	0	0	0	0
31	42	0	0	0	0.010471	0.113402	0.073034	0.024272	0	0	0	0	0	0	0	0
32	42	0	0	0	0.005236	0.046392	0.095506	0.038835	0.012146	0.009009	0.008197	0	0	0	0	0
33	60	0	0	0	0	0.036082	0.106742	0.087379	0.02834	0.031532	0.004098	0	0.006944	0	0	0
34	145	0	0	0	0	0.030928	0.252809	0.223301	0.121457	0.054054	0.008197	0.01087	0.006944	0	0	0
35	164	0	0	0	0	0.025773	0.185393	0.276699	0.125506	0.094595	0.036885	0.028986	0	0	0	0
36	160	0	0	0	0	0	0.067416	0.179612	0.182186	0.103604	0.102459	0.047101	0.013889	0.055556	0	0
37	152	0	0	0	0	0	0.005618	0.053398	0.206478	0.157658	0.122951	0.057971	0.041667	0.018519	0	0.025641
38	187	0	0	0	0	0	0	0.082524	0.186235	0.198198	0.127049	0.134058	0.069444	0	0.076923	0
39	168	0	0	0	0	0	0.005618	0.019417	0.080972	0.175676	0.151639	0.152174	0.152778	0.055556	0	0
40	169	0	0	0	0	0	0	0.009709	0.036437	0.117117	0.180328	0.202899	0.173611	0.111111	0.038462	0
41	126	0	0	0	0	0	0	0	0.020243	0.031532	0.159836	0.17029	0.125	0.148148	0	0.051282
42	86	0	0	0	0	0	0	0	0	0.022523	0.069672	0.076087	0.152778	0.166667	0.192308	0.179487
43	42	0	0	0	0	0	0	0	0	0	0.020492	0.050725	0.069444	0.12963	0.076923	0.102564
44	46	0	0	0	0	0	0	0	0	0	0.004098	0.043478	0.111111	0.111111	0.192308	0.153846
45	31	0	0	0	0	0	0	0	0	0	0.004098	0.018116	0.041667	0.166667	0.153846	0.153846
46	14	0	0	0	0	0	0	0	0	0	0	0.003623	0.027778	0.018519	0.076923	0.153846
47	7	0	0	0	0	0	0	0	0	0	0	0	0.006944	0.018519	0.076923	0.076923
48	5	0	0	0	0	0	0	0	0	0	0	0.003623	0	0	0.115385	0.025641
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.025641
51	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.051282

Because the large sample sizes can shift the proportions within an age to those sizes with the higher sample sizes, I reduced the numbers within the length intervals by randomly selecting individual data until the average number of samples (43) for length intervals 13-32" was reached. This was repeated 25 times and average selectivity across the 25 replicates were used in the quota calculations. The select curves are shown below in Appendix Figure 1.

Appendix Figure 1. Selectivity patterns from random sampling of number in length interls 33-42" (black) and mean selectivity of 25 replicates (red).



The data series used for the spawning stock biomass-per-recruit and yield-per-recruit analyses were taken from the 2018 benchmark assessment:

age	M	femalemat	propfemale
1	1.13	0.00	0.53
2	0.68	0.00	0.56
3	0.45	0.00	0.56
4	0.33	0.09	0.52
5	0.25	0.32	0.57
6	0.19	0.45	0.65
7	0.15	0.84	0.73
8	0.15	0.89	0.81
9	0.15	1.00	0.88
10	0.15	1.00	0.92
11	0.15	1.00	0.95
12	0.15	1.00	0.97
13	0.15	1.00	1.00
14	0.15	1.00	1.00
15+	0.15	1.00	1.00

Catch weights used in the YPR analysis were the geometric mean of 2016-2017 weights-at-age through 15+ ,and SSB weights used in the SPR analysis were the geometric mean of 2016-2017 adjusted rivard weights-at-age through 15+.

For the SPR and YPR analyses, ages 1-15+ were modeled but it was assumed that the oldest age was 100. In this case, the weights-at-age were assumed equal to the weight of the age 15+ group. For the SPR analysis, the fraction of F before spawning was assumed to be 0.1 and fraction of M before spawning was assumed to be 0.333 (taken from 2018 benchmark assessment).

The *sbpr* and *ypr* function in R package fishmethods were used.

To calculate the quota for a new size regulation, the baseline quota is multiplied by the ratio of YPR under the proposed change divided the YPR value for the baseline case (YPR change/ YPR Base) .

Atlantic Striped Bass Addendum VI Implementation Plan
Regional – (Rhode Island, Connecticut, and New York)

Introduction

The states of Rhode Island, Connecticut and New York are submitting a regional conservation equivalency (CE) proposal in the interest of maintaining regional consistency for recreational striped bass regulations. This regional proposal is only relative to the recreational sector. Each states combined reduction (all sectors combined) will meet the 18% threshold since Rhode Island and New York commercial measures are implementing an 18% reduction from approved CE Addendum IV quotas. Connecticut is suspending its bonus striped bass program indefinitely and therefore will not use its commercial quota. Implicit with this proposal is that all three states will implement identical size and bag limits (the same option) for the recreational sector.

Summary of Proposed Measures

1. Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Regional: RI/CT/NY – A	**28” – 35”**	**1**	**All modes**	**1/1 – 12/31***
Regional: RI/CT/NY – B	**30” – 40”**	**1**	**All modes**	**1/1 – 12/31***
Regional: RI/CT/NY – C	**30” – 40”**	**1**	**Private/Shore**	**1/1 – 12/31***
Regional: RI/CT/NY – C	**28” – 37”**	**1**	**For-Hire**	**1/1 – 12/31***

* States maintain closed season if the state currently has a closure.

2. Commercial Fishery

Rhode Island:
Rhode Island will implement an 18% reduction from approved CE Addendum IV quota and maintain 2017 size limits in commercial fisheries (see proposed state implementation plan).

Connecticut:
Commercial harvest of striped bass is banned by state statute in Connecticut. Since 2011, Connecticut has used the commercial quota and conservation equivalency to implement a bonus striped bass harvest program. Connecticut has decided to suspend the bonus striped bass program indefinitely, and is therefore not submitting a conservation equivalency proposal relative to commercial quota at this time (see proposed state implementation plan).

New York:
New York will implement an 18% reduction from approved CE Addendum IV quota. NY’s current regulation is a 795,795 lb. quota with a slot limit of 28-38”. An 18% reduction in quota would result in a new quota limit of 652,552 lbs, with no change in slot size. Other slot options that maintain at least an 18% reduction from approved CE Addendum IV quota are presented in the proposed New York implementation plan.

Section 1: Regional Options – Rhode Island, Connecticut and New York Recreational Fishery

1A.) A one fish bag limit and a slot size limit of 28" minimum size to less than 35" total length may be implemented for state (and Regional RI/CT/NY) recreational fishery (all modes) without further analysis. The same fishing seasons as 2017 will be maintained.

- No further analyses is required because this is equivalent with the selected recreational management measure in Addendum IV. However, a three state regional analysis was performed and included here as a baseline, see Table 1.

OR

1B.) A CE proposal using a regional approach including three states; Rhode Island, Connecticut and New York, implementing a one fish bag limit and a slot size limit of 30" minimum size to less than 40" total length may be implemented for the recreational fishery (all modes) on a regional bases, i.e. all three states must implement this option to be considered.

- Our proposal meets the standards as established by the Technical Committee (TC) in the TC memo (M19-084).
- Our analysis uses pooled 2016-2017 Marine Recreational Information Program (MRIP) data. Data were compiled from the raw 2016-2017 size.csv MRIP data files and consisted of 1,940 records of data.
- To address concerns with MRIP B2 estimates in Connecticut from the shore and private modes a Modified Thompsons Tau and Winzorization was performed to first identify outliers for the Connecticut 2016-2017 B2 MRIP data by mode and wave, and then apply the smoothing. The same approach and methodology was recently used and subsequently approved by the black sea bass TC. The methods previously used for black sea bass were repeated here as these have already been vetted and approved for identifying outliers and smoothing data.
- A Hudson and Delaware River adjustment was applied to the regional analyses for additional removals estimated in 2017. This adjustment of 11,384 fish (9,222 fish from Hudson R. and 2,162 fish from Delaware R.) for the regional tristate analysis resulted in about a 1% impact on the final three options presented here.
- NY Hudson River removals (9,222 fish) were a 5.23% reduction in estimated 2017 total removals (9,731 fish). This represents the lowest estimated percent reduction (and greatest number of removals) of the three proposed NY CE options for 2020 Hudson River regulatory changes (option HR1- see State Report). NY Hudson River Options HR2 and HR3 would result in 137 and 146 fewer 2020 total removals, respectively, than NY Option HR1.
- NY Delaware River removals were the estimated total removals in 2017 (2,162 fish), if NY were to do no regulatory change in 2020. Actual removals due to NY's proposed regulatory change in 2020 (1 fish @ 28-35") are expected to be lower (achieving a greater percentage reduction). We used the 2,162 fish as a worst case scenario, since an exact number of expected 2020 removals could not be calculated at this time.
- Any shortening of NY fishing season, or more restrictive regulations, such as not allowing party/charter boat captain and crew to retain a fish, would result in greater percentage regional reductions

- Our proposal achieves at least a 20% reduction in removals after smoothing for outliers (Table 2). Without applying the smoothing our proposal meets at least a 19% reduction in total removals (see workbook).
- The size limit analysis used follows the standard procedure used for Draft Addendum VI using the methods outline in Greg Wojcik's spreadsheet.
- The same level of non-compliance that occurred in 2016-2017 was assumed to occur in 2020.
- A post-release mortality rate of 9% was used.

OR

1C.) A CE proposal using a regional approach including three states; Rhode Island, Connecticut and New York, implementing a one fish bag limit for all modes, a slot size limit of 30" minimum size to less than 40" total length for the private and shore modes, and a slot size limit of 28" minimum size to less than 37" total length for the for-hire modes may be implemented for the Regional recreational fishery (all three states must implement this option to be considered).

- Our proposal meets the standards as established by the TC in the TC memo (M19-084).
- Our analysis uses pooled 2016-2017 Marine Recreational Information Program (MRIP) data. Data were compiled from the raw 2016-2017 size.csv MRIP data files and consisted of 1,940 records of data.
- To address concerns with MRIP B2 estimates in Connecticut from the shore and private modes a Modified Thompsons Tau and Winzorization was performed to first identify outliers for the Connecticut 2016-2017 B2 MRIP data by mode and wave, and then apply the smoothing. The same approach and methodology was recently used and subsequently approved by the black sea bass TC. The methods previously used for black sea bass were repeated here as these have already been vetted and approved for identifying outliers and smoothing data.
- A Hudson and Delaware River adjustment was applied to the regional analyses for additional removals estimated in 2017. This adjustment of 11,384 fish (9,222 fish from Hudson R. and 2,162 fish from Delaware R.) for the regional tristate analysis resulted in about a 1% impact on the final three options presented here.
- NY Hudson River removals (9,222 fish) were a 5.23% reduction in estimated 2017 total removals (9,731 fish). This represents the lowest estimated percent reduction (and greatest number of removals) of the three proposed NY CE options for 2020 Hudson River regulatory changes (option HR1- see State Report). NY Hudson River Options HR2 and HR3 would result in 137 and 146 fewer 2020 total removals, respectively, than NY Option HR1.
- NY Delaware River removals were the estimated total removals in 2017 (2,162 fish), if NY were to do no regulatory change in 2020. Actual removals due to NY's proposed regulatory change in 2020 (1 fish @ 28-35") are expected to be lower (achieving a greater percentage reduction). We used the 2,162 fish as a worst case scenario, since an exact number of expected 2020 removals could not be calculated at this time.
- Any shortening of NY fishing season, or more restrictive regulations, such as not allowing party/charter boat captain and crew to retain a fish, would result in greater percentage regional reductions

- Mode-specific data analysis demonstrates that our proposal achieves at least a total reduction of 20% in removals after smoothing for outliers (Table 3). Without applying the smoothing our proposal meets at least a 19% reduction in total removals (see workbook).
- The size limit analysis used follows the standard procedure used for Draft Addendum VI using the methods outline in Greg Wojcik's spreadsheet.
- The same level of non-compliance that occurred in 2016-2017 was assumed to occur in 2020.
- A post-release mortality rate of 9% was used.

Section 3: Coastal Commercial Fishery

See individual state implementation plans for details.

Section 5: Circle Hook Requirements

See individual state implementation plans for details.

Section 6: Timeline for Implementation

See individual state implementation plans for details.

Table 1. Results from regional size limit analysis to implement 1 fish at a 28" – 35" slot limit for all modes (coastwide standard). Pooled 2016-2017 MRIP data for Rhode Island, Connecticut and New York were used.

Slot (Coastwide standard)	**28-35**		
(Option A)	**SH/PR**	**PC**	**Total**
New Harvest including Non-Comp	758,027	51,521	809,548
New non Comp Harvest	62,292	7,108	69,400
New Dead Discards	51,446	5,871	57,317
Old Dead Removals (WINZ)	1,124,088	13,867	1,137,955
Removals (WINZ)	1,995,854	78,366	2,074,220
Removal Reduction (WINZ)	**20.67%**	**43.10%**	**21.84%**
Adding Hudon and Delaware River Fish Back in.			**20.89%**

Table 2. Results from regional size limit analysis to implement 1 fish at a 30" – 40" slot limit for all modes. Pooled 2016-2017 MRIP data for Rhode Island, Connecticut and New York were used.

Slot - 30-40 (All Modes)	**30-40**		
(Option B)	**SH/PR**	**PC**	**Total**
New Harvest including Non-Comp	776,552	57,077	833,629
New non Comp Harvest	60,471	6,562	67,033
New Dead Discards	49,943	5,420	55,362
Old Dead Removals (WINZ)	1,124,088	13,867	1,137,955
Removals (WINZ)	2,011,055	82,925	2,093,980
Removal Reduction (WINZ)	**20.07%**	**39.79%**	**21.09%**
Adding Hudon and Delaware River Fish Back in.			**20.14%**

Table 3. Results from regional mode-specific size limit analysis to implement a 30" – 40" slot limit for private and shore modes, and a 28" – 37" slot limit for for-hire modes. Pooled 2016-2017 MRIP data for Rhode Island, Connecticut and New York were used.

Slot, Split Modes - SH/PR 30-40, PC 28-37	**30-40**	**28-37**	
(Option C)	**SH/PR**	**PC**	**Total**
New Harvest including Non-Comp	776,552	61,368	837,920
New non Comp Harvest	60,471	6,141	66,612
New Dead Discards	49,943	5,071	55,014
Old Dead Removals (WINZ)	1,124,088	13,867	1,137,955
Removals (WINZ)	2,011,055	86,446	2,097,501
Removal Reduction (WINZ)	**20.07%**	**37.23%**	**20.96%**
Adding Hudon and Delaware River Fish Back in.			**20.01%**

Atlantic Striped Bass Addendum VI Implementation Plan – Rhode Island

Summary of Proposed Measures

1. Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Rhode Island – A	**28” – 35”**	**1**	**All modes**	**1/1 – 12/31**
Rhode Island – B	**32” – 40”**	**1**	**All modes**	**1/1 – 12/31**
Rhode Island – C	**32” – 40”**	**1**	**Private/Shore**	**1/1 – 12/31**
Rhode Island – C	**30” – 40”**	**1**	**For-Hire**	**1/1 – 12/31**

2. Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Rhode Island – General category – A	**34”**	**90,822 lbs***	**5/20 – 6/30; 7/1 – 12/31****
Rhode Island – Floating fish trap – A	**26”**	**58,067 lbs***	**4/1 – 12/31****

***** Based on 39/61 split between the floating fish traps and general category respectively. This may be re-visited in 2020 through RI Regulatory Process.

******2019 open seasons (RIMF Part 3 - Finfish, 2019). 2020 open seasons will be determined through RI Regulatory Process in early 2020.

Section 1: Rhode Island Recreational Fishery

1A.) A one fish bag limit and a slot size limit of 28” minimum size to less than 35” total length may be implemented for the RI recreational fishery (all modes) without further analysis. The same fishing seasons as 2017 will be maintained.

- No further analyses needed because this is equivalent with the selected recreational management measure in Addendum IV.

OR

1B.) A conservation equivalency (CE) proposal implementing a one fish bag limit and a slot size limit of 32” minimum size to less than 40” total length may be implemented for the RI recreational fishery (all modes).

- Our proposal meets the standards as established by the TC in the TC memo (M19-084).
- Our analysis uses pooled 2016-2017 Marine Recreational Information Program (MRIP) data. Data were compiled from the raw 2016-2017 size.csv MRIP data files and consisted of 811 records of data.
- Our proposal achieves at least a 25% reduction in removals.
- The size limit analysis used follows the standard procedure used for Draft Addendum VI using the methods outline in Greg Wojcik’s spreadsheet.
- The same level of non-compliance that occurred in 2016-2017 was assumed to occur in 2020.
- A post-release mortality rate of 9% was used.

OR

1C.) A conservation equivalency (CE) proposal implementing a one fish bag limit for all modes, a slot size limit of 32” minimum size to less than 40” total length for the private and shore modes, and a slot size limit of 30" minimum size to less than 40" total length for the for-hire modes may be implemented for the RI recreational fishery (all modes).

- Our proposal meets the standards as established by the TC in the TC memo (M19-084).
- Our mode-specific analysis uses pooled 2015-2018 Marine Recreational Information Program (MRIP) data. Data were compiled from the raw 2015-2018 size.csv MRIP data files and consisted of 1,519 records of data.
- Mode-specific data analysis demonstrates that our proposal achieves at least a total state-wide reduction of 19% in removals.
- The size limit analysis used follows the standard procedure used for Draft Addendum VI using the methods outline in Greg Wojcik's spreadsheet.
- The same level of non-compliance that occurred in 2016-2017 was assumed to occur in 2020.
- A post-release mortality rate of 9% was used.

Section 3: Coastal Commercial Fishery

2A.) Rhode Island will implement an 18% reduction from our approved CE Addendum IV quota and maintain 2017 size limits in our commercial fisheries.

Section 5: Circle Hook Requirements

Rhode Island will be a holding a public workshop on striped bass regulations in January of 2020 to discuss the implementation of Addendum VI. At that time, we will work with industry to develop draft language for a circle hook requirement. Proposed regulatory changes will go forward to a public hearing in February and a Rhode Island Marine Fisheries Council meeting in March. The Director will then make a decision on the provision and these regulations could be implemented as early as April 1,2020. If it is deemed necessary to conduct additional workshops and/or outreach on circle hook provisions in 2020, Rhode Island may opt to hold off implementation until January 1, 2021.

Section 6: Timeline for Implementation

Rhode Island will be a holding a public workshop on striped bass regulations in January of 2020 to discuss the implementation of Addendum VI. Proposed regulatory changes will go forward to a public hearing in February and a Rhode Island Marine Fisheries Council meeting in March. The Director will then make a decision on the proposed regulatory changes and these regulations will be implemented on April 1,2020. If it is deemed necessary to conduct additional workshops and/or outreach on circle hook provisions in 2020, Rhode Island may opt to hold off implementation until January 1, 2021.

Table 1. Results from size limit analysis to implement 1 fish at a 32" – 40" slot limit for all modes. Pooled 2016-2017 MRIP data were used.

Slot	ALL 32-40
New Harvest	59369.05
New non Comp Harvest	171.73
New Dead Discards	11555.51
Old Dead Removals	266347.26
New Removals	337443.54
Old Removals	454283.26
% Reduction	25.72%

Table 1. Results from mode-specific size limit analysis to implement a 32" – 40" slot limit for private and shore modes, and a 30" – 40" slot limit for for-hire modes. Pooled 2015-2018 MRIP data were used.

	For-Hire	Shore & Private/Rental	
Slot	30-40	32-40	TOTAL
New Harvest	4863.99	99981.30	104845.29
New non Comp Harvest	21.07	141.07	162.14
New Dead Discards	1954.10	15067.94	17022.04
Old Dead Removals	2098.89	609250.59	611349.48
New Removals	8938.06	724440.89	733378.95
Old Removals	28695.89	876794.59	905490.48
% Reduction			19.01%

Atlantic Striped Bass Addendum VI Implementation Plan - Connecticut

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Connecticut - A	**28 – 35”**	**1**	**All modes**	**1/1 – 12/31**
Connecticut - B	**30 – 38”**	**1**	**All modes**	**1/1 – 12/31**
Connecticut - C	**32 – 40”**	**1**	**All modes**	**1/1 – 12/31**
Connecticut - D	**28 – 35”** **30 – 38”**	**1** **1**	**Private/Shore** **For-Hire**	**1/1 – 12/31** **1/1 – 12/31**
Connecticut - E	**30 – 38”** **32 – 40”**	**1** **1**	**Private/Shore** **For-Hire**	**1/1 – 12/31** **1/1 – 12/31**
Connecticut - F	**30 – 38”** **28 – 35”**	**1** **1**	**Private/Shore** **For-Hire**	**1/1 – 12/31** **1/1 – 12/31**
Connecticut - G	**32 – 40”** **30 – 40”**	**1** **1**	**Private/Shore** **For-Hire**	**1/1 – 12/31** **1/1 – 12/31**
Connecticut - H	**32 – 40”** **28 – 35”**	**1** **1**	**Private/Shore** **For-Hire**	**1/1 – 12/31** **1/1 – 12/31**

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Connecticut	**N/A**	**N/A**	**N/A**

Section 1: Coastal Recreational Fishery

1a.) A one fish bag limit and a slot size limit of 28” minimum size to less than 35” total length may be implemented for the ocean fishery without further analysis. The same fishing seasons as in 2017 is required.

OR

1b.) A conservation equivalency (CE) proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required.

If submitting CE, please address the following questions,

- What is your state proposing for a conservation equivalency measure?
    - Connecticut prefers to implement the coastal recreational fishery measure approved in Addendum VI (28 – 35” slot) but is proposing seven alternate regulation options (B – H) to provide opportunity to implement regulations as consistent as possible with New York and Rhode Island should those states choose to implement a measure other than the approved Addendum VI measure. The 28 – 35” slot limit (A) will produce an estimated 8.17% (based on 2016-17 MRIP data) or 7.95% (based on 2015-18 MRIP data) reduction in removals for Connecticut. Although none of the alternate regulation options (B – H) proposed by Connecticut produce ≥18% estimated reductions in removals, they are all more conservative than the 28 – 35”

slot, meaning that Connecticut would accomplish greater conservation than achieved under the approved Addendum VI measure by implementing any of the alternative proposed measures.

The relatively low reductions in removals achieved in Connecticut under the approved Addendum VI measure as well as the suite of alternative measures proposed here is largely related to what Connecticut views as spuriously large recreational discard estimates from 2017-18 MRIP Wave 2 and 6 data. For example: MRIP estimated Connecticut Wave 6 striped bass discards (B2) in 2014-16 averaged 233,456 fish; MRIP estimated Connecticut Wave 6 striped bass discards in 2017 and 2018 were approximately 2.9 million and 5.4 million fish, respectively (total estimated coast-wide striped bass discards in 2017-18 were approximately 42 and 33 million fish, respectively). These spuriously large discard estimates and attendant spurious estimates of dead recreational discards "swamp out" the harvest reductions achieved by size limit changes in calculations of overall removal reductions.

- Does your proposal meet the data standards established by the TC?
  - Connecticut's proposal meets the standards as established by the TC in the TC memo.
- What data sources are used in the analysis (include mode or season specific if applicable)?
  - Connecticut's analysis uses pooled 2016-17 Marine Recreational Information Program (MRIP) data for analyses of alternative measures that encompassed all modes, and pooled 2015-18 MRIP data for analyses of alternative measures that included mode splits.
- Sample size summary by mode, season, or state and/or data source as applicable.
  - Data were compiled from the raw 2015-18 size.sas MRIP data files and consisted of 385 (2016-17) or 641 (2015-18) data records. The sample sizes for 2015-18 for-hire and shore/private modes was 272 and 369 data records, respectively.
- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
  - Connecticut's analysis used the methods outlined in Greg Wojcik's spreadsheet.
- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
  - See Table 1-2 below
- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
  - As noted above, none of the alternative measures (B-H) achieve ≥18 % reductions in removals, but all alternative measures are more conservative than the Addendum VI approved measure (28 – 35" slot).

Section 3: Coastal Commercial Fishery

- Commercial harvest of striped bass is banned by state statute in Connecticut. In previous years (2011-19), Connecticut used conservation equivalency to implement a bonus striped bass harvest program, under which the state's commercial striped bass quota could be utilized by recreational fishers, subject to reporting requirements and a limit on the number of bonus striped bass tags distributed annually. Connecticut has decided to suspend the bonus striped bass program indefinitely, and is therefore not submitting a conservation equivalency proposal relative to commercial quota at this time. Should Connecticut choose to re-visit the bonus striped bass program at some time in the future, it will base any conservation equivalency proposal on an 18% reduction in commercial quota as prescribed by Addendum VI, provided that Addendum VI has not been superseded by a subsequent management action.

Section 5: Circle Hook Requirements

- Connecticut will undertake a regulations process in 2020 to develop and implement the Addendum VI circle hook requirement (CT DEEP cannot use our more expedient declaration process to implement the circle hook requirement as our declaration authority does not allow for implementation of terminal tackle requirements/restrictions). Connecticut's regulation process is complex and lengthy, typically requiring 6-8 months. It is unlikely that Connecticut will implement the circle hook requirement before January 1, 2021. Connecticut has already begun outreach and education efforts in 2019, distributing circle hooks and informational cards to the public in a variety of venues. We anticipate enhancing education and outreach efforts in 2020.

Section 6: Timeline for Implementation

- Depending on the outcome of the February Striped Bass Management Board meeting, Connecticut may hold public meetings in February or early March to gather further public input on recreational management measures. CT DEEP can enact size limit changes via declaration, which is a relatively simple and expedient process. We therefore anticipate that recreational measures for the 2020 season will be enacted by April 1, 2020. As noted above, circle hook regulations will likely not be implemented until January 1, 2021.

Table 1. Results from size limit analyses for coastal recreational measure approved in Addendum VI (A) and two alternative regulations (B-C) that encompass all modes (analyses used 2016-17 pooled MRIP data).

Slot	28-35 (A)	30-38 (B)	32-40 (C)
New Harvest	87,188	81,263	66,276
New non Comp Harvest	6,409	6,946	8,305
New Dead Discards	5,785	6,269	7,496
Old Dead Removals	558,123	558,123	558,123
New Removals	657,505	652,602	640,200
Old Removals	715,993	715,993	715,993
Removal Reduction	**8.17%**	**8.85%**	**10.59%**

Table 2. Results from size limit analyses for coastal recreational measure approved in Addendum VI (A) and five alternative regulations (D-H) that utilize mode splits (analyses used 2015-18 pooled MRIP data).

Slot	**28-35 (A)**	**28-35 (A)**		**28-35 (D)**	**30-38 (D)**		**30-38 (E)**	**32-40 (E)**	
Mode	**Shore/Private**	**For-Hire**	**Total**	**Shore/Private**	**For-Hire**	**Total**	**Shore/Private**	**For-Hire**	**Total**
New Harvest	194,874	26,233	221,106	194,874	25,621	220,495	189,893	25,435	215,328
New non Comp Harvest	6,958	864	7,822	6,958	893	7,851	7,197	902	8,099
New Dead Discards	12,425	1,543	13,967	12,425	1,595	14,020	12,851	1,611	14,462
Old Dead Removals	1,381,257	11,625	1,392,882	1,381,257	11,625	1,392,882	1,381,257	11,625	1,392,882
New Removals	1,595,514	40,264	1,635,777	1,595,514	39,734	1,635,247	1,591,199	39,573	1,630,771
Old Removals	1,721,141	55,861	1,777,001	1,721,141	55,861	1,777,001	1,721,141	55,861	1,777,001
Removal Reduction	**7.30%**	**27.92%**	**7.95%**	**7.30%**	**28.87%**	**7.98%**	**7.55%**	**29.16%**	**8.23%**

Slot	**30-38 (F)**	**28-35 (F)**		**32-40 (G)**	**30-40 (G)**		**32-40 (H)**	**28-35 (H)**	
Mode	**Shore/Private**	**For-Hire**	**Total**	**Shore/Private**	**For-Hire**	**Total**	**Shore/Private**	**For-Hire**	**Total**
New Harvest	189,893	26,233	216,126	148,406	32,529	180,936	148,406	26,233	174,639
New non Comp Harvest	7,197	864	8,061	9,188	562	9,749	9,188	864	10,051
New Dead Discards	12,851	1,543	14,394	16,406	1,003	17,409	16,406	1,543	17,949
Old Dead Removals	1,381,257	11,625	1,392,882	1,381,257	11,625	1,392,882	1,381,257	11,625	1,392,882
New Removals	1,591,199	40,264	1,631,462	1,555,257	45,719	1,600,976	1,555,257	40,264	1,595,521
Old Removals	1,721,141	55,861	1,777,001	1,721,141	55,861	1,777,001	1,721,141	55,861	1,777,001
Removal Reduction	**7.55%**	**27.92%**	**8.19%**	**9.64%**	**18.16%**	**9.91%**	**9.64%**	**27.92%**	**10.21%**

New York Addendum VI Implementation Plan for Atlantic Striped Bass

Current Management Regulations:

Current Coastal Marine Recreational Fishery

State	Season	Bag Limit	Minimum Size	Special Conditions	License
NY	Marine: April 15-Dec 15	1	28”	Angling only. Spearing permitted in ocean waters. Catch and release only during closed season.	Marine angler registry

Current Commercial Fishery (Marine District only)

State	Season	Annual Quota	Trip Limit	Minimum Size	Reporting Requirements	# of Participants
NY	May 15–Dec 15	795,795 lbs.	Season may close if projected quota is exceeded	28”-38” minimum size	Trip reports	439

Summary of Proposed Measures – Marine Recreational Options:
Section 1 : Coastal Marine Recreational Fishery:

No Change in Costal Season

		Coastal		with Hudson/DE	
		% Reduction from 2017 Coastal	#fish	% Reduction from 2017 Total	#fish
slot	28-35"	25.4%	537,558	23.8%	548,942
	30-40"	23.8%	549,135	22.2%	560,519
	32-40"	28.6%	514,802	27.0%	526,186
Minimum Size	35"	21.3%	567,288	19.7%	578,672

- All Bag Limits are for 1 fish.
- New York State will meet the 18% reduction in total removals from 2017 levels required by Addendum VI by following the criteria set by the Technical Committee in Memo M19-084. The reduction will be accomplished by different regulation changes in the Marine and Coastal District, the Hudson River management area, and the Delaware River Management area. The total coastal, Hudson River, and Delaware River removals combined result in a reduction of at least 18% statewide.
- Total combined Hudson/Delaware River removals were 11,384 fish. Tables show removals and percentage reductions for the coast vs. combined NY coast/Delaware River/Hudson River.

- NY may implement changes in size limits, with no change in current season (April 15 – December 15), but will probably implement seasonal changes for all modes.
- Alternatively, NY may close the April and December fishing season, thus changing the 2020 season to May 1– Nov. 30. Closing fishing in April would allow fish to spawn before being caught for the season, and may provide consistent regulations with neighboring State's proposals.
- All proposals meet the standards established in ASMFC memo (M19-084).
- All analyses use length frequency proportions complied from pooled 2016 - 2017 MRIP data,
- Removals for "no seasonal change" options were calculated from 2017 MRIP data.
- Removals for "seasonal change" options were calculated from pooled 2015-2018 MRIP data.
- A 9% post release mortality rate was calculated for all options.
- All size limit analyses follow procedures used for Draft Addendum VI, and spreadsheet.
- The same level of "non-compliance" in 2016-2017 was assumed to occur in 2020. (i.e. proportion of fish harvested that were < 28" TL). This results in a non-compliance factor of 0.11 for NY (vs. 0.055 in the ASMFC spreadsheet for the total coast), and the 0.11 value was used in all NY "new non-compliance harvest" calculations.
- This may represent a worst-case scenario. MRIP measurements are taken in fork length (in mm), and were converted to TL for the addendum. So, for example, a fish in the 27" bin may either represent an undersized fish that was caught; or it may have been 28" but was put in the 27" bin, due to rounding errors, etc.
- It should also be noted that MRIP also covers the Hudson River in NY, from Hudson rm 0 at the Battery, to rm 45 in Peekskill. The marine coastal regulations for striped bass end at the George Washington Bridge (rm 12), but MRIP codes fish taken up to the Tappan Zee (Mario Cuomo) Bridge (rm 28) as a Hudson/Raritan "estuary" fish (D). Thus, a fish that was legally caught under Hudson River regulations (18-28" TL) may be present in the MRIP age-length key.
- For CE options, NY must demonstrate a reduction of at least 18% in total removals from 2017 levels.
- All CE options for proposed NY "seasonal changes" represent a reduction of at least 18%.

2017	**Recreational Coast- all modes**
Harvest	472,321
Discards	2,760,839
Dead Discards	248,476
Total removals	720,797

An 18% reduction in total coastal recreational removals, compared to 2017, would result in 129,743 fewer fish; or 591,053 total removals. (i.e., coastal total removals must be less than or equal to 591,053 fish to achieve an 18% reduction).

- 2017 coastal for hire modes comprise 7.5% of total coastal recreational removals (53,795 fish). An 18% reduction in for-hire removals would result in 9,683 fewer fish; or 44,112 total removals.

2017 - for hire	
Harvest	48,978
Discards	53,523
Dead Discards	4,817
Total removals	53,795

- 2017 coastal private modes comprise 92.5% of total recreational removals (667,001 fish).

An 18% reduction in private mode removals would result in 120,060 fewer fish; or 546,941 removals.

2017- private modes	
Harvest	423,343
Discards	2,707,316
Dead Discards	243,658
Total removals	667,001

ALL Coastal Modes Same Regulation-Season Change

		May 1 - Nov 30 (No April or Dec)	**Coastal Only**	**With Hudson/DE**	
	TL	% Reduction from Coastal total	#fish	% Reduction from total	#fish
slot	28-35"	28.10%	518,066	26.5%	529,450
	28-38"	22.50%	558,266	21.0%	569,650
	30-40"	27.10%	525,480	25.5%	536,864
	30-42"	21.60%	565,222	20.0%	576,606
	32-44"	23.30%	552,903	21.7%	564,287
slot or Trophy	28-35 or >44"	21.90%	562,868	20.3%	574,252
Minimum Size	34"	21.50%	565,936	19.9%	577,320

- Delaware River fish that are not sampled in MRIP were reported to represent an average 0.3% bias in total MRIP removals (SAW 66 benchmark striped bass stock assessment). A 0.3% bias in MRIP estimates would result in in an additional 2,162 total removals for NY in 2017. NY Delaware River removals shown in the Tables were the estimated Total Removals in 2017 (2,162 fish), if NY were to do no regulatory change in 2020. (See Section 4 of this report). Actual removals due to NY's proposed regulatory change in 2020 (1 fish @ 28-35") are expected to be lower (achieving a greater percentage reduction). We used the 2,162 fish as a worst-case scenario, since an exact number of expected 2020 removals could not be calculated at this time.

- Hudson River fish that are not sampled in MRIP, were reported to represent an average 1.35% bias in total NY MRIP removals. (SAW 66 benchmark striped bass stock assessment). A 1.35% bias in MRIP estimates would result in an additional 9,731 total removals for NY in 2017. NY Hudson River removals (9,222 fish) were a 5.23% reduction in estimated 2017 total removals (9,731 fish). This represents the lowest estimated percent reduction (and greatest number of removals) of the three proposed NY CE options for 2020 Hudson River regulatory changes. (option HR1-). NY Hudson River Options HR2 and HR3 would result in 137 and 146 fewer 2020 total removals, respectively, than NY Option HR1 (see Section 5 of this report).

- NY may implement a season change (no April or December), with the same options as above for the coastal private/shore modes; but a 31" minimum for party/charter boats. Additionally, party/charter boat captain and crew would no longer be able to keep a fish. (see Table below).

	Split Coastal Private Vs. Party/Charter Regulations -Season Change							
	May 1 - Nov 30							
	(No April or Dec)		**Private**		**Total- Split Regulations**			
			May 1 - Nov 30		**Coastal**		**With Hudson/DE**	
			(No April or Dec)		**31" for hire**			
TL	% Reduction from hire	#fish	% Reduction from private	#fish	Total % Reduction	Total #fish	Total % Reduction	Total #fish
28-35"			28.0%	480,108	27.3%	523,842	25.7%	535,226
28-38"			22.7%	515,392	22.4%	559,126	20.9%	570,510
30-40"			27.0%	486,616	26.4%	530,350	24.8%	541,734
30-42"			21.8%	521,497	21.6%	565,231	20.0%	576,615
32-44"			23.4%	510,685	23.1%	554,419	21.5%	565,803
28-35 or >44"			22.1%	519,432	21.9%	563,166	20.3%	574,550
34"			21.7%	522,125	21.5%	565,859	19.9%	577,243
31" (party/charter)	18.70%	43,734						

- Alternatively, RI/CT/NY may choose a Regional coastal plan. The options would be :

State	Size Limits	Bag Limits	Other
Regional: RI/CT/NY – A	**28" – 35"**	**1**	**All modes**
Regional: RI/CT/NY – B	**30" – 40"**	**1**	**All modes**
Regional: RI/CT/NY – C	**30" – 40"**	**1**	**Private/Shore**
Regional: RI/CT/NY – C	**28" – 37"**	**1**	**For-Hire**

Details are provided in a separate report.

- In summary, all proposed options achieve a greater than 18% reduction on total recreational removals for the entire state.

Section 2 : Proposed. Coastal Marine Commercial Fishery Options:

	Slot Size
Current Regulation	28-38" TL
18% reduction	28-38" TL
	24-36" TL
	26-38" TL

Analysis:

- NY's current regulation is a 795,795 lb. quota with a slot limit of 28-38". An 18% reduction in quota would result in a new quota limit of 652,552 lbs, with no change in slot size, as per Addendum VI. No additional analysis is required, but results are included in the following Tables, for comparison to the other two options.

- **CE Analysis :** YPR/SPR analysis:

- Analyses were performed using the Yield Per Recruit (YPR) version 3.3 program from the NOAA Fisheries
- Toolbox. (F_s = 0.1, M_s=0.33). M, Maturity, and Weights were derived from the 2018 Striped Bass Benchmark Stock Assessment Report (SAW 66). Analyses used an age range of 1 - 13+, with maximum age in cohort calculation = 100. Selectivity curves were derived from 2016-2017 NY age-length keys.

- For SPR = 28-38” SPR:

size	F	SPR	YPR	%MSP	Quota
28-38	0.197	2.73	0.386	39.23	652,552
26-38	0.165	2.73	0.379	39.20	640,718
24-36	0.192	2.73	0.368	39.30	622,122

- <u>Results for 26-38”TL, 2.73 SPR:</u>

28-38 quota	652,552
reduction = YPR26-38/YPR28-38	0.98
Resulting quota at 26-38"	640,718

- <u>Results for 24-36”TL, 2.73 SPR:</u>

28-38" Quota	652,552
reduction = YPR24-36/YPR28-38	0.95
Resulting quota at 24-36"	622,122

<u>Section 3: Circle Hook Requirements</u>

To improve post release survival of striped bass and comply with Addendum VI, circle hooks will be a required gear to be used when fishing with natural bait for striped bass beginning January 1, 2021. The circle hook will adhere to the definition put forth in Addendum VI as “a non-offset hook where the point is pointed perpendicularly back towards the shank”. “The term “non-offset” means the point and barb are in the same plane as the shank (e.g. when the hook is laying on a flat surface, the entire hook and barb also lay flat).” NY will develop public education and outreach campaigns on the benefits of using circle hooks with natural bait as well as best handling practices, covering both the marine district as well as inland waters.

<u>Timeline for Implementation:</u>

NYS DEC held a Marine Resources Advisory Council (MRAC) meeting in November to discuss commercial and recreational striped bass regulatory options. Another MRAC meeting is scheduled for mid-January. The Hudson River Estuary Management Advisory Committee (HREMAC) will also be consulted for feedback. There will also be opportunities for public comment prior to implementing new regulations in 2020. Regulations are expected to be implemented prior to the start of the Hudson River Recreational fishing season on April 1, 2020. Marine recreational striped bass season starts April 15, and commercial season starts on June 1. The circle hook provisions of Addendum VI will be implemented before January 1, 2021.

Proposed Inland Fishery Regulations: Recreational options only are presented; commercial fisheries for striped bass are closed in inland waters.

Section 4: Delaware River (Inland) Fishery:

Current Delaware River Recreational Fishery Management Regulations:

State	Size Limits	Bag Limit	Other	Open Season	License
NY Delaware River	28 inches TL	1		All year	Marine Angler Registry

Summary of Proposed Measures:
Proposed Delaware River Recreational Fishery:

State	**Size Limits**	**Bag Limit**	**Other**	**Open Season**	**License**
NY Delaware River	28 to <35" TL	1		All year	Marine Angler Registry

- NY proposes to implement a 1 fish at 28 to less than 35 inch TL size limit for the Delaware River recreational fishery as stated in Addendum VI.

- Delaware River fish that are not sampled in MRIP were reported to represent an average 0.3% bias in total MRIP removals (SAW 66 benchmark striped bass stock assessment). A 0.3% bias in MRIP estimates would result in in an additional 2,162 total removals for NY in 2017. An 18% reduction of those 2,162 fish would result in 389 fewer fish; or 1,773 total removals. It is unknown what the percentage reduction of Delaware River striped bass will be under this proposed regulation. NY Delaware River removals shown in the Tables in Section 1 of this report (showing total NY recreational reductions) were the estimated Delaware River Total Removals in 2017 (2,162 fish), if NY were to do no regulatory change in 2020. Actual removals due to NY's proposed regulatory change in 2020 (1 fish @ 28-35") are expected to be lower (achieving a greater percentage reduction). We used the 2,162 fish as a worst-case scenario, since an exact number of expected 2020 removals could not be calculated at this time.

Delaware R	Options	% reduction	total removals	Diff from 18% (# fish)
No Reg. Change		0	2,162	-389
18% Delaware R Reduction		18.0%	1,773	0
Addendum VI	28 - 35"	unknown		

Section 5: Hudson River (Inland) Fishery:

Current Hudson River Recreational Fishery Regulation:

State	Size Limits	Bag Limit	Other	Open Season	License
NY Hudson	18-28 inches OR >40 inches TL	1		Apr 1 – Nov 30	Marine Angler Registry

<u>Summary of Proposed Recreational Fishery Options:</u> ALL options are for 1 fish per day bag limit for the Hudson River and Tributaries, North of the George Washington Bridge (river mile 12)

Option	**Description**	**Size limit**	**Season**	**Other**	**C&R* mort. rate**	**% reduction**
HR1.	Slot w/ no trophy	18-28 inches	Apr 1-Nov 30	No trophy	9%	5.2%
HR2.	Increase in slot restriction, season ends Sep 30th	18-28 inches or > 44 inches	Apr 1-Sep 30	Larger trophy, season ends early	9%	6.6%
HR3.	Slot w/ no trophy, season ends Sep 30th	18-28 inches	Apr 1-Sep 30	No trophy, season ends early	9%	6.7%

Dates are approximate for season ending.
*C&R: Catch and release mortality; based on standard default mortality rate as specified by ASMFC memorandum (M19-084).

<u>Overview of data used for all Hudson River options:</u>

New York state will meet the 18% reduction in total removals from 2017 levels required by Addendum VI by following the criteria set by the Technical Committee in Memo M19-084. The reduction will be accomplished by different regulation changes in the Marine and Coastal District, the Hudson River management area, and the Delaware River Management area. The total coastal, Hudson River, and Delaware River removals combined will result in a reduction of at least 18% statewide.

Hudson Options

	Options	% reduction	total removals	Diff from 2017 (#)	Diff from 18%(#)
No Reg. Change		0	9,731	0	-1,752
18% Hudson Reduction		18.0%	7,979	1,752	0
same season; no trophy	HR1	5.2%	9,222	509	-1,243
shorter season; larger trophy	HR2	6.6%	9,085	646	-1,105
shorter season; no trophy	HR3	6.7%	9,076	655	-1,097

- Hudson River fish that are not sampled in MRIP were reported to represent an average 1.35% bias in total NY MRIP removals. (SAW 66 benchmark striped bass stock assessment). A 1.35% bias in MRIP estimates would result in an additional 9,731 total removals for NY in 2017. An 18% reduction in those 9,731 fish would result in 1,752 fewer fish; or 7,979 fewer total removals. NY Hudson River removals (9,222 fish) shown in Section 1 Tables of this report (showing total NY recreational reductions) were a 5.23% reduction in estimated 2017 total removals (9,731 fish). This represents the lowest estimated percent reduction (and greatest number of removals) of the three proposed NY CE options for 2020 Hudson River regulatory changes. (option HR1). NY Hudson River Options HR2 and HR3 would result in 137 and 146 fewer 2020 total removals, respectively, than NY Option HR1.

- The Hudson River is a small component of New York state Striped Bass harvest. Estimates of total removals from inland waters not represented by MRFSS/MRIP were generated in the 2019 Benchmark Stock Assessment to examine the potential magnitude of recreational total removals (i.e. harvest and dead discards) occuring in the inland portion of the Hudson River relative to total removals in New York marine waters. Data from two previous river-wide creel surveys conducted by Normandeau in 2001 and 2005 (NAI 2003 and 2007) were compared to estimates of harvest and discard loss from MRFSS/MRIP for the equivalent years. The analysis indicated that Hudson River composed 1.7% and 1.0% of the statewide removals in 2001 and 2005, respectively.

- Our proposal meets the standards as established by the ASMFC Technical Committee in the TC memo (M19-084).
- National Marine Fisheries Service MRIP (Marine Recreational Information Program) data are not available for the Hudson River north of Peekskill. Our proposed reductions are based on data obtained from a Hudson River Cooperative Angler logbook (CAP) program run by the DEC, pooling data from 2016-2017 for size analyses and pooling data from 2015-2018 for seasonal analyses, and on data from two previous river-wide creel surveys run by Normandeau in 2001 and 2005. The two Normandeau creel surveys were extensive river-wide surveys. The data from the Normandeau creels were used as a comparison to the CAP data in the Addendum IV implementation plan. Recorded sizes of fish caught and harvested under the current CAP program continue to be very similar to what was recorded by Normandeau.
- Catch and harvest numbers from the 2001 Normandeau creel survey were used to estimate reduction for seasonal analyses. The 2005 Normandeau creel survey was only concentrated on the spring and so was not used in our seasonal analysis.
- CAP data were subset to include the spring season (April 1 to June 15) (Table 1). The size analyses were based on averages of the 2016-2017 CAP data, using a total of 1,751 trips and a catch of 7,286 fish for the two years (Table 1).
- We used the methods as provided by Dr. G. Nelson that were used for Addendum IV coastal size and bag limit reduction analyses.
- For Addendum VI, we used the default 9% mortality rate, like all other jurisdictions on the coast, as specified by the Technical Committee memorandum (M19-084) on conservation equivalency.

Hudson River Recreational Option 1: One fish @ 18-28" TL slot limit.

- Option HR1 proposes to implement a 1 fish @ 18-28 inch TL slot limit for the Hudson River recreational fishery.
    - Table 3 provides expected reductions for Option 1 for Hudson River removals, under assumption of 9% catch and release mortality rate. For HR Option 1: 1 fish at 18-28 inch slot limit with a 9% C&R rate would produce a 5.23**%** reduction from average 2017 Hudson River total removals. This option would be eliminating the harvest and targeting of all fish over 28". This option would protect the size of fish that in the Hudson River spawning stock data are entirely female and the additional savings in terms of biomass and reproductive potential is closer to 11.34%. There is an added benefit of eliminating the trophy fishery through changing trip pressure and angler behavior, although the exact savings cannot be calculated.

Hudson River Recreational Option 2: One fish @ 18-28" or >44" TL slot limit and season begins on April 1 and closes on September 30th.

- Option HR2 proposes to implement a 1 fish @ 18-28 or >44 inch TL slot limit for the Hudson River recreational fishery in addition to ending the fishing season early on September 30th.
    - Table 4 provides expected reductions for Option 2 for Hudson River removals, under assumption of 9% catch and release mortality rate. For HR Option 2: 1 fish at 18-28 or >44 inch slot limit with a 9% C&R rate and would produce a 6.64% reduction from average 2017 Hudson River total removals. This option would be extending the upper bounds of the size of fish that are protected from harvest in the Hudson River. Currently the minimum size for a trophy fish is 40" and if it were moved to 44", it would protect the majority of spawning females in the Hudson while still allowing for the harvest of a trophy fish above 44". Based on the 2016-17 CAP data, fish that were harvested and larger than 44" accounted for 0 .12% of total harvest. Changing the fishing season end date will result in a reduction of 25% of the fishing season on the Hudson. Targeting striped bass (catch and release) out of season in the Hudson is not allowed and so would not only result in less harvested, but also would reduce catch and release mortality.

Hudson River Recreational Option 3: One fish @ 18-28" TL slot limit and season begins on April 1 and closes on September 30th.

- Option HR3 proposes to implement a 1 fish at 18-28 TL slot limit for the Hudson River recreational fishery in addition to ending the fishing season early on September 30th.
    - Table 5 provides expected reductions for Option 3 for Hudson River removals, under assumption of 9% catch and release mortality rate. For HR Option 3: 1 fish at 18-28 inch slot limit until September 30 with a 9% C&R rate would produce an 6.73**%** reduction from average 2017 Hudson River total removals. This option would be eliminating the harvest and targeting of fish over 28". The fish in this size range from Hudson River spawning stock data are entirely female and the savings in terms of biomass and reproductive potential is closer to 11.34% and coupled with a shortened season, approximately an 12.8% reduction. There is an added benefit of eliminating the trophy fishery through changing trip pressure and angler behavior, although the exact savings cannot be calculated. Changing the fishing season end date will result in a reduction of 25% of the fishing season on the Hudson. Targeting striped bass out of season in the Hudson is not allowed and so would not only result in less harvested, but also would reduce catch and release mortality.

Table 1. NYSDEC cooperative angler diary program statistics. Size related analyses used averages of the 2016-2017 data and seasonal analyses used averages of the 2015-2018 data.

April 1-June15 only					
Year	N Participants	N Trips	N s. bass caught*	N Anglers	Angler Hours
2006	20	263	624	590	3425
2007	26	330	1118	740	3607
2008	38	459	2577	1014	5518
2009	39	498	1678	1195	6654
2010	52	529	1962	1198	6807
2011	83	840	1970	1797	8829
2012	66	745	2576	1617	8834
2013	56	604	1786	1305	6961
2014	47	512	1267	1136	5409
2015	**60**	**554**	**1549**	**1320**	**7750**
2016	**76**	**965**	**3830**	**2160**	**11286**
2017	**65**	**684**	**3281**	**1559**	**8454**
2018	**96**	**974**	**3451**	**2050**	**10072**
2016-2017 sum	141	1649	7111	3719	19740
2016-2017 avg	71	825	3556	1860	9870
2015-2018 sum	297	3177	12111	7089	37562
2015-2018 avg	74	794	3028	1772	9390
"All year" data					
2015	62	571	1559	1324	7764
2016	76	1030	3916	2204	11397
2017	65	721	3370	1592	8511
2018	96	1029	3480	2088	10145
2016-2017 sum	141	1751	7286	3796	19908
2015-2018 sum	299	3351	12325	7208	37817
*Not all fish caught are measured					

Table 2. Numbers and proportion at length for Hudson River recreational size limit analysis using cooperative angler logbook data; percent averaged from 2016-2017 and 2015-2018.

	Total catch				Harvested				% harvested		% harvested	
	2015	2016	2017	2018	2015	2016	2017	2018	2016-17	cumulative	2015-18	cumulative
7-7.9	3	6							0.00	0.00	0.00	0.00
8-8.9	1	27	4	3					0.00	0.00	0.00	0.00
9-9.9	2	19		1					0.00	0.00	0.00	0.00
10-10.9	2	41	9	7					0.00	0.00	0.00	0.00
11-11.9	1	15	6	3					0.00	0.00	0.00	0.00
12-12.9	10	83	66	31					0.00	0.00	0.00	0.00
13-13.9	11	48	27	26					0.00	0.00	0.00	0.00
14-14.9	14	130	129	73					0.00	0.00	0.00	0.00
15-15.9	13	91	99	148					0.00	0.00	0.00	0.00
16-16.9	32	139	170	248					0.00	0.00	0.00	0.00
17-17.9	59	102	159	278					0.00	0.00	0.00	0.00
18-18.9	78	114	161	303	3	6	16	25	0.03	0.03	0.04	0.04
19-19.9	55	85	70	229	4	13	17	30	0.04	0.07	0.04	0.08
20-20.9	84	132	118	262	6	14	11	24	0.03	0.10	0.04	0.12
21-21.9	108	119	73	174	19	18	16	34	0.04	0.15	0.07	0.19
22-22.9	116	168	94	137	18	28	30	37	0.08	0.22	0.08	0.27
23-23.9	57	137	66	90	19	48	32	40	0.10	0.32	0.10	0.37
24-24.9	96	286	113	121	22	74	34	46	0.13	0.45	0.12	0.49
25-25.9	62	173	84	75	35	67	36	30	0.13	0.58	0.13	0.62
26-26.9	55	202	103	76	20	72	39	24	0.13	0.71	0.11	0.73
27-27.9	56	180	109	89	30	106	60	51	0.20	0.91	0.17	0.90
28-28.9	54	111	69	70	20	29	18	31	0.06	0.97	0.07	0.97
29-29.9	39	67	51	46					0.00	0.97	0.00	0.97
30-30.9	37	88	49	56	1		1		0.00	0.97	0.00	0.97
31-31.9	39	38	36	53					0.00	0.97	0.00	0.97
32-32.9	54	75	43	50					0.00	0.97	0.00	0.97
33-33.9	42	71	27	56			1		0.00	0.98	0.00	0.97
34-34.9	44	94	33	32					0.00	0.98	0.00	0.97
35-35.9	37	60	20	27					0.00	0.98	0.00	0.97
36-36.9	35	87	25	38					0.00	0.98	0.00	0.97
37-37.9	24	63	18	19					0.00	0.98	0.00	0.97
38-38.9	23	43	8	16					0.00	0.98	0.00	0.97
39-39.9	13	21	3	21					0.00	0.98	0.00	0.97
40-40.9		16	7	15		8		3	0.01	0.98	0.01	0.98
41-41.9	4	11	1	3	3	9	1	2	0.01	0.99	0.01	0.99
42-42.9		6	3	5		2		2	0.00	1.00	0.00	0.99
43-43.9	2	2	1	2		1	1	1	0.00	1.00	0.00	0.99
44-44.9	1		2	3			1	2	0.00	1.00	0.00	1.00
45-45.9	3				3				0.00	1.00	0.00	1.00
46-46.9		1		1					0.00	1.00	0.00	1.00
47-47.9	2								0.00	1.00	0.00	1.00
48-48.9									0.00	1.00	0.00	1.00
Total	1368	3151	2056	2887	203	495	314	382	1	24	1	24

Table 3. Reduction achieved when implementing HR Option 1: 1 fish at 18 to 28 inch TL slot limit for the Hudson River in-river recreational fishery. Reduction based on an average from 2016 to 2017 cooperative angler data.

	Option HR1
New SLOT Size Limit	no trophy 18-28
Prop Har Reduction	0.09
New Harvest	287
New Dead Rel09	2
Old Dead Rel	157
Total Removal	446
% Total Reduct	**-5.23**

Table 4. Reduction achieved when implementing HR Option 2: 1 fish at either an 18-28" slot or a trophy fish at >44 inches TL for the Hudson River in-river recreational fishery starting April 1 and ending September 30. Reduction based on an average from 2016 to 2017 cooperative angler data as well as 2001 creel data.

			Option HR2
New SLOT Size Limit	+>44 18-28	early season closure	
Prop Har Reduction	0.08	0.006363259	
New Harvest	287	7183	
New Dead Rel09	2	0	
Old Dead Rel	157	3,338	combined
Total Removal	447	10,521	reduction
% Total Reduct	-5.13	-1.59	6.64%

Table 5. Reductions achieved from Hudson River recreational fishery Option 3: 1 fish at 18 to 28 inch TL slot limit for the Hudson River in-river recreational fishery starting April 1 and ending September 30. Reduction based on an average from 2016 to 2017 cooperative angler data as well as 2001 creel data.

			Option HR3
New SLOT Size Limit	no trophy 18-28	early season closure	
Prop Har Reduction	0.09	0.00636	
New Harvest	287	7183	
New Dead Rel09	2	0	
Old Dead Rel	157	3338	combined
Total Removal	446	10521	reduction
% Total Reduct	**-5.227**	-1.5862	**6.73%**

References:

1. Normandeau, 2003. Assessment of Hudson River Recreational Fisheries. Normandeau Associates under contract to NYSDEC (Contract C004005).
2. Normandeau, 2007. Assessment of Spring 2005 Hudson River Recreational Fisheries. Normandeau Associates under contract to NYSDEC (Contract C005100).
3. NESC Document 19-08. 2019. 66th Northeast Regional Stock Assessment Workshop(66th SAW) Stock Assessment Report. (Striped Bass Benchmark Stock Assessment). pp 457 - 1175.

New Jersey Atlantic Striped Bass Addendum VI Implementation Plan

Implementation Plans are due November 30, 2019

Please use the following template when submitting implementation plans. Please be as concise as possible and use bullets to ensure inclusion of all important information. This template references data standards established by the Technical Committee (TC) and detailed in the TC memo (M19-084).

Summary of Proposed Measures

Recreational Fishery

	State	Size Limits	Bag Limits	Other	Open Season
R1	NJ	1 @ 24” to < 28”	1	Raritan Bay closure. Earliest open date: - March 8 with C1 - March 1 with C3 - March 8 with C4 - March 8 with C5	1/1 – 12/31*^
R2	NJ	1 @ 24” to < 29”	1	Raritan Bay closure. Earliest open date: - April 3 with C2 - March 24 with C3 - April 3 with C6 - April 3 with C7	1/1 – 12/31*^
R3	NJ	1 @ 28” to < 35”	1		1/1 – 12/31*^
R4	NJ	1 @ 28” to < 34”	1		1/1 – 12/31*^
R5	NJ	1 fish ≥ 35”	1		1/1 – 12/31*^

*Closed January 1 to February 28 in all waters except Atlantic Ocean and April 1 to May 31 in the lower Delaware River and tributaries (spawning ground closure)
^New Jersey may consider closing Raritan Bay beyond dates listed in table above but until no later than May 1

Commercial Fishery – **Striped Bass Bonus Program**

	State	Size Limits	Seasonal Quota	Open Season
C1	New Jersey	1 @ 24” to < 28”	215,912	5/15 – 12/31 or 9/1 – 12/31
C2	New Jersey	1 @ 24” to < 29”	218,464	5/15 – 12/31 or 9/1 – 12/31
C3	New Jersey	1 fish ≥ 35”	459,898	5/15 – 12/31 or 9/1 – 12/31

C4	**New Jersey**	**1 @ 24 to < 28” or 1 fish ≥ 43” (500 trophy permits)**	**215,912**	**5/15 – 12/31 or 9/1 – 12/31**
C5	**New Jersey**	**1 @ 24 to < 28” or 1 fish ≥ 43” (1000 trophy permits)**	**215,912**	**5/15 – 12/31 or 9/1 – 12/31**
C6	**New Jersey**	**1 @ 24 to < 29” or 1 fish ≥ 43” (500 trophy permits)**	**218,464**	**5/15 – 12/31 or 9/1 – 12/31**
C7	**New Jersey**	**1 @ 24 to < 29” or 1 fish ≥ 43” (1000 trophy permits)**	**218,464**	**5/15 – 12/31 or 9/1 – 12/31**

Section 1: Coastal Recreational Fishery

1a.) A one fish bag limit and a slot size limit of 28” minimum size to less than 35” total length may be implemented for the ocean fishery without further analysis. The same fishing seasons as in 2017 is required.

OR

1b.) A conservation equivalency (CE) proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required.

If submitting CE, please address the following questions,

- What is your state proposing for a conservation equivalency measure?
    - New Jersey currently has no preferred option but is considering the options summarized in table above under Recreational Fishery.
- Does your proposal meet the data standards established by the TC?
    - New Jersey’s proposal meets the standards as established by the TC detailed in the TC memo (M19-084)
- What data sources are used in the analysis (include mode or season specific if applicable)?
    - Data sources include: NJ MRIP and NJ Striped Bass angler logs
    - See also Appendix A.
- Sample size summary by mode, season, or state and/or data source as applicable.
    - Sample sizes by data source are provided in Table 1
- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik’s spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - For proposed measures R1-R2, we used trip-level data from NJ’s 2016-2017 Striped Bass logbooks from individual anglers. See Appendix_A_rev_sb2019 for more details. See worksheet ‘options R1 and R2’ in attached spreadsheet newJersey_revJan2020.xlsx.

    - For proposed measures R3, R4, and R5, New Jersey's analysis used the spreadsheet methods used to develop coastal recreational sub-options for Addendum VI. See worksheet 'options R3, R4, R5' in attached spreadsheet newJersey_revJan2020.xlsx.
- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - Calculations and detailed results presented in spreadsheet newJersey_revJan2020.xlsx
    - Summary of results are presented in Table 2
- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - New Jersey's 18% reduction in total removals (commercial and recreational) is achieved entirely through options presented for the recreational fishery. Total required reductions were calculated for each pair of proposed recreational and commercial options. For recreational options R1 and R2, an additional TC-required reduction was needed to account for the loss in yield per recruit from a sub-28" option. To account for the additional reduction, Raritan Bay seasonal closure was added to meet the total required reduction. See Appendix_A_rev_sb2019 and attached spreadsheet newJersey_revJan2020xlsx.

Note: Whether implementing 1a or 1b, please indicate the open and close dates of a season. Also specify if regulations are different by geographical area if applicable (e.g., ocean, bay, river) and the specific season dates of those areas. Also, more conservative regulations may be implemented without pursuing CE. Please contact Max Appelman mappelman@asmfc.org to confirm that proposed measures are more conservative.

<u>Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)</u>
Not applicable for New Jersey.

<u>Section 3: Coastal Commercial Fishery</u>
2a.) Implementation of an 18% reduction from the Addendum IV quotas. The reduced quotas in Addendum VI account for previously approved CE programs, therefore, states do not need to submit for CE if they choose to maintain 2017 size limits in its commercial fisheries.
OR
2b.) If a state chooses to modify 2017 size limits, the state needs to submit a CE proposal adjusting its quota relative to the new Addendum VI quota baseline (i.e., 18% reduction from the quota as listed in Addendum IV).

New Jersey is once again proposing to reallocate its commercial quota to the recreational fishery through conservation equivalency by implementing one of the options above under Commercial Fishery – **Striped Bass Bonus Program**:
- Does your proposal meet the data standards established by the TC?
    - New Jersey's proposal meets the standards as established by the TC detailed in the TC memo (M19-084)

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - For the yield per recruit/spawning potential ratio analysis we used data from the coastwide assessment: natural mortality, female maturity, and weights at age (catch wts = geometric mean of catch wts from 2016-2017), SS Bets – geometric mean of 2016-2017 adjusted Rivard wts). We assumed max age in cohort = 100 and 15 ages in the population (with a plus group). We estimated selectivity using age length keys from 2016 and 2017 (age data are from a variety of NJ fishery-independent and -dependent sampling programs including Del Bay tagging, Del River seine survey, Atlantic Herring surveys, Ocean Trawl, party/charter boat sampling, and fishing tournaments); where max selectivity < 1, we scaled the entire selectivity vector to its maximum value.
- Sample size summary by mode, season, or state and/or data source as applicable.
    - Our composite age length key (2016 and 2017) was comprised of 777 aged fish.
- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - New Jersey followed the methods of Lee (2007)[1] using NOAA's Yield Per Recruit Version 3.3[2]
- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - Calculations detailed results presented in spreadsheet newJersey_revJan2020.xlsx
    - Results are presented in Table 2
- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - New Jersey's 18% reduction in total removals (commercial and recreational) is achieved entirely through options presented for the recreational fishery. Total required reductions were calculated for each pair of proposed recreational and commercial options. See Appendix_A_rev_sb2019 and attached spreadsheet newJersey_revJan2020.xlsx.
- Striped Bass Bonus Program details for Options C4 through C7:
    - Under options C4 to C7, the Striped Bass Bonus Program will consist of two segments: Slot Size (24" to <28"(or <29") and Trophy (43+")
    - Each segment will issue a different colored permit "tag" to distinguish between segments and aid with enforcement and compliance. The segment name ("Slot" or "Trophy") will be printed on the permit/tag as well.
    - A limited number of permits will be issued to ensure the quota is not exceeded. NJ calculates the total number of issuable permits by converting the quota to number of fish based on mean weight for each size class (slot and trophy).
    - Participants must apply and specify permit type (Slot or Trophy).

[1] Lee, L. 2007. Proposal for conservation equivalency in Rhode Island's commercial trap net fishery for Striped Bass. Report to the ASMFC Striped Bass Technical Committee. 9 pp.
[2] https://www.nefsc.noaa.gov/nft/YPR.html

- Reporting Bonus Harvest is mandatory and is monitored daily.

Note: Whether implementing 2a or 2b, please include a list of commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type). Also, please be brief when submitting commercial fishery CE proposals and follow a similar outline as described in Section 1.

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)
Not applicable for New Jersey.

Section 5: Circle Hook Requirements

New Jersey is drafting regulatory language to require the mandatory use of circle hooks when fishing with bait to reduce release mortality in recreational striped bass fisheries. New Jersey will consider the Law Enforcement Committee's recommendation to adopt a standard definition of a circle hook and to standardize regulatory language with other jurisdictions. New Jersey will develop a public education and outreach campaign to promote awareness and assure compliance with the circle hook regulation. New Jersey is considering (but not limited to) implementing the following options through the public education campaign:

- Develop an outreach presentation to educate anglers on the benefits of circle hooks and to promote proper fish handling techniques to reduce release mortality. Target audiences include fishing clubs, fishing tournament Captain's meetings, fishing seminars, Division outreach events, for-hire organizations
- Develop brochures/hand-outs to distribute at fishing tournaments, outreach events, fishing clubs, marinas, and to SBBP participants
- Develop a webpage on the Division website with information on circle hooks and proper fish handling techniques. In addition, send out emails to Marine Fisheries/Wildlife email lists with a link to the webpage
- Buy and distribute circle hooks to anglers
- Work cooperatively with the Rutgers University Cooperative Extension to help spread awareness of circle hooks and fish handling practices
- Develop a Striped Bass Fishing Advisory System (similar to MD) to advise anglers when temperatures are extreme and could increase release mortality. This is not designed to address the circle hook requirement but would be an additional measure aimed to reduce striped bass release mortality during the summer months.

Section 6: Timeline for Implementation

New Jersey plans to begin implementing parts of its circle hook public education & outreach campaign immediately, with full implementation of the campaign including circle hook regulations by January 1, 2021. All other provisions of Addendum VI including recreational measures and Striped Bass Bonus Program regulations will be implemented by April 1, 2020.

Table 1. Sample sizes by data source (2016-2017).

Data source	Disposition	Trips	Fish
MRIP (NJ)	Kept	145	196
NJ SBBP logs	Kept	4,215	4,720
NJ SBBP logs (all fish)	Kept & released	7,946	23,085

Table 2. Results of analysis used to develop recreational and paired SBBP options for Addendum VI.

	Summary								
	Rec option		Paired with commercial' option:	total req reduction comm red = 0%	predicted reduction w/o seasons	predicted reduction w/ season closure	min closure length	RB earliest open date	Actual RB open date
R1	[24,28)	C1	[24,28)	35.9%	34.6%	35.9%	7	March 8	March 15, April 1, April 15, or May 1
R1	[24,28)	C3	[35+	35.7%	36.0%	36.0%	0	March 1	March 1, March 15, April 1, April 15, or May 1
R1	[24,28)	C4	[24,28) or [43+; 500 tags	35.9%	34.6%	35.9%	7	March 8	March 15, April 1, April 15, or May 1
R1	[24,28)	C5	[24,28) or [43+; 1000 tags	35.9%	34.6%	35.9%	7	March 8	March 15, April 1, April 15, or May 1
R2	[24,29)	C2	[24,29)	35.1%	28.8%	35.1%	33	April 3	April 15 or May 1
R2	[24,29)	C3	[35+	34.9%	30.6%	34.9%	23	March 24	April 1, April 15, or May 1
R2	[24,29)	C6	[24,29) or [43+; 500 tags	35.1%	28.8%	35.1%	33	April 3	April 15 or May 1
R2	[24,29)	C7	[24,29) or [43+; 1000 tags	35.0%	28.8%	35.0%	33	April 3	April 15 or May 1
R3	[28,35)	C1	[24,28)	18.7%	42%				
R3	[28,35)	C3	[35+	18.4%	42%				
R3	[28,35)	C4	[24,28) or [43+; 500 tags	18.6%	42%				
R3	[28,35)	C5	[24,28) or [43+; 1000 tags	18.6%	42%				
R4	[28,34)	C1	[24,28)	18.7%	46%				
R4	[28,34)	C3	[35+	18.4%	46%				
R4	[28,34)	C4	[24,28) or [43+; 500 tags	18.6%	46%				
R4	[28,34)	C5	[24,28) or [43+; 1000 tags	18.6%	46%				
R5	[35+	C1	[24,28)	18.7%	27%				
R5	[35+	C2	[24,29)	18.7%	27%				
R5	[35+	C3	[35+	18.4%	27%				
R5	[35+	C4	[24,28) or [43+; 500 tags	18.6%	27%				
R5	[35+	C5	[24,28) or [43+; 1000 tags	18.6%	27%				
R5	[35+	C6	[24,29) or [43+; 500 tags	18.7%	27%				
R5	[35+	C7	[24,29) or [43+; 1000 tags	18.6%	27%				

Table 3. Results (and inputs) of YPR analysis showing quota changes for each of our "commercial" options

Bonus program							
	Regulation	F	%MSP	YPR	Change	Quota	
Base (current 'commercial' reg)	[24,28)	0.197	52.36	0.0846	-	215,912	Adj Ad IV quota
	[24,28)	0.197	52.36	0.0846	0.0%	215,912	Addendum VI quota
	[24,29)	0.208	52.43	0.0856	1.2%	218,464	Addendum VI quota
	[35+	0.018	52.47	0.1802	113.0%	459,898	Addendum VI quota
*	[43+	0.335	52.39	0.2081	146.0%	531,103	Addendum VI quota
	* Implemented as [24,28) <u>OR</u> [43+						

Appendix A (revised). Supplemental information regarding recreational measure of 1 fish between 24" to less than 28" (option R1) or < 29" (Option R2).

Appendix A revised. Supplemental information regarding recreational measure of 1 fish between 24" to less than 28" (option R1) or 29" (Option R2).

Input received during NJ's public hearings suggested that there was interest in a recreational regulation similar to our 2019 Striped Bass bonus program regulation (1 fish at 24" to less than 28"). As noted in the Striped Bass Technical Committee's (TC) October 22nd memorandum to the Management Board, The TC does not have a standard methodology for pursing lower minimum sizes (e.g., < 28"), therefore, alternative methods to the coastwide analysis may be used and will be reviewed on a case by case basis. To that end, we mimicked methods used for a summer flounder conservation equivalency proposal from ~2014.

Specifically, we used NJ's Striped Bass log book program from individual anglers' trip-level data from 2016-2017. In our December 2019 analyses, we removed bonus fish from the dataset prior to analyses, but discussion and supplemental analyses from a December 2019 Technical Committee meeting suggested concerns with this approach for a number of reasons including that the results were sensitive to the decision. There was interest from the TC in having NJ make an attempt to make the logbook length frequency data as similar to MRIP as possible. To this end, we reasoned that the performance of the NJ implementation plan for recreational measures (and for all coastal states) will be judged by MRIP estimates (2017 total rec removals vs 2020 total rec removals) and NJ's bonus program fish are captured by MRIP. We therefore retained all bonus fish in the dataset. There are 621 bonus fish with associated length records in our dataset. In 2017, 2161 bonus fish were reported as harvested. The discrepancy between the number of bonus fish length records (621 in 2016 and 2017) and reported harvest of bonus fish in 2017 (2161) results from a number of factors. Logbook data and harvest data are reported separately and housed in different databases: harvested bonus fish must be reported within 24 hours of harvest (and is how we monitor our quota), while logbook data (which may or may not contain bonus fish) must be reported by the end of the calendar year in which fishing took place; not all anglers submit logbooks at the end of the year; some logbook entries are not entered into the length database if the log is filled out insufficiently (e.g., rather than providing individual lengths, an angler instead provides a length range). Finally, some bonus fish are reported by party/charter boat (PCBT) captains on behalf of their customers. For this analysis we chose not to use data from PCBT captains because that would allow for the potential of duplicate records (e.g., if a PCBT captain reports fish from all anglers in his/her daily log, and individual anglers on the same PCBT trip also report their fish in their individual logs, we would have duplicate records). Length frequency data below suggest that individual logs are capturing a representative fraction of for-hire catch and harvest (and areas fished, etc.) compared to MRIP (see results and discussion below).

For our updated analysis, for each angler trip in which a bonus fish was not harvested, one fish between 24" to less than 28" (or < 29" for option R2) was considered harvested when caught on a trip, and all other fish caught on the trip would be released (and 9% mortality would be applied; Figure 1). To account for non-compliance, we included additional harvest using the non-compliance rate (1.4%) from worksheet 'options R3, R4, R5' in spreadsheet newJersey_revJan2020.xlsx. We calculated the following:

- Original total removals = all harvested fish + 9% of all releases under 2019 regulations
- New harvest = fish harvested under new regulation [one fish [24",28") or [24",29")]
- New releases = fish released under new regulation
- New non-compliant harvest = (original harvest – new harvest) * noncompliance rate

- New dead releases = (new releases – new noncompliant harvest) * 9%
- New total removals = new harvest + new noncompliant harvest + new dead releases
- Reduction = (new total removals / original total removals) - 1

For trips in which a bonus fish was harvested in 2016 or 2017 see Figure 2. Briefly, in an effort to retain bonus fish in the dataset, and as a simplifying assumption, if a trip in 2016 or 2017 harvested a bonus fish we assumed that same trip would have been available to harvest a bonus fish under the new 2020 bonus regulations (similar to the conservation equivalency assumptions we make in general, we are assuming that the observed trip-level past behavior and length frequency is the best predictor of future behavior, with the standard set of caveats the TC has discussed). Our CE calculations shift recreational fish (non-bonus fish) into kept or released dispositions based on 2020 recreational regulations (i.e., [24,28) or [24,29)), and, because expected recreational reductions (as will be calculated from MRIP estimates) will depend on 2020 bonus program regulations (since bonus program fish are captured by MRIP), we also move bonus fish into kept or released dispositions based on 2020 bonus program regulations (i.e., [24,28), [24,29), [35+, [24,28) or [43+, and/or [24,29) or [43+ options; see Figures 1 and 2).

The 22 October 2019 TC memorandum indicates that Marine Recreational Information Program (MRIP) are the standard data set for analyses, but that alternative data may be used to supplement or replace MRIP data, provided justification, a source description, and its applicability to the analysis conducted are provided. Regarding justification and applicability, since there are few fish < 28" harvested in the MRIP dataset, and MRIP release data are very sparse, MRIP data are not well suited for an analysis that assumes fish < 28" will be harvested (or more broadly, that fish will be harvested outside of current legal-size limits). NJ's Striped Bass log book program data are currently used to characterize NJ's catch at age (harvest and releases) in the coastwide assessment and include many fish <28" in the catch, and therefore seemed to be a justifiable dataset for the proposed analyses.

Regarding the data source description – participants in the Bonus program must apply (so total participation is known). There is mandatory reporting of length information and voluntary reporting of weight data from harvested fish for individual anglers. Individuals are required to report Bonus Harvest within 24 hours (and are eligible for a second permit after reporting harvest of initial permit). Participants are asked to submit their personal logbooks at end of year for striped bass fishing trips from September 1st through December 31st and are encouraged to record and submit trips from the entire year. Comparisons of NJ's log book data with MRIP data are provided in Figures 3-8. Sample sizes are provided in Table 1. Since all NJ log book data are from individual anglers, they are compared with MRIP data where all fish were caught by an individual (F_BY_P=1) unless otherwise indicated.

Table 1 indicates that NJ's log book program reports approximately 24 times more harvested fish than MRIP, from approximately 29 times more trips than MRIP. In 2016 and 2017, of the 196 fish reported as harvested by MRIP, 5 were bonus fish (~3% of total harvest), whereas of the 4720 fish reported as harvested in our NJ log book program, 621 were bonus fish (~13% of total harvest). It is not surprising that the logbook program contains a higher percentage of bonus fish in the harvest given the requirements of the program (see above). Nevertheless, our December 2019 analysis indicated that removing bonus fish from analyses results in less conservative estimated recreational reductions relative to when bonus fish remain in the dataset (Table 2 vs Table 3); consequently, a higher percentage of bonus fish in our dataset (relative to, for example, MRIP) should result in conservative estimated reductions.

The percent of harvest by seasons is similar between MRIP and NJ's log books with most harvest occurring in the fall (Figure 3); addition of bonus fish had no observable effect on Figure 3. Harvest to catch ratios are likewise similar (Figure 4); addition of bonus fish brought the NJ logbook harvest ratios a little closer to MRIP harvest ratios (compare tables at bottom of Figure 4). Length frequencies of harvested fish from 2016, 2017, and 2016+2017 combined are provided in Figure 5 and suggest that length frequencies between MRIP and NJ's log books are similar; the differences between the two data sources in 2017 may result from a more complete length frequency in the NJ log book program in that year. The length frequency of NJ logbook bonus sized fish ([24,28)) more closely matches MRIP in 2017 than 2016 (Figure 5). Figure 6 illustrates the fraction of harvest by mode by data source; this figure suggests that the for-hire sector, as characterized by MRIP, accounts for approximately 40% of the harvest, whereas the for-hire sector as characterized by NJ logbooks accounts for approximately 10% of harvest. Those differences notwithstanding, NJ's log book data suggest that length frequencies of harvest from the for-hire and private modes are very similar (Figure 7a); the length frequency of released fish differs somewhat between the two modes (Figure 7b), but the fraction of fish within the slot limit we are proposing (24" to less than 28" or 29") are very similar (option R1: for-hire = 20%, private = 17%; option R2: for-hire = 25%, private = 19%). When comparing the length frequency of harvested fish by mode between MRIP and NJ's log program, the for-hire sector length frequencies are very similar (Figure 7c); length frequencies of the private mode are not too dissimilar (Figure 7d), and it is not known whether differences result from sample size differences (Table 1) or other issues (behavior, availability, etc.). Finally, Figure 8 illustrates the fraction of harvest by area (ocean vs inland) and suggests the two data sources are very similar. Overall, inclusion of bonus fish in these diagnostic figures in some cases made our data more similar to features of MRIP (e.g., Figure 4), in some cases less similar (e.g., 2016 in Figure 5a vs 5b), but in most cases resulted in little change. As we note above, given that MRIP has and will continue to capture bonus fish, we now feel that inclusion of bonus fish in our logbook dataset, combined with our treatment of those fish in determining predicted total recreational reductions (e.g., Figure 2), are the best way to proceed with these data. From our comparisons we concluded that data from the NJ logbook program were robust (large sample sizes) and were sufficiently similar to data from MRIP to conduct analyses using our logbook data. In the future, this data set (and analysis) can be useful in exploring additional recreational options (e.g., harvest of fish outside of a [28",35") slot limit).

Results from this analysis are provided in Table 3 (see also worksheet 'options R1 and R2' in spreadsheet newJersey_revJan2020.xlsx) and show that options R1 and R2 achieve predicted recreational reductions of 29-37%. Since we are proposing a 'commercial' regulation (bonus program option) of [24,28) or [43+ we explored a scenario where all bonus permits were allocated to 43" or greater fish; this results in the greatest possible recreational reductions of the scenarios we explored (Table 3). Given the unknown participation rate in such a program, for purposes of predicted reductions we are assuming that the predicted reduction for this program would be equal to that from allocating all permits to fish in the [24,28) or [24,29) slot, which is the most conservative of our predicted reductions.

Worksheet ‘final’ in spreadsheet newJersey_revJan2020.xlsx show the reductions necessary for NJ to allocate its entire required reduction (commercial + recreational) to the recreational sector; in addition, the TC required NJ to take an additional reduction for options R1 and R2 to account for the loss in yield per recruit from a sub-28” option, and those calculations are also provided in the same worksheet. In order to achieve the reduction required for our ‘commercial’ sector to take no reduction for options R1 and R2, we need to implement season closures in Raritan Bay. See worksheets ‘seasons and areas - NJ’ and ‘final’ in spreadsheet newJersey_revJan2020.xlsx for details.

Table 1. Sample sizes by data source (2016-2017).

Data source	Disposition	Trips	Fish
MRIP (NJ)	Kept	145	196
NJ SBBP logs	Kept	4,215	4,720
NJ SBBP logs (all fish)	Kept & released	7,946	23,085

Table 2. Results of analyses using data from NJ's logbook program where bonus fish were removed from dataset (December 2019 results). Total removals in 2016 and 2017 using NJ's logbook data were 5,752 fish (4,099 fish were harvested).

Option	from min size	to less than	new harvest (# kept)	new releases (# released)	new non-comp harvest	new dead releases	new total removals	reduction	non-compliance rate		non-compliance rate	
R1	24"	28"	1,641	20,823	34	1,871	3,546	-38%	NJ		NJ	1.014
R2	24"	29"	2,054	20,410	29	1,834	3,917	-32%	NJ			

Table 3. Results of analyses using data from NJ's logbook program where bonus fish were retained in the dataset (January 2020 results). Total removals in 2016 and 2017 using NJ's logbook data were 6,373 fish (4,720 fish were harvested; see worksheet 'options R1 and R2' in spreadsheet newJersey_revJan2020.xlsx).

Recreational option	from min size	to less than	Paired with bonus program option:	new harvest (# kept)	new releases (# released)	new non-comp harvest	new dead releases	new total removals	reduction		non-compliance rate	
R1	24"	28"	[24,28)	2,262	20,823	34	1,871	4,167	-34.6%		NJ	1.014
	24"	28"	[35+	2,161	20,924	36	1,880	4,077	-36.0%			
	24"	28"	[43+	2,093	20,992	37	1,886	4,016	-37.0%			
Recreational option	from min size	to less than	Paired with bonus program option	new harvest (# kept)	new releases (# released)	new non-comp harvest	new dead releases	new total removals	reduction		non-compliance rate	
R2	24"	29"	[24,29)	2,675	20,410	29	1,834	4,538	-28.8%		NJ	1.014
	24"	29"	[35+	2,550	20,535	30	1,845	4,426	-30.6%			
	24"	29"	[43+	2,482	20,603	31	1,851	4,365	-31.5%			

Figure 1. Flow chart for trips in which a bonus fish was <u>not</u> harvested in 2016 or 2017.

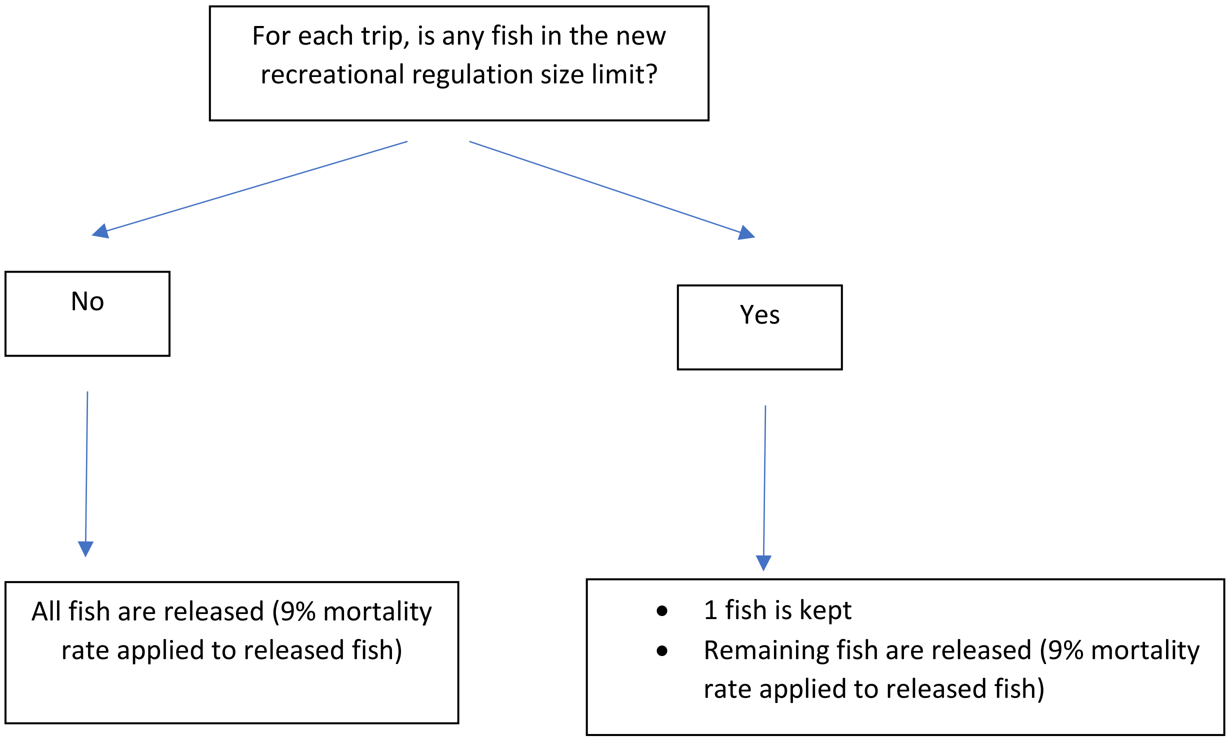


Figure 2. Flow chart for trips in which a bonus fish was harvested in 2016 or 2017.

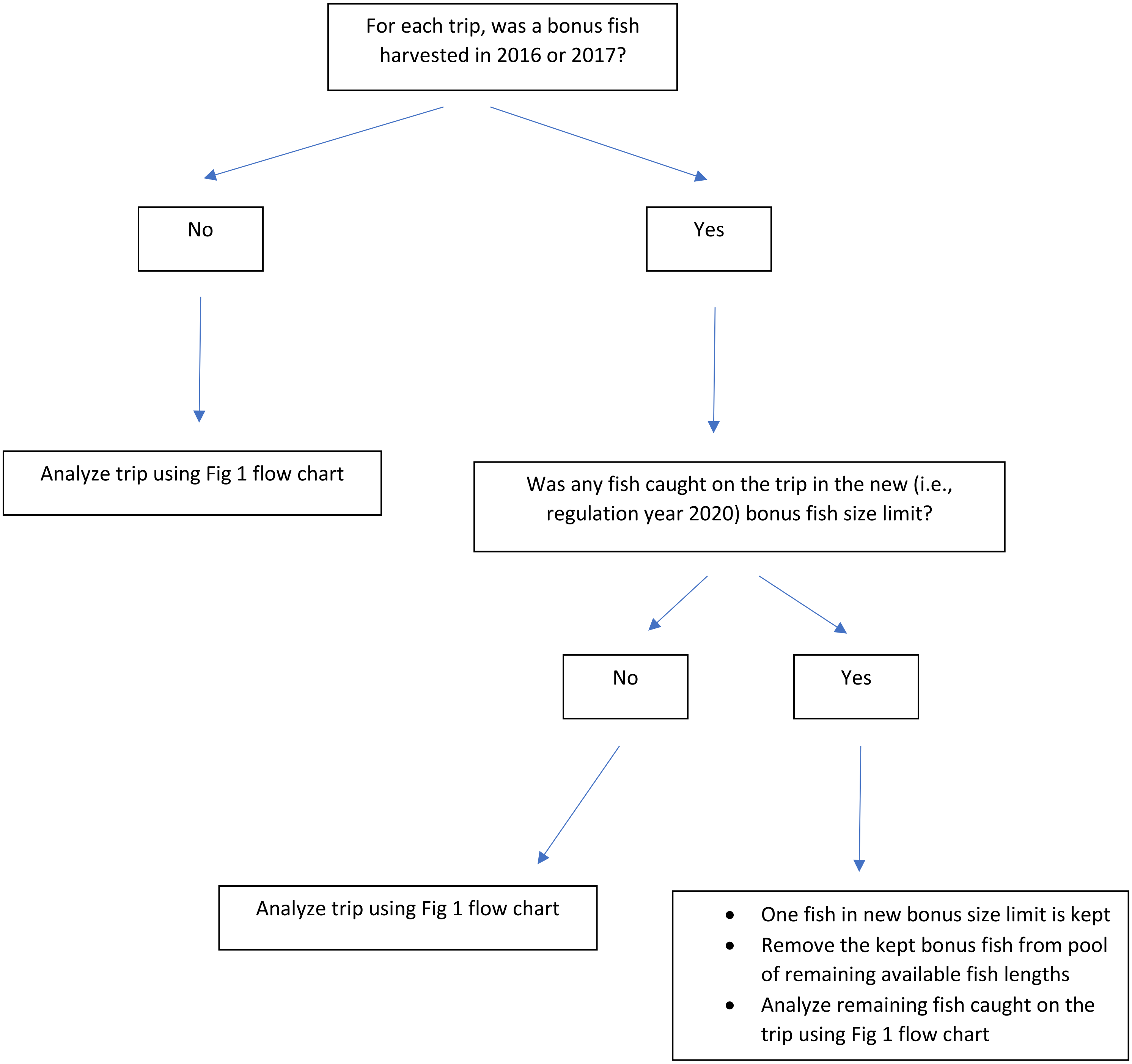
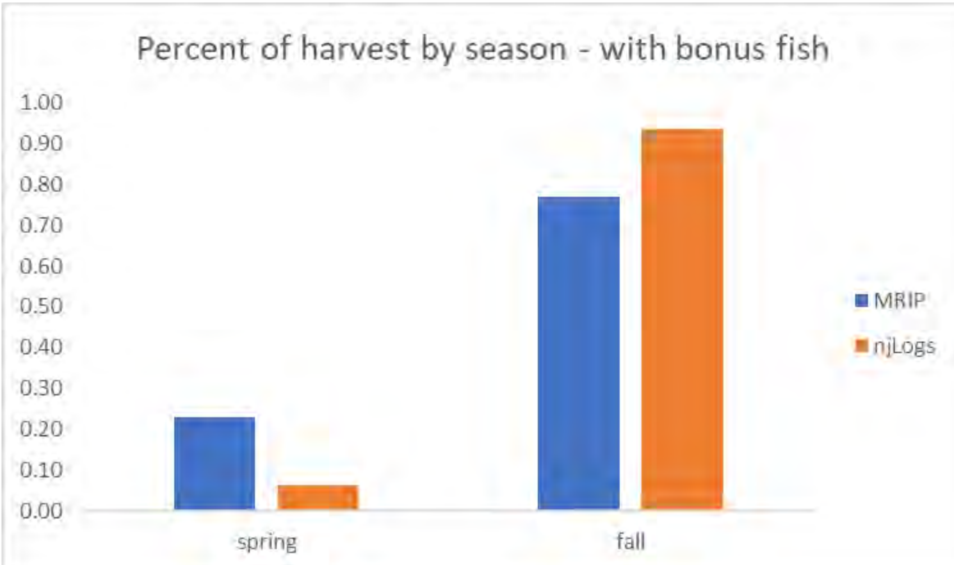


Figure 3. Percent of harvest landed by season.



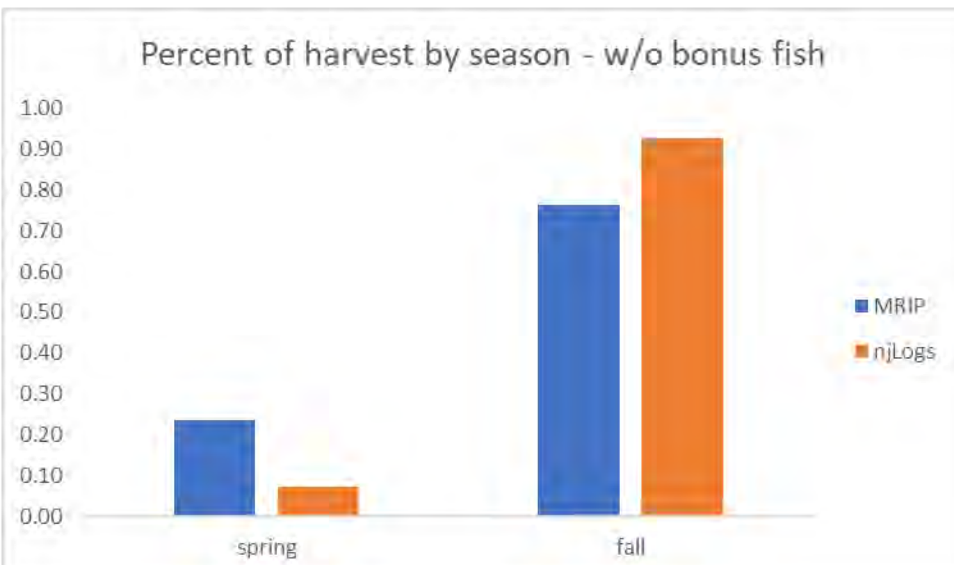
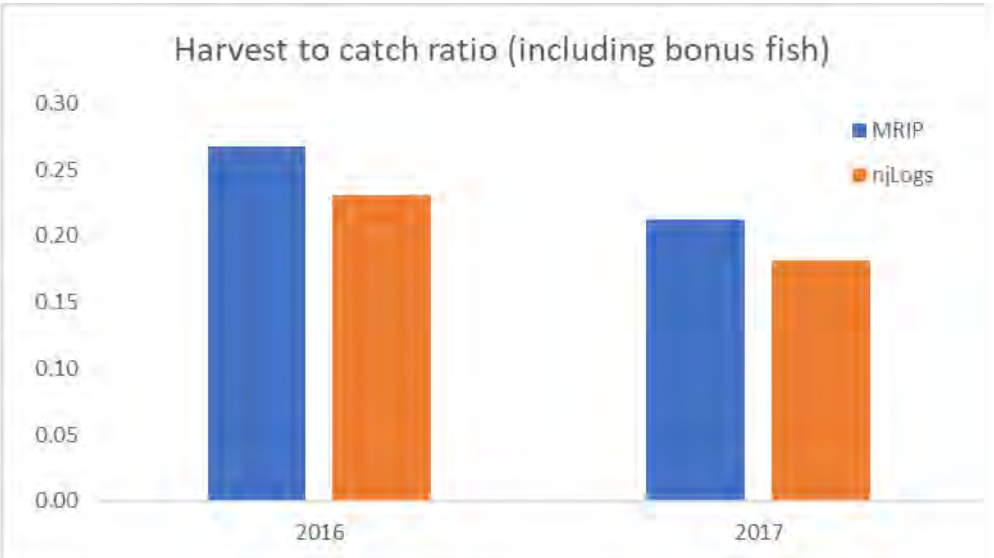


Figure 4. Harvest to catch ratios. Note: to make comparison of catch with njLogs, expanded MRIP estimates of catch were queried from MRIP website (all catch).



Including bonus fish

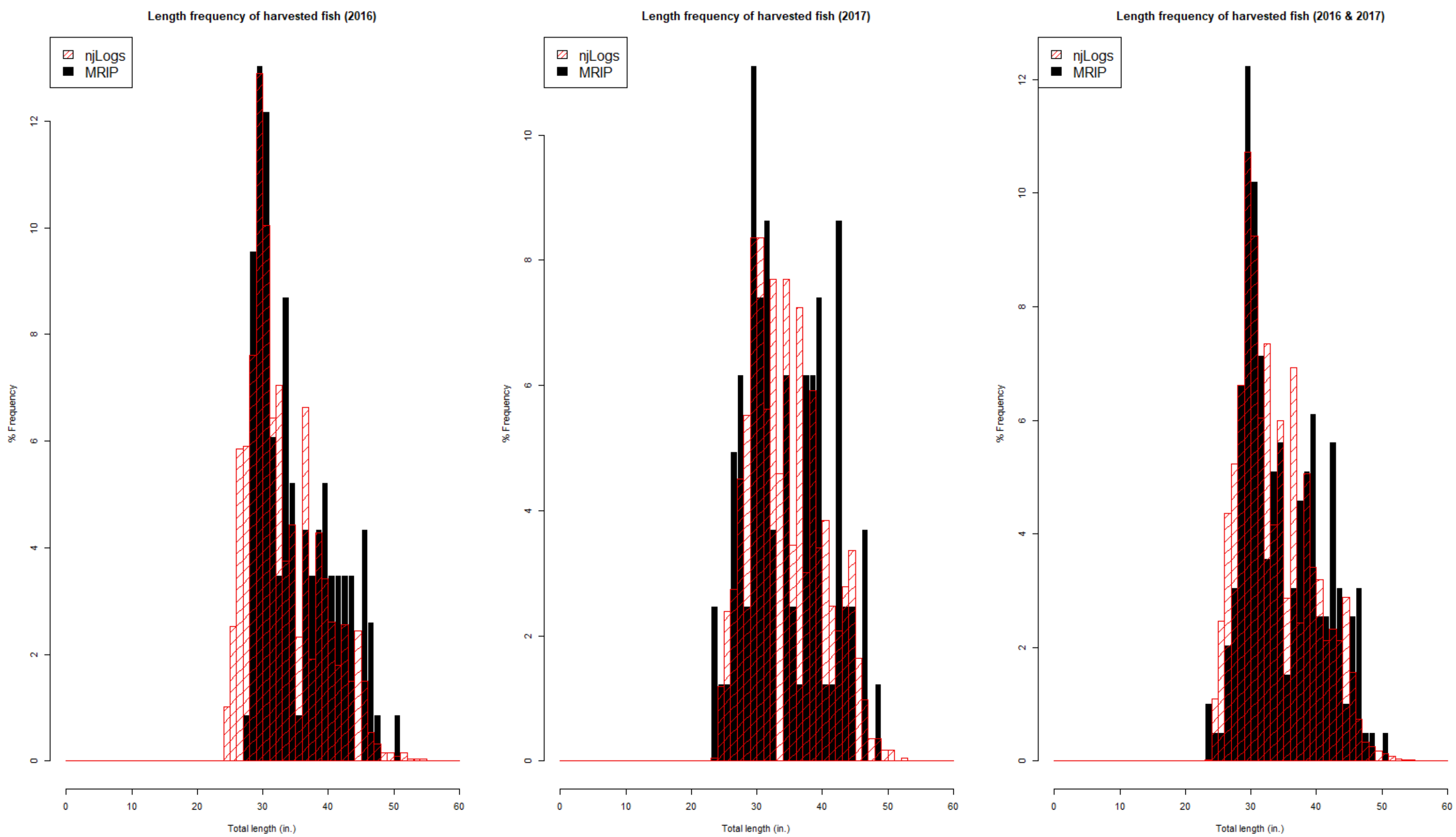
	Total catch		Harvest		Harvest ratio	
	MRIP	njLogs	MRIP	njLogs	MRIP	njLogs
2016	2,467,743	10,639	659,575	2,458	0.27	0.23
2017	2,942,274	12,446	625,909	2,262	0.21	0.18
Combined	5,410,017	23,085	1,285,484	4,720	0.24	0.20

Not including bonus fish:

	Total catch		Harvest		Harvest ratio	
	MRIP	njLogs	MRIP	njLogs	MRIP	njLogs
2016	2,467,743	10,263	659,575	2,082	0.27	0.20
2017	2,942,274	12,201	625,909	2,017	0.21	0.17
Combined	5,410,017	22,464	1,285,484	4,099	0.24	0.18

Figure 5. Length frequency of harvested Striped Bass by data source. A) including bonus fish, B) excluding bonus fish.

A) including bonus fish



B) without bonus fish

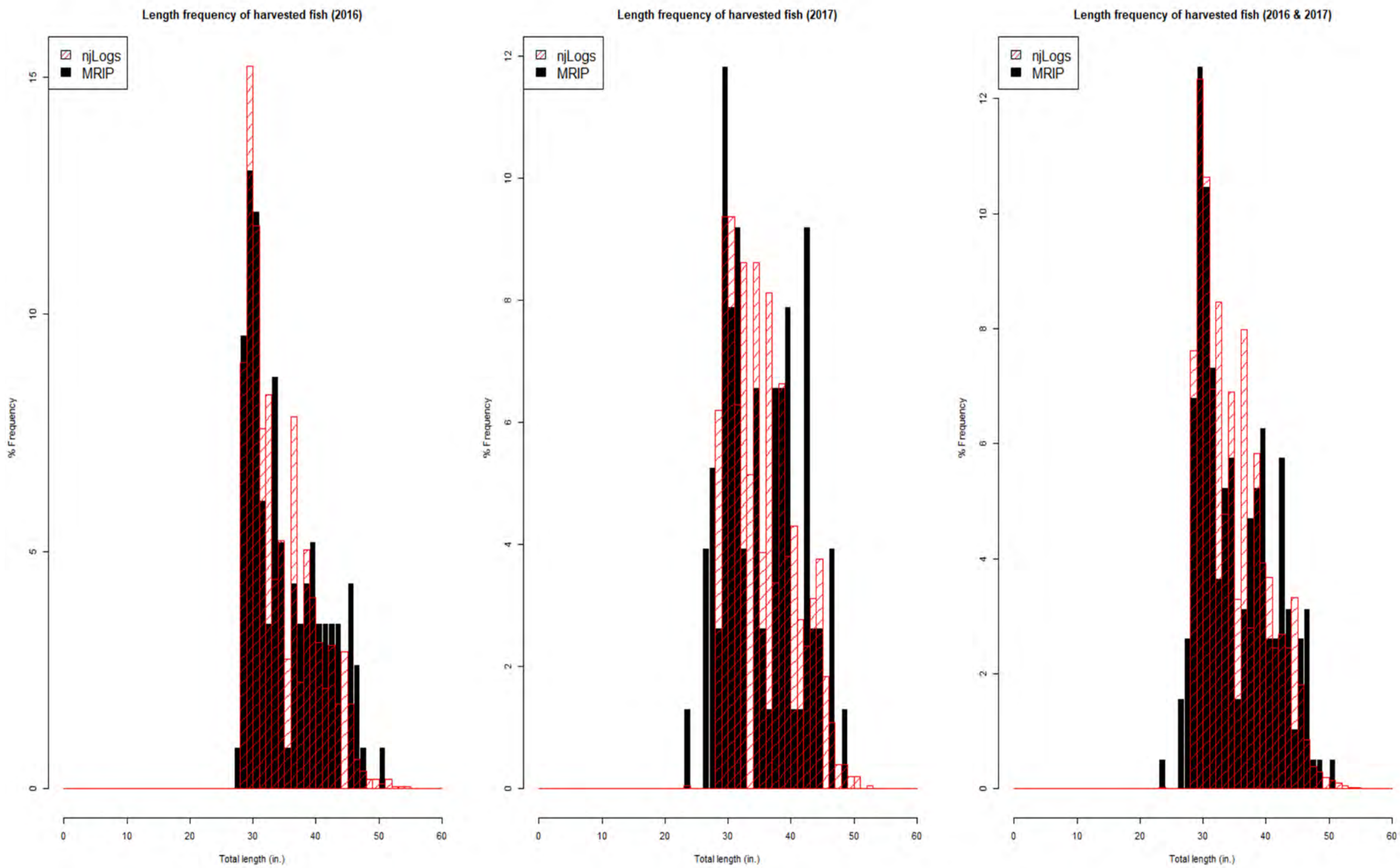
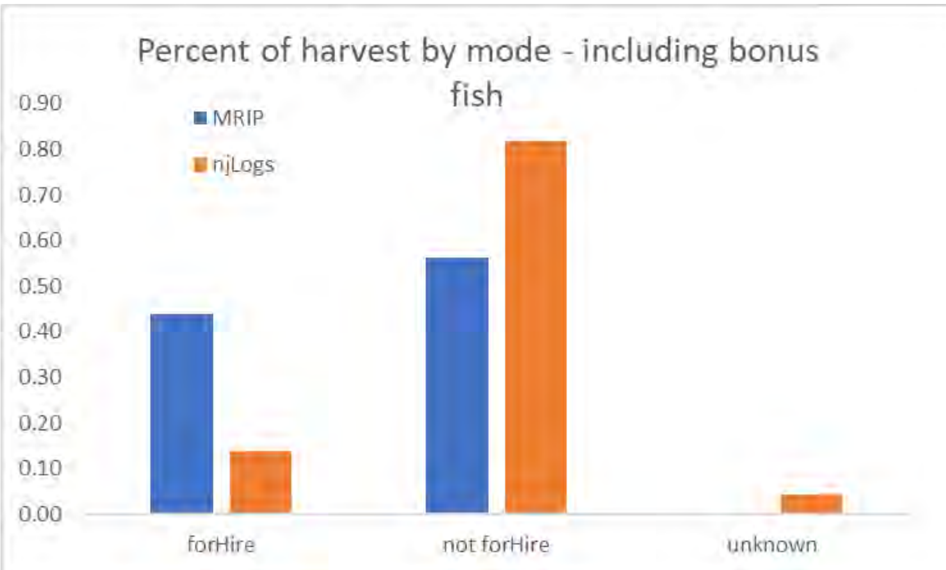


Figure 6. Percent of harvest by mode.



Excluding bonus fish:

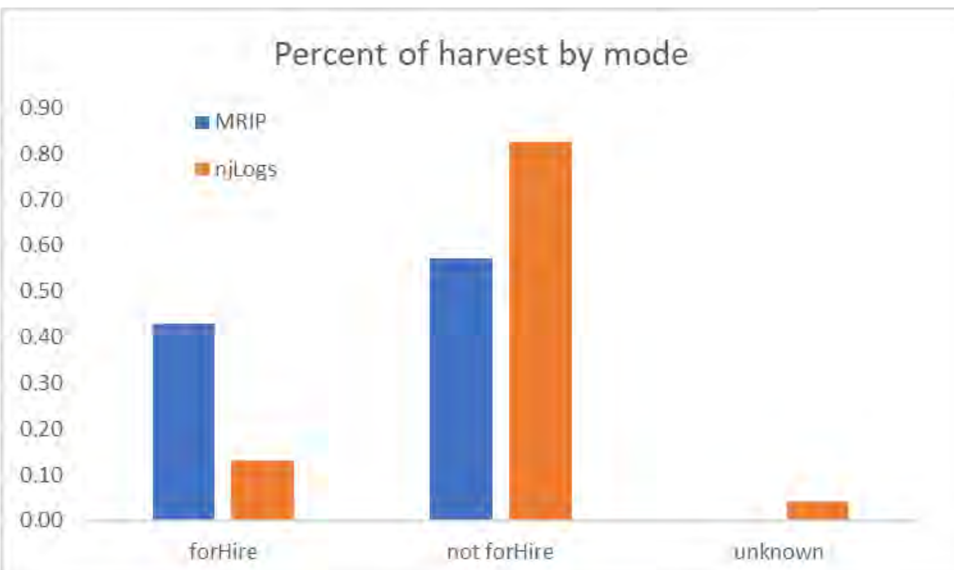
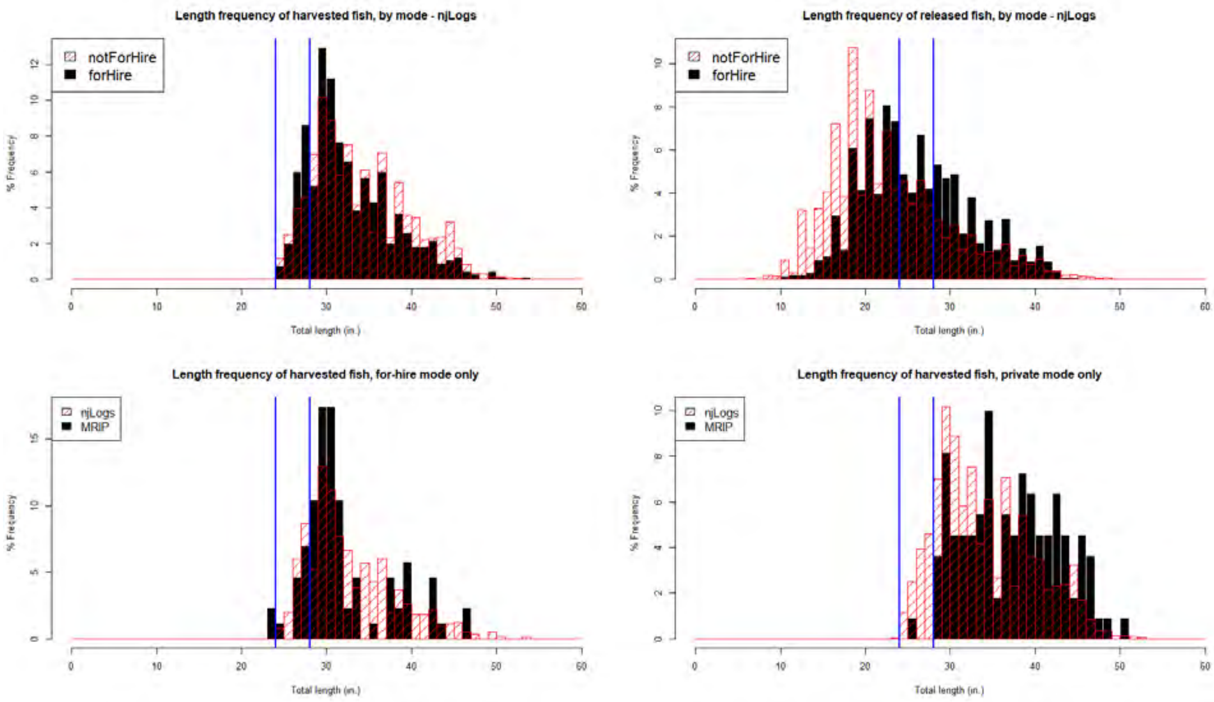


Figure 7. Length frequency of harvested (and released, for NJ's log program) fish by mode from MRIP and NJ's log program. Blue vertical lines are added at 24 and 28 inches. A) including bonus fish; B) without bonus fish.

A) including bonus fish



B) without bonus fish

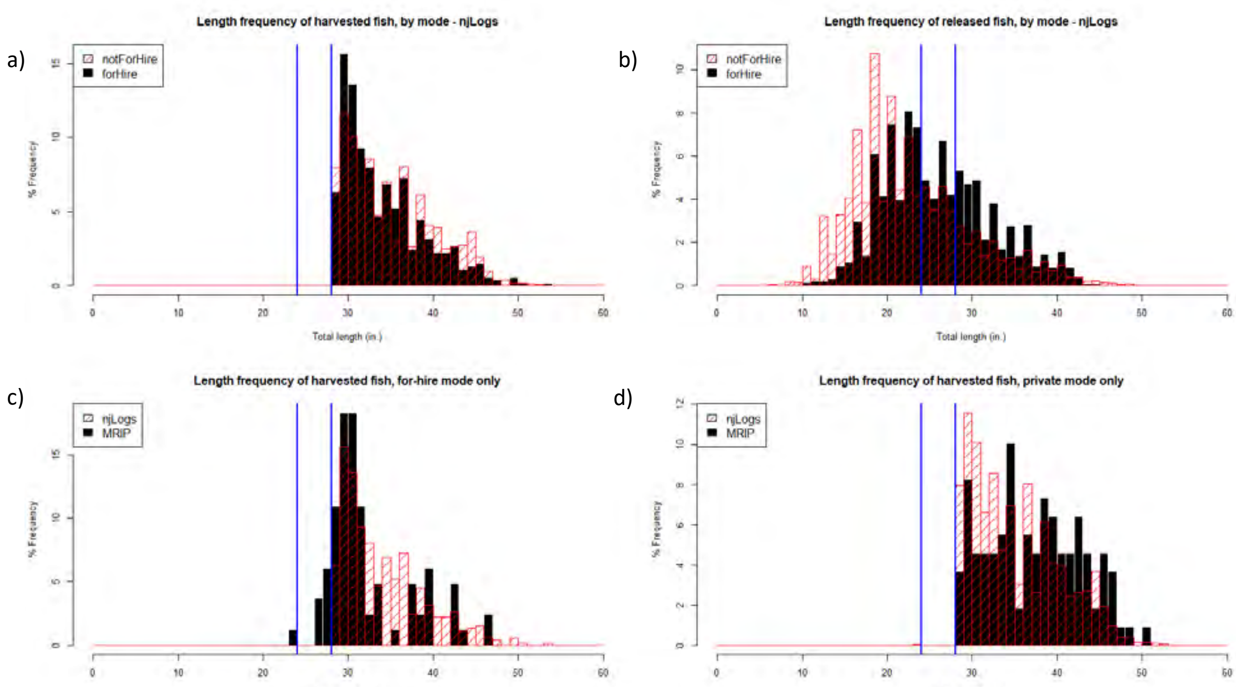
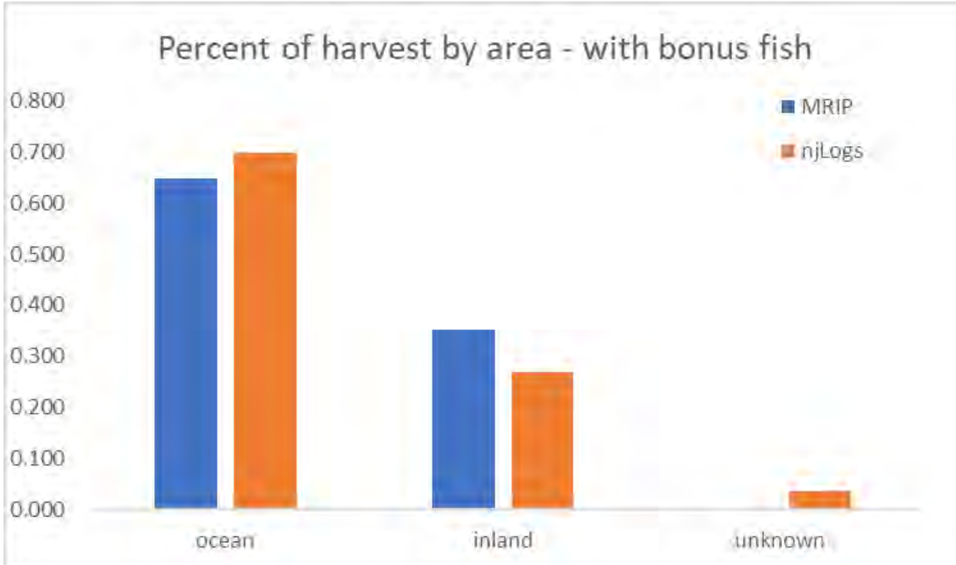
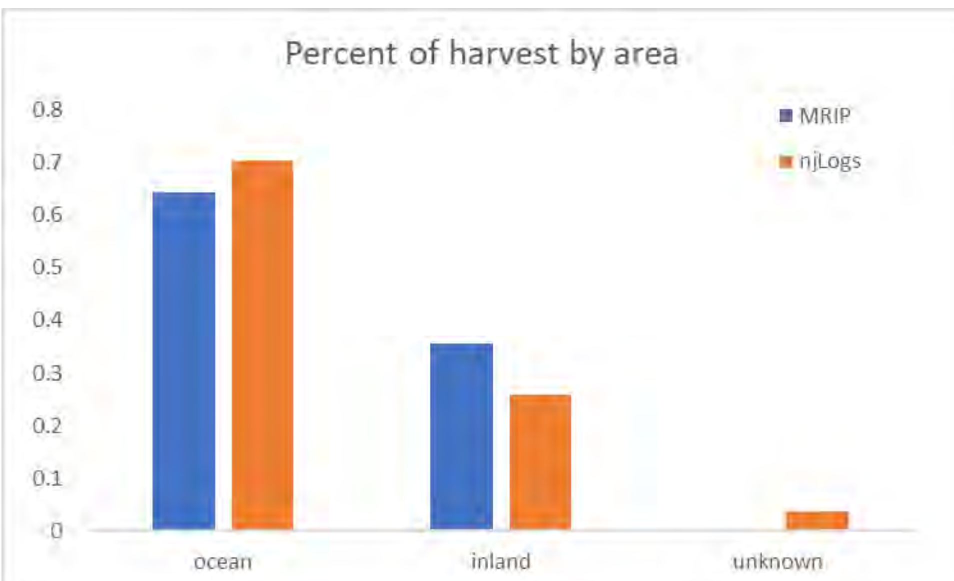


Figure 8. Percent of harvest by area.



Without bonus fish:



Pennsylvania's Atlantic Striped Bass Addendum VI Implementation Plan

Summary of Proposed Measures

Recreational Fishery

State	Size Limits		Bag Limits	Other	Open Season
Pennsylvania Delaware Estuary *PA/DE state line upriver to Calhoun St. Bridge at Morrisville, PA (56 river-miles)*	Slot Limit	21" to less than 24"	2	Non-offset circle hooks required when fishing with bait	4/1-5/31
	2-A2	28" to less than 35"	1	Non-offset circle hooks required when fishing with bait	1/1-3/31, 6/1-12/31
Pennsylvania Delaware River (non-tidal) *Calhoun St. Bridge upriver (196 river-miles)*	2-A2	28" to less than 35"	1	Non-offset circle hooks recommended when fishing with bait*	1/1-12/31

**Non-tidal reach supports a limited Striped Bass fishery.*

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Not applicable to Pennsylvania (no commercial fishery)			

Section 1: Coastal Recreational Fishery

1b.) **Conservation equivalency proposal (CE)**

- Pennsylvania proposes to implement the following slot limit for its CE measure:
  - Slot Limit (21" to less than 24", 2 fish, 4/1-5/31)
- This proposal meets the data standards established by the Technical Committee (TC) and detailed in the TC memo (M19-084) to the extent practical given that Pennsylvania is not covered by the Marine Recreational Information Program (MRIP).
- The size and season limit analysis used the proportion at length of slot size Striped Bass on the Delaware River spawning grounds determined by the Pennsylvania Fish and Boat Commission's (PFBC) fishery independent spawning stock electrofishing surveys conducted annually in May (Appendix A). Data used in the analysis were collected during survey years 2015 through 2018.
- Slot Limit
  - Data were pooled from 2015 to 2018 and adjusted using the post release mortality rate of 9%. One-inch increments were then removed from the upper end of current slot limit regulation (21" to less than 25") until a reduction of at least of 18% was achieved.
  - Removing one inch from the upper end of Pennsylvania's current slot limit would result in an estimated reduction in harvest of 19.1% (Table 1).
  - Additionally, approximately 32% of fish within the current 21" to less than 25" slot limit are mature females and roughly 21% of those females would be protected from harvest by narrowing the current slot limit to 21" to less than 24".

Sections 2, 3, and 4 are not applicable to Pennsylvania

Section 5: Circle Hook Requirements

Pennsylvania's portion of the Delaware River Estuary (PA/DE state line upriver to Calhoun St. Bridge at Morrisville, PA; 56 river-miles), including tidal reaches of numerous tributaries, supports a multi-use urban fishery where adult Striped Bass are primarily targeted by recreational anglers during the April and May spawning period. During summer, when most adult Striped Bass have migrated to coastal estuaries or the ocean, juvenile Striped Bass are often caught as bycatch from bait use in other recreational fisheries (i.e., catfish species, White Perch). Pennsylvania is committed to protecting Striped Bass; therefore, the non-offset circle hook requirement applied to the use of bait when fishing for Striped Bass should also apply to the use of bait in other referenced fisheries. As such, Pennsylvania will enact a year-round mandatory non-offset circle hook regulation in the tidal portion of the Delaware River Estuary by April 1, 2020, for any species targeted with bait. This approach provides added protection to Striped Bass captured by bait anglers targeting other species.

Upon implementation of the circle hook requirement in 2020, an education and outreach campaign will be initiated by the PFBC. The campaign will utilize a variety of education and outreach techniques and will be disseminated to target audiences through a wide range of marketing campaigns and media outlets.

Section 6: Timeline for Implementation

Pennsylvania will begin the process to change Striped Bass regulations in February 2020 following the winter Atlantic States Marine Fisheries Commission meeting. To enact the new slot limit regulations and non-offset circle hook requirements by April 1, 2020, PFBC's Executive Director will implement a temporary modification to the current regulations under 58 PA Code §65.25. To finalize these changes, they will then require publication in the *Pennsylvania Bulletin* as notices of proposed rulemaking. The publications could occur shortly after the April 2020 quarterly meeting of PFBC's Board of Commissioners. Public comments will be accepted for 30 days after the official publication of the notices, and the Commission will consider the proposal for final rulemaking at either the July or October 2020 quarterly meeting.

Table 1. Length frequency distribution of slot size Striped Bass on the Delaware River spawning grounds as determined by the Pennsylvania Fish and Boat Commission's spawning stock electrofishing survey conducted annually in May. Data were pooled from 2015 to 2018 and adjusted for post release mortality.

TL (in)	***N***	***% of fish***	**Slot Option 1** **% of fish** *Adjusted for default post release mortality rate (9%)*
21	65	23.9	21.7%
22	75	27.6	25.1%
23	75	27.6	25.1%
24	57	21.0	**19.1%**
Total	272	100.0	91%

Appendix A

PA FISH AND BOAT COMMISSION

COMMENTS AND RECOMMENDATIONS

June 6, 2019

WATER: Delaware Estuary - Sections 02, 03, and 04

EXAMINED: May 8 – June 1, 2018

BY: B. Chikotas, J. Buzzar, and M. Kaufmann

Report Approved: ________________________________Date: ________________________

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AREA COMMENTS:

As required by the Atlantic States Marine Fisheries Commission (ASMFC), the Pennsylvania Fish and Boat Commission (PFBC) began annual sampling of the Delaware River Striped Bass spawning stock in 1992. This was done in conjunction with sampling efforts by the states of Delaware and New Jersey as part of the overall monitoring of the Striped Bass population recovery along the East Coast. Potential electrofishing index sites were evaluated by the PFBC in 1994 and 1995, with 21 sites established in 1995. In 1997, the Delaware River Basin Fish and Wildlife Cooperative Technical Committee and ASMFC declared the Delaware River Striped Bass stock restored to historical population levels based on high juvenile recruitment, high spawning stock biomass, and low fishing mortality rates. In spring, 2018, 21 electrofishing index sites were sampled to assess the Striped Bass spawning stock that utilize the portion of the Delaware Estuary bordering Pennsylvania and New Jersey, and to tag Striped Bass in conjunction with the coast-wide cooperative tagging program managed by the U.S. Fish and Wildlife Service for exploitation and migration studies conducted by the ASMFC.

A total of 176 Striped Bass were captured from the 21 index sites in 2018. An additional 170 Striped Bass were captured during supplemental sampling conducted to tag additional fish. Mean catch rates from the 21 index sites for total catch, fish ≥300 mm total length (TL), and fish ≥700 mm TL were 9.3 fish/hr (95% CI=5.1-14.6 fish/hr; n=176), 7.5 fish/hr (95% CI=4.2-11.7 fish/hr; n=140), and 1.4 fish/hr (95% CI=0.7–2.3 fish/hr; n=33), respectively. The corresponding long-term average catch rates for total catch, fish ≥300 mm TL, and fish ≥700 mm TL were 20.0 fish/hr, 12.4 fish/hr, and 2.2 fish/hr, respectively. Regression analyses did not demonstrate a temporal trend between year and mean catch rate for total catch ($F_{1,21}$=0.39; p=0.54). A declining temporal trend was observed for fish ≥300 mm TL ($F_{1,21}$=5.48; p=0.03) and for fish ≥700 mm TL ($F_{1,21}$=9.57; p=0.005). Total catch was buffered from the declining trends in other segments of the population by the frequently abundant age-1 and/ or age-2 fish, which did not contribute to the other catch-per-unit-effort indices.

A total of 211 Striped Bass were tagged by the PFBC in 2018. The tagged fish ranged from 404 to 1,090 mm TL and 3 to 13 years of age. Males, females, and fish of unknown sex comprised 47% (n=99), 21% (n=44), and 32% (n=68) of the tagged fish, respectively.

The PFBC tagged a total of 5,295 Striped Bass in the Delaware Estuary since 1995. Sixteen percent (n=845) of the 5,295 Striped Bass were recaptured and 16 fish were recaptured twice. Recreational anglers, including those on charter boats, accounted for 89% (n=754) of the tag returns, while commercial fishermen accounted for only 7% (n=59). Four percent (n=32) of the tag returns were associated with other collections; mainly scientific research. Fifty-one percent of the recaptured fish were released; 48% were harvested; and 1% were accidentally killed, found dead, or were used for scientific research. Recreational and commercial fishermen harvested 47% and 78% of their respective Striped Bass catches.

Throughout the years of tagging, 75.4% of the tagged Striped Bass were recaptured in New Jersey (42.0%), Maryland (18.0%), and Delaware (15.4%), while the remaining 24.6% were recaptured in Pennsylvania (7.6%), Massachusetts (5.3%), New York (3.3%), Virginia (3.0%), Rhode Island (2.7%), North Carolina (0.8%), Connecticut (0.7%), and Maine (0.1%). Recapture location was not reported for 1.1% of the tag returns. There was no measurable increase in the number of tag returns from Pennsylvania since implementation of Pennsylvania’s slot limit regulation on the Delaware Estuary in 2009.

AREA RECOMMENDATIONS:

1. Continue to monitor the Striped Bass spawning stock at the 21 index sites extending from Rancocas Creek (RM 109.76) downriver to Raccoon Creek (RM 80.66) in 2019.

2. Continue supplemental tagging efforts as time allows at Trenton Falls, the head-of-tide, to increase the number of Striped Bass tagged in 2019.

3. Continue to assess potential high catch sampling areas for potential replacement of the Upper Navy Yard (STB23) index site that will be lost due to the container ship terminal development project, known as the Southport Project, inland construction of which was underway during the 2018 survey.

This work made possible by funding from the Sport Fish Restoration Act Project F-57-R Fisheries Management

Pennsylvania Fish and Boat Commission
Bureau of Fisheries
Fisheries Management Division

Delaware Estuary

Rancocas Creek (RM 109.76) downriver to Raccoon Creek (RM 80.66)

Striped Bass Spawning Stock Survey - 2018

Prepared by
B. Chikotas

Fisheries Management Database Name: Delaware Estuary
Lat/Lon: 39°48’00”/75°25’00”

Survey Period: May 9 – June 1, 2018 Prepared: February 2019

Introduction

As required by the Atlantic States Marine Fisheries Commission (ASMFC), the Pennsylvania Fish and Boat Commission (PFBC) began annual sampling of the Delaware River Striped Bass *Morone saxatilis* spawning stock in 1992. This was done in conjunction with sampling efforts by the states of Delaware and New Jersey as part of the overall monitoring of the Striped Bass population recovery along the East Coast. Potential electrofishing index sites were evaluated by the PFBC in 1994 and 1995, with 21 sites established in 1995. In 1997, the Delaware River Basin Fish and Wildlife Cooperative Technical Committee and ASMFC declared the Delaware River Striped Bass stock restored to historical population levels based on high juvenile recruitment, high spawning stock biomass, and low fishing mortality rates. In spring, 2018, 21 electrofishing index sites were sampled to assess the Striped Bass spawning stock that utilize the portion of the Delaware Estuary bordering Pennsylvania and New Jersey, to tag Striped Bass in conjunction with the coast-wide cooperative tagging program managed by the U.S. Fish and Wildlife Service (USFWS) for exploitation and migration studies conducted by the ASMFC.

Methods

Daytime boat electrofishing was conducted at 21 index sites in the Delaware Estuary between the mouth of Rancocas Creek in Burlington County, New Jersey (RM 109.76) and the mouth of Raccoon Creek in Gloucester County, New Jersey (RM 80.66) to develop an index of Striped Bass spawning stock abundance (Figure 1). In Pennsylvania, this reach approximated the estuary segment between the Philadelphia-Bucks County line and Trainer, Delaware County. Sampling occurred between May 8 and June 1, 2018. Each index site was sampled twice, which represented a return to the original sampling design in which the 21 index sites were sampled twice (1995-2003, 2005, 2007, 2009-2017), and a departure from the sampling design in which each index site was sampled only once (2004, 2006, 2008). This was done to reduce high variability in catch rates when each site was sampled only once (Hosack and Kaufmann 2008).

Since 1995, five of 21 index sites have been permanently replaced for logistical reasons (1 site) or a consistent paucity of Striped Bass (4 sites), defined as the capture of two or less Striped Bass during multiple years. In 1998, the most upriver index site near Neshaminy Creek was relocated 9.7 km (6.0 mi) downriver near Rancocas Creek, which improved the efficiency of the survey and provided similar catches. In 2002, following three years of low catches, the index site along the northwestern side of Chester Island was moved upriver 1.0 km (0.62 mi) to the breakwater between Chester and Monds Islands. In 2003, following five years of low catches, the index site directly downriver from Pennypack Creek was moved upriver 3.0 km (1.86 mi) near Rancocas Creek. In 2007, following six consecutive years of low catches, the index site at Woodbury Creek was moved downriver 5.4 km (3.4 mi) to a large, shallow shoal extending upriver from Little Tinicum Island (RM 87.58). In 2008, a near-by site along an unnamed island off the mouth of the Schuylkill River temporarily replaced the Big Timber Creek index site. This site was equally unproductive as the Big Timber Creek site had usually been since the outset of this survey. No fish were captured along the island and sampling returned to the Big Timber Creek index site. In 2010, following four years of low catches, the most downriver sampling location near the Commodore Barry Bridge was shifted downriver 1.9 km (1.24 mi) to the mouth of Raccoon Creek.

The electrofishing boat was outfitted with a pair of fixed boom electrodes. Each boom supported six dropper-style stainless steel cable anodes suspended in a circular array. The electrical power source was a 5,000-watt Honda generator combined with a Smith-Root model GPP 5.0 electrofishing unit. The electrofishing unit was operated between 6.5 and 7.5 amps of pulsed direct current in water depths ranging from 0.6 to 3.7 m (2 to 12 ft). Generally, the targeted maximum depth was 2.4 m (8 ft.). Electrofishing was conducted by traveling in a sinuous pattern with the direction of tidal current.

The 21 index sites were sampled twice for 1,000 seconds per site as recorded on the electrofishing unit, which represented the time period that electric current passed through the water column. The total effort for the index sites was 11.67 hours. Several supplemental surveys were conducted for tagging purposes. All catch rates were calculated based on the 1,000 second index sites and did not include supplemental surveys conducted for tagging.

Captured Striped Bass were processed and released. The total length (TL) of each fish was measured to the nearest millimeter (mm). Scale samples were taken from mid-way between the lateral line and juncture of the hard and soft dorsal fins for subsequent age and growth analysis. Striped Bass ≥400 mm TL and in good condition were tagged with USFWS anchor tags of appropriate size. Fish 400 to 599 mm TL were implanted with small tags (19 mm oval insert), while fish ≥600 mm TL were implanted with large tags (29 mm oval insert).

Descriptive age and growth statistics for the Striped Bass spawning population were determined using scales. In preparation for age estimation, scales were cleaned if necessary and pressed on warm acetate slides using an Anne Arbor Rolling Press Model 110. Scale impressions were projected using a Bausch and Lomb microprojector for evaluation. Annuli were determined using the standard criteria described by Lagler (1956). Unaged fish were assigned ages based on 25 mm length groups using an age-length key developed from the 2018 data set. Ages were assigned based on the discrete probability distributions derived from the age-length key for fish that corresponded to 25 mm length groups where multiple ages were collected.

A square root transformation was used to calculate mean catch rates and associated 95% confidence intervals (CI) according to the procedure described by Sokal and Rohlf (1969). Mean catch rates and CI's were back-transformed to a linear scale. Additional details on the statistical procedures used to assess Striped Bass catch rates were presented in Kaufmann and Soldo (1995). Simple linear regression analyses (α=0.05) were used to analyze catch rates for temporal trends and for comparisons to the New Jersey Division of Fish and Wildlife's (NJDFW) juvenile Striped Bass index.

Results and Discussion

A total of 176 Striped Bass were captured at the 21 index sites in 2018. An additional 170 Striped Bass were captured during supplemental sampling for tagging purposes. Males, females, and fish of unknown sex comprised 66% (n=116), 20% (n=36), and 14% (n=24) of the total catch from the index sites, respectively. The inability to determine sex was primarily due to the collection of small, immature fish.

Index Sites

Mean catch rates for total catch, fish ≥300 mm TL, and fish ≥700 mm TL were 9.3 fish/hr (95% CI=5.1–14.6 fish/hr; n=176), 7.5 fish/hr (95% CI=4.2-11.7 fish/hr; n=140), and 1.4 fish/hr (95% CI=0.7–2.3 fish/hr; n=33), respectively (Figure 2). The corresponding long-term average catch rates for total catch, fish ≥300 mm TL, and fish ≥700 mm TL were 20.0 fish/hr, 12.4 fish/hr, and 2.2 fish/hr, respectively. Regression analyses did not demonstrate a temporal trend between year and mean catch rate for total catch ($F_{1,21}$=0.39; p=0.54); however, declining temporal trends were observed for fish ≥300 mm TL ($F_{1,21}$=5.48; p=0.03) and fish ≥700 mm TL ($F_{1,21}$=9.57; p=0.005). A declining temporal trend was observed for fish ≥300 mm TL ($F_{1,21}$=5.48; p=0.03) and for fish ≥700 mm TL ($F_{1,21}$=9.57; p=0.005). Total catch was buffered from the declining trends in other segments of the population by the frequently abundant age-1 and/or age-2 fish, which did not contribute to the other catch-per-unit effort indices.

Male Striped Bass consistently accounted for most of the catch on the spawning grounds. Males were captured at a mean rate of 4.0 fish/hr (95% CI=1.3-7.8 fish/hr) and accounted for 66% of the total catch in 2018. Males ranged from 210 to 915 mm TL (Figure 3) and 1 to 10 years of age in 2018 (Table 1). The 2014 and 2015 year classes were captured at the highest rates (Tables 1 and 2).

Female Striped Bass were captured at a mean rate of 1.7 fish/hr (95% CI=0.8–3.0 fish/hr) and comprised 20% of the total catch in 2018. Female Striped Bass ranged from 556 to 1,090 mm TL (Figure 3) and 5 to 13 years of age in 2018 (Table 1). The 2010 and 2011 year classes were captured at the highest rates (Tables 1 and 2). Females age-7 and older accounted for 86% (n=31) of the females collected in 2018, which represented an increase from their composition (57%) in 2017. Berlinsky et al. (1995) determined that the maturity schedule for female Striped Bass was 12% at age-4, 34% at age-5, 77% at age-6, and 100% at age-7.

There was no relationship ($F_{1,5}$=0.32; p=0.60) between the NJDFW's juvenile Striped Bass index and the PFBC's 2018 Striped Bass spawning stock survey (Tables 1 and 3). In the 1990's, the spawning stock survey affirmed the juvenile index with high seine catches of age-0 Striped Bass which corresponded to high catches of adult Striped Bass from the same cohort in subsequent survey years; however, this trend demonstrated little consistency since that time.

Tagging Program

The PFBC tagged 211 Striped Bass in the Delaware Estuary in 2018. The tagged fish ranged from 404 to 1,090 mm TL and 3 to 13 years of age. Males, females, and fish of unknown sex comprised 47% (n=99), 21% (n=44), and 32% (n=68) of the tagged fish, respectively.

A total of 5,295 Striped Bass were tagged by the PFBC since 1995. Of those, 5,181 fish (3,670 males, 1,231 females, and 280 sex unknown) were tagged in the tidal Delaware River; 111 fish (37 males, 61 females, and 13 sex unknown) were tagged in the tidal Schuylkill River; and three females were tagged in the non-tidal Delaware River.

Sixteen percent (n=845) of the 5,295 Striped Bass tagged by the PFBC were recaptured and 16 fish were recaptured twice. Forty-eight percent (n=402) of the recaptured Striped Bass were harvested and 51% (n=430) were released. The disposition of the remaining one percent has varied (*e.g.*, accidentally killed, found dead, or used for scientific research). Recreational anglers, including those on charter boats, accounted for 89% (n=754) of the tag returns and 88% (n=354) of the total harvest. Commercial fishermen accounted for 7% (n=59) of the tag returns and 11% (n=46) of the total harvest. However, underreporting by commercial fishermen is a known problem. Four percent (n=32) of the tag returns were credited to other collections, primarily scientific research (n=23). Recreational anglers and commercial fishermen harvested 47% and 78% of their respective Striped Bass catches.

Males, females, and fish of unknown sex comprised 66% (n=555), 29% (n=242), and 5% (n=48) of the total tag returns, respectively. Tag return rates for male and female Striped Bass were 15% and 20%, respectively. Additionally, 41% of recreational anglers who returned tags from males and 62% who returned tags from females harvested the fish. Recreational and commercial fishermen combined selectively harvested female over male Striped Bass at a ratio of approximately 1.5 to 1.0, which indicates the potential for disproportionate fishing mortality on the female segment of the population. This ratio is likely influenced by the large number of tagged males that are smaller than legal length in many fisheries along the Atlantic Coast, which would prohibit their harvest.

Throughout the years of tagging, 75.4% of the tagged Striped Bass were recaptured in New Jersey (42.0%), Maryland (18.0%), and Delaware (15.4%), while the remaining 24.6% were recaptured in Pennsylvania (7.6%), Massachusetts (5.3%), New York (3.3%), Virginia (3.0%), Rhode Island (2.7%), North Carolina (0.8%), Connecticut (0.7%), and Maine (0.1%). Recapture location was not been reported for 1.1% of the tag returns (Figure 4). There was no measurable increase in the number of tag returns from Pennsylvania since implementation of Pennsylvania's harvestable slot limit regulation on the Delaware Estuary in 2009.

Of the Striped Bass tagged by the PFBC, there were 113 tag returns since 2009 for fish of slot size at the time of recapture. Eighty-eight percent (n=100) of those fish were recaptured outside of Pennsylvania's allowable harvest area and/or outside of Pennsylvania's permitted harvest period for slot size fish (April 1 to May 31). The remaining 13 fish (12%; 8 males, 2 females, and 3 sex unknown) were recaptured by recreational anglers within the allowable harvest area and harvest period in Pennsylvania. Three (23%) of those fish were harvested. For comparison, 31 of the 113 tag returns (27%) were reported catch in the Chesapeake Bay and 26 (84%) were harvested.

To better characterize Pennsylvania's slot fishery for Striped Bass, tag returns to all states participating in the USFWS's coast-wide cooperative tagging program were analyzed. Considering these data, there were 43 tag returns since 2009 for fish that were within the slot limit at the time of recapture and were caught from Pennsylvania's allowable harvest area during the permitted harvest period. Fourteen (33%) of those fish were harvested, suggesting with limited data that the harvest rate during Pennsylvania's slot season is 33% of the captured slot size fish. Males (n=10) and fish of unknown sex (n=3) comprised 71% and 21% of the harvested slot size fish, respectively.

Management Recommendations

1. Continue to monitor the Striped Bass spawning stock at the 21 index sites extending from Rancocas Creek (RM 109.76) downriver to Raccoon Creek (RM 80.66) in 2019.

2. Continue supplemental tagging efforts as time allows at Trenton Falls, the head-of-tide, to increase the number of Striped Bass tagged in 2019.

3. Continue to assess potential high catch sampling areas for potential replacement of the Upper Navy Yard (STB23) index site that will be lost due to the container ship terminal development project, known as the Southport Project, inland construction of which was underway during the 2018 survey.

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Table 1. Mean catch rates (fish/hr) and associated 95% confidence intervals (CI) for male and female Striped Bass captured at the 21 index sites on the Delaware Estuary between May 8 and 25, 2018. Fish of unknown sex were not included in this table.

Age	Year Class	Mean Catch Rate (fish/hr) and 95% CI		
		Male	Female	Sexes Combined
1	2017	0.05 (0.00 - 0.14)	–	0.05 (0.00 - 0.14)
2	2016	0.28 (0.03 - 0.57)	–	0.28 (0.03 - 0.57)
3	2015	1.56 (0.25 - 3.51)	–	1.56 (0.25 - 3.51)
4	2014	1.13 (0.26 - 2.31)	–	1.13 (0.26 - 2.31)
5	2013	0.51 (0.11 - 1.02)	0.05 (0.00 - 0.14)	0.58 (0.15 - 1.11)
6	2012	0.05 (0.00 - 0.14)	0.17 (0.00 - 0.40)	0.22 (0.00 - 0.49)
7	2011	0.14 (0.00 - 0.32)	0.62 (0.20 - 1.14)	0.79 (0.31 - 1.40)
8	2010	0.14 (0.00 - 0.39)	0.31 (0.03 - 0.64)	0.46 (0.08 - 0.94)
9	2009	–	0.19 (0.00 - 0.41)	0.19 (0.00 - 0.41)
10	2008	0.05 (0.00 - 0.14)	0.09 (0.00 - 0.24)	0.14 (0.00 - 0.32)
11	2007	–	0.19 (0.00 - 0.24)	0.19 (0.00 - 0.24)
12	2006	–	0.09 (0.00 - 0.24)	0.09 (0.00 - 0.24)
13	2005	–	0.05 (0.00 - 0.14)	0.05 (0.00 - 0.14)

Table 2. Age frequency distribution and mean total length (mm) at capture for male and female Striped Bass captured at the 21 index sites on the Delaware Estuary between May 8 and 25, 2018. Fish of unknown sex were not included in this table.

Age	Year Class	No. Fish Collected		Percent	Mean Total Length at Capture (mm)	
		Male	Female		Male	Female
1	2017	1	–	0.7%	210	–
2	2016	6	–	3.9%	238	–
3	2015	56	–	36.8%	340	–
4	2014	32	–	21.1%	414	–
5	2013	12	1	8.6%	455	556
6	2012	1	4	3.3%	508	678
7	2011	3	13	10.5%	679	681
8	2010	4	7	7.2%	701	775
9	2009	–	4	2.6%	–	913
10	2008	1	2	2.0%	915	811
11	2007	–	2	1.3%	–	990
12	2006	–	2	1.3%	–	1,045
13	2005	–	1	0.7%	–	1,080

Table 3. Juvenile index of relative abundance for age-0 Striped Bass captured from the tidal Delaware River by the New Jersey Division of Fish and Wildlife from 1980 to 2018.

Year	No. of Seine Hauls	No. of Age-0 Striped Bass Collected	Arithmetic Mean	Proportion of Postive Hauls	Geometric Mean	SE	Lower 95% CI	Upper 95% CI	RANGE
1980	20	2	0.10	0.100	0.07	0.05	-0.03	0.18	0 - 1
1981	13	0	0.00	0.000	0.00	0.00	0.00	0.00	0 - 0
1982	26	4	0.15	0.115	0.10	0.05	-0.01	0.23	0 - 2
1983	22	2	0.09	0.091	0.07	0.04	-0.02	0.16	0 - 1
1984	29	18	0.62	0.345	0.37	0.10	0.14	0.65	0 - 5
1985	56	5	0.09	0.018	0.03	0.03	-0.03	0.10	0 - 5
1986	46	23	0.50	0.304	0.32	0.07	0.16	0.51	0 - 4
1987	96	150	1.56	0.281	0.53	0.08	0.30	0.78	0 - 32
1988	96	60	0.63	0.292	0.35	0.05	0.21	0.49	0 - 11
1989	96	321	3.34	0.531	1.07	0.09	0.73	1.48	0 - 125
1990	96	218	2.27	0.552	1.05	0.08	0.74	1.41	0 - 43
1991	256	270	1.05	0.301	0.47	0.04	0.35	0.59	0 - 22
1992	258	985	3.82	0.500	1.18	0.06	0.93	1.46	0 - 94
1993	204	1,183	5.80	0.603	1.78	0.08	1.39	2.23	0 - 185
1994	204	473	2.32	0.520	0.96	0.06	0.74	1.19	0 - 35
1995	204	1,552	7.61	0.613	1.98	0.08	1.54	2.50	0 - 211
1996	204	892	4.37	0.583	1.70	0.08	1.34	2.12	0 - 67
1997	205	461	2.25	0.512	1.01	0.06	0.79	1.25	0 - 34
1998	166	582	3.51	0.536	1.31	0.08	1.00	1.67	0 - 108
1999	192	932	4.85	0.630	1.90	0.08	1.51	2.36	0 - 130
2000	192	1,164	6.06	0.573	1.78	0.08	1.36	2.26	0 - 113
2001	192	511	2.66	0.557	1.20	0.06	0.95	1.49	0 - 55
2002	192	249	1.30	0.354	0.53	0.05	0.39	0.69	0 - 27
2003	192	1,670	8.70	0.656	2.47	0.09	1.93	3.11	0 - 277
2004	192	573	2.98	0.443	1.13	0.07	0.86	1.45	0 - 32
2005	190	474	2.49	0.584	1.22	0.06	0.97	1.51	0 - 26
2006	192	246	1.28	0.427	0.67	0.05	0.52	0.84	0 - 16
2007	192	520	2.71	0.630	1.41	0.06	1.14	1.72	0 - 36
2008	160	395	2.47	0.563	1.26	0.07	0.98	1.58	0 - 31
2009	192	1,101	5.73	0.615	1.92	0.08	1.50	2.42	0 - 146
2010	192	487	2.54	0.604	1.30	0.06	1.04	1.59	0 - 28
2011	173	707	4.09	0.526	1.41	0.08	1.08	1.79	0 - 96
2012	192	117	0.61	0.307	0.34	0.04	0.24	0.44	0-17
2013	190	363	1.91	0.510	0.90	0.06	0.70	1.12	0-30
2014	189	667	3.53	0.651	1.65	0.07	1.33	2.02	0-72
2015	192	390	2.03	0.516	0.94	0.06	0.73	1.17	0-25
2016	190	588	3.09	0.568	1.41	0.07	1.12	1.75	0-77
2017	191	451	2.36	0.560	1.18	0.06	0.94	1.45	0-39
2018	190	640	3.37	0.489	1.2	0.07	0.91	1.53	0-58
Long-Term Means (1980-2018):			**2.69**	-	**1.03**	**0.06**	**0.78**	**1.32**	-

Source: H. Corbett, New Jersey Division of Fish and Wildlife
1980-1990: Fixed station design with replicate sets; second half of July through first half of November (bi-monthly sampling)
1991-1997: Fixed and random station design with no replicate sets; August through October (bi-monthly sampling)
1998-2015: Fixed station design with no replicates; August through October (bi-monthly sampling)
2012: Sampling impacted by Hurricane Sandy; catches not high before hurricane but decreased substantially afterwards; a few weeks of sampling were lost. CI = Confidence interval SE = Standard error

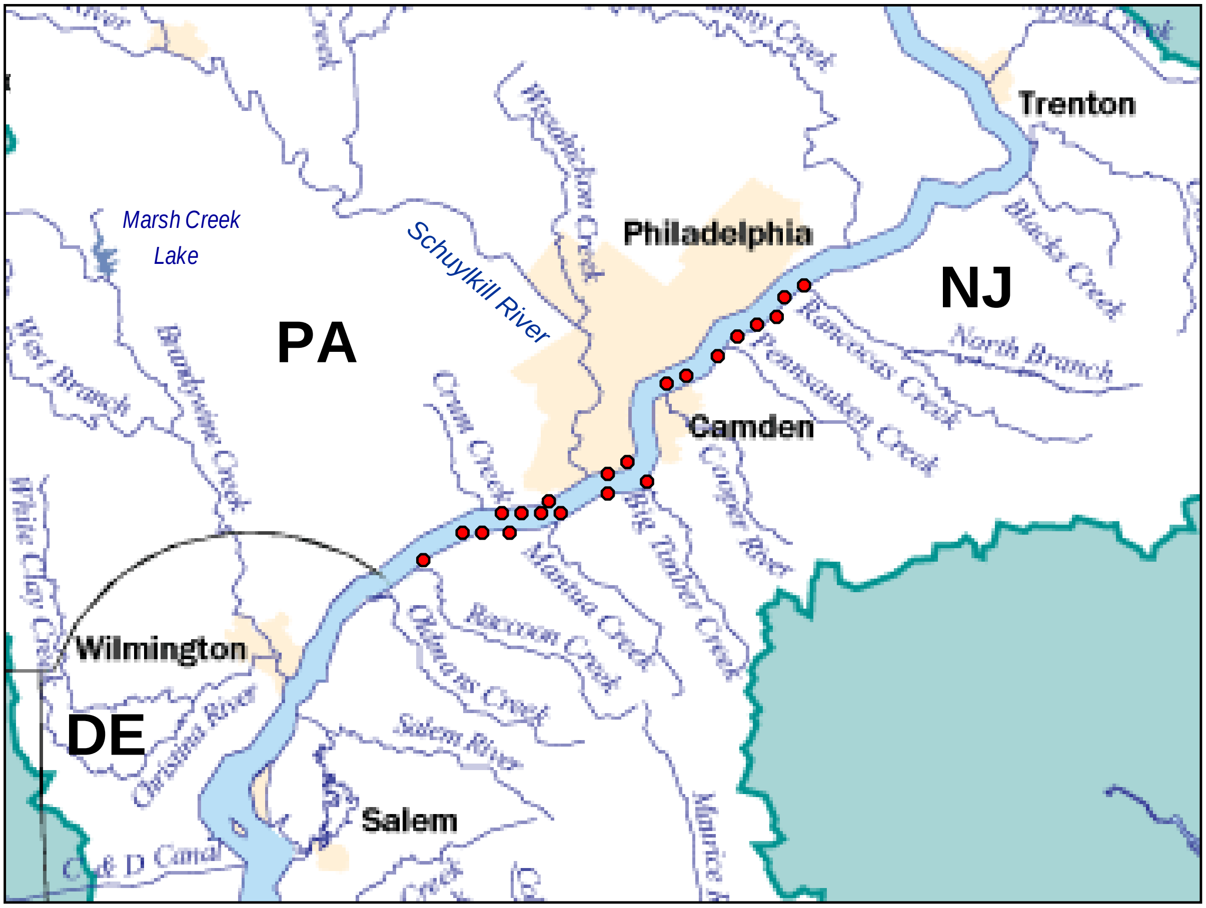

Figure 1. Map of the 21 index sites sampled between Rancocas Creek (RM 109.76) and Raccoon Creek (RM 80.66) on the Delaware Estuary between May 8 and 25, 2018. Base map adapted from the Delaware River Basin Commission.

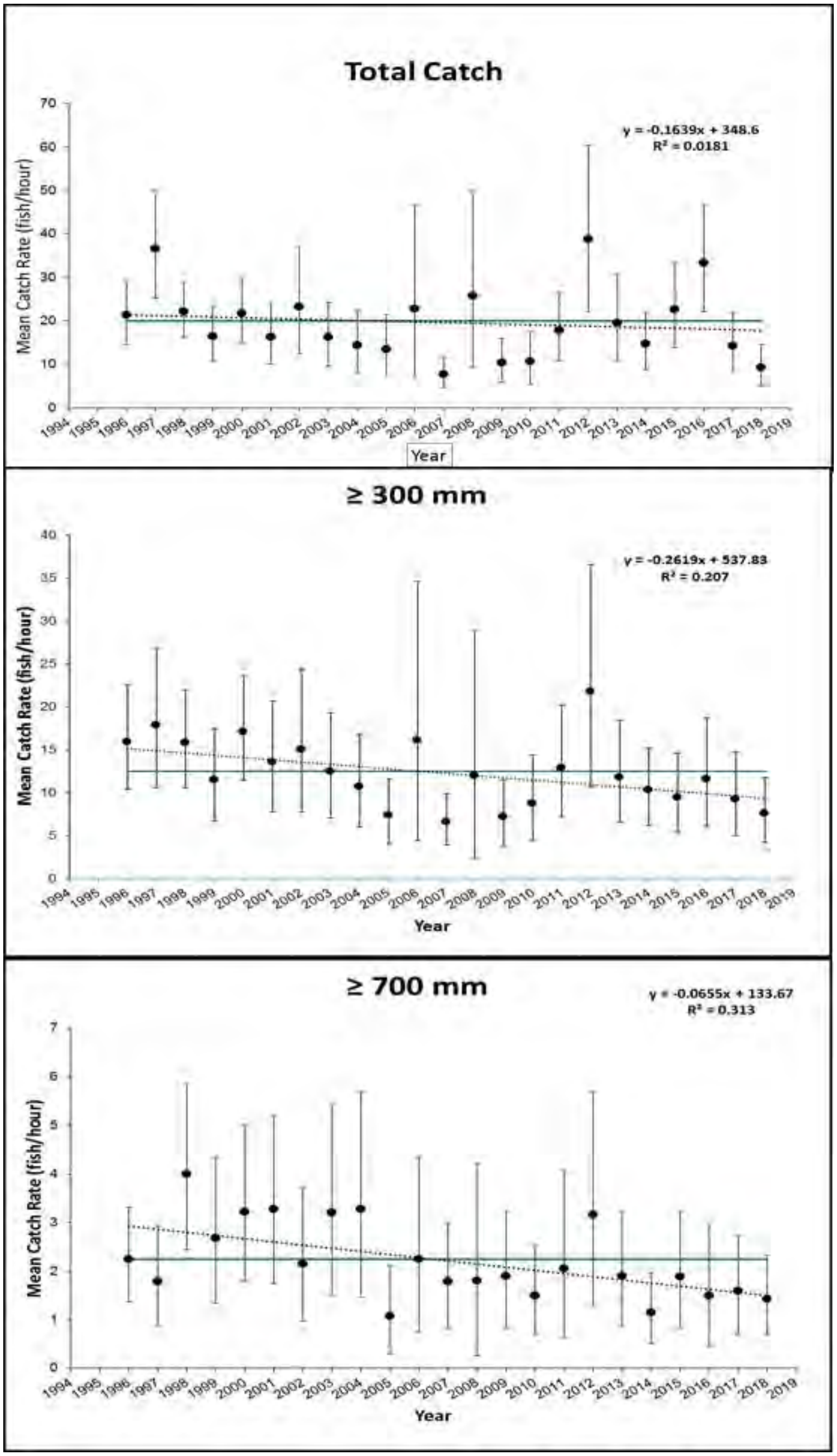

Figure 2. Mean catch rates, 95% confidence intervals, linear trends (dashed line), and long-term means (solid blue line) for Striped Bass captured from the 21 index sites on the Delaware Estuary between 1996 and 2018.

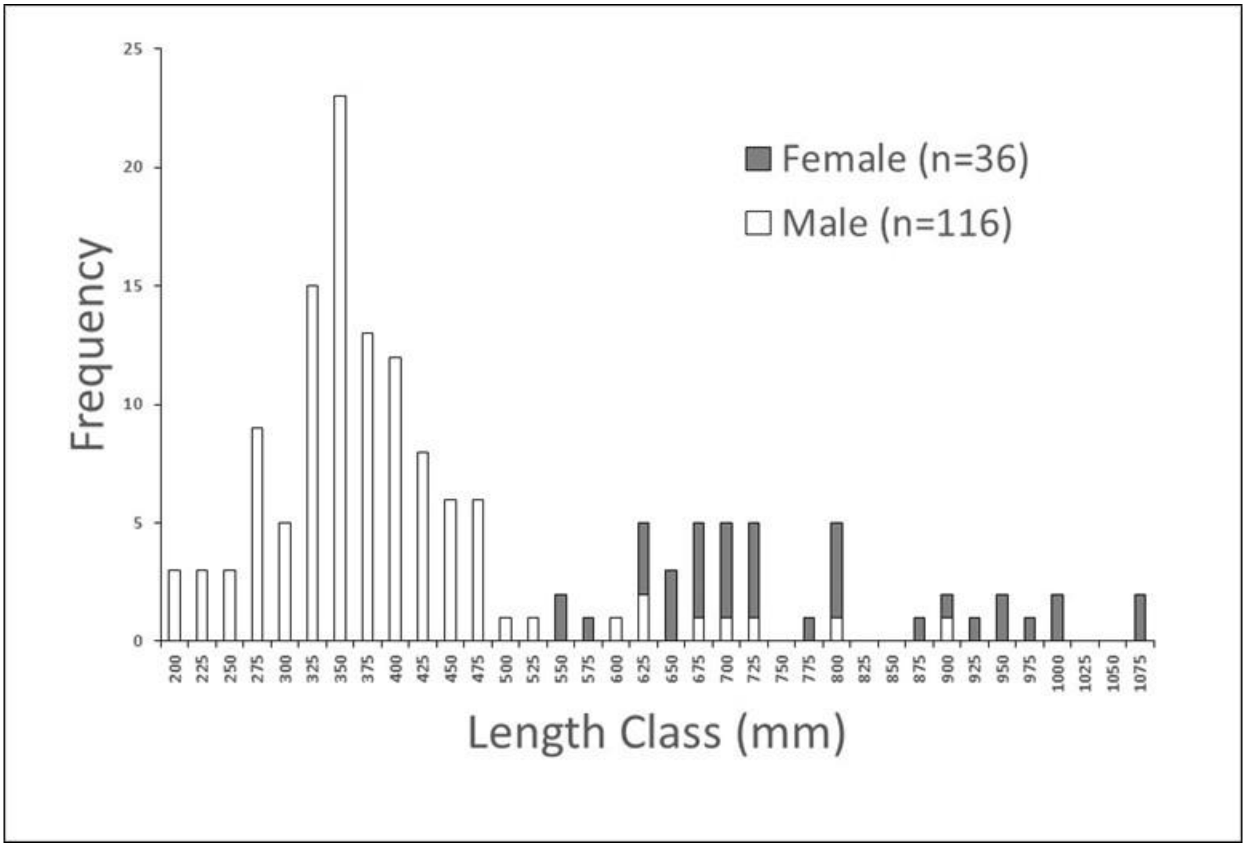

Figure 3. Length-frequency distribution for male (white bars) and female (gray bars) Striped Bass captured from the 21 index sites on the Delaware Estuary between May 8 and 25, 2018.

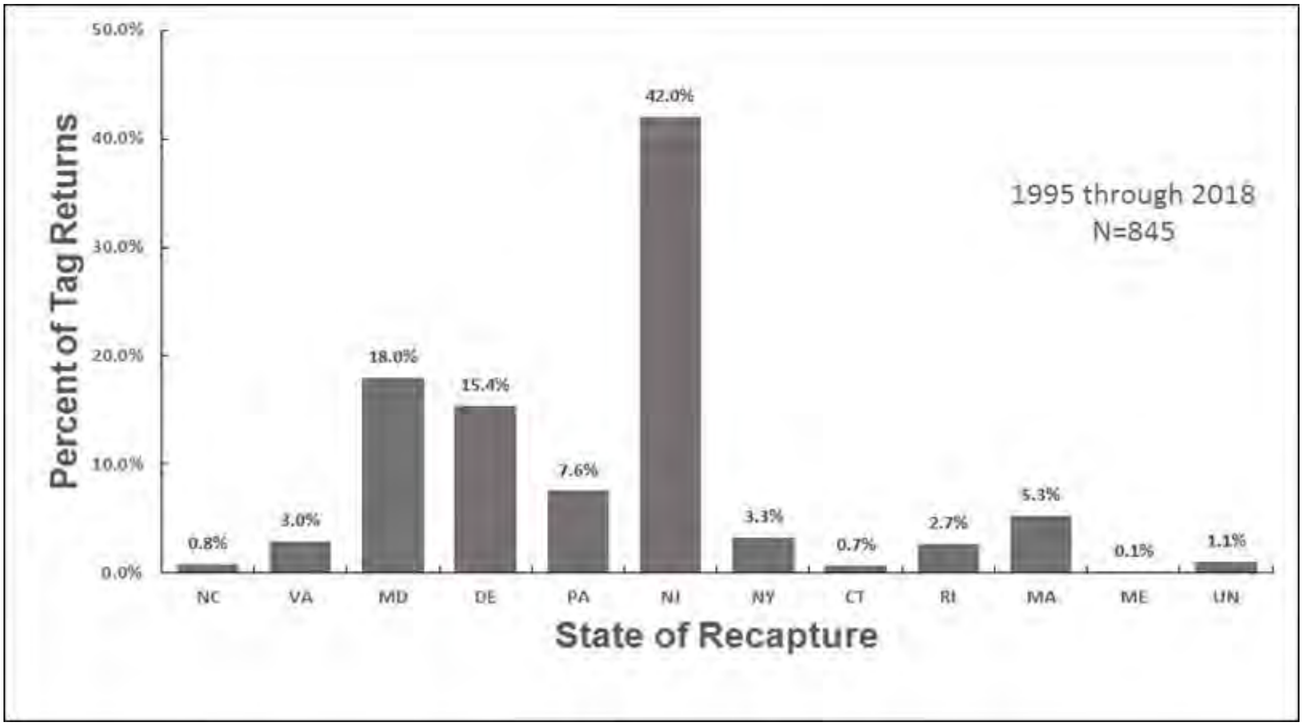

Figure 4. Percentage of tag returns by state of recapture for Striped Bass implanted with U.S. Fish and Wildlife Service anchor tags by the Pennsylvania Fish and Boat Commission during spawning stock surveys on the Delaware Estuary between 1995 and 2018 (UN = unknown recapture location).

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Delaware's Atlantic Striped Bass Addendum VI Implementation Plan

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Delaware	28-38" slot	1	Catch & release on spawning grounds Apr. 1 – May 31	Year round.
	Except in Delaware Bay and River and their tidal tributaries, 20-25"	1		July 1 – Aug. 31

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Delaware – Gillnet	28" minimum size, except 20" min in Del. Bay and River during spring season	113,021 lbs.	2.15-5.31 (2.15-3.30 for Nanticoke River) & 11.15-12.31; drift nets only 2.15-2.28 & 5.1-5.31; no fixed nets in Del. River. No trip limit
Delaware – Hook and Line	28" min	5,948 lbs.	4.1-12.31, 200 lbs/day trip limit

Section 1: Coastal Recreational Fishery

Delaware proposes a conservation equivalency (CE) option that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the Technical Committee (TC). Delaware's CE option expands the board-approved slot limit to 28 - 38" TL with a one fish bag limit year round for all state waters, with the exception of Delaware Bay and River, and their tidal tributaries, which will have a 20-25" slot size limit and a one fish bag limit during July 1-Aug. 31. Reducing from a two fish bag to one fish in the Delaware Bay and River will decrease total mortality, but at this time we do not have the data available to quantify the amount of reduction this conservation method will produce.

This option will reduce total removals by at least 18.18%, with additional reductions occurring through the reduced bag limit during the summer season. Also, our proposed Conservation Equivalency option will maintain a spawning area closure from April 1-May 31 to protect spawning adults. The spawning area is further defined in Section 2 and prohibits recreational and commercial harvest in the spawning areas during that time. Further analysis is provided. This proposal meets the data standards established by the TC.

The data sources used in the analysis are the MRIP estimates provided in Greg Wojcik's spreadsheet, and tag-recapture data collected by Delaware's Division of Fish & Wildlife to confirm that Delaware River striped bass that remain in river during the summer months comprise a resident population of males.

The MRIP data obtained by Greg Wojcik for Delaware consists of 60 individual length assignments for a total of 33,678 striped bass during 2016 through 2017. Striped bass catches in Delaware only occur in Waves 2, 3, 4, and 6. The only "non-compliant" catch in Delaware waters consists of the 20-25" resident Delaware River male striped bass caught in Wave 4 (July/August) in 2016-2017. Although classified as 'non-compliant' in the analysis, these fish were fully compliant as their harvest was allowed based on the Conservation Equivalency proposal approved by the TC and Management Board in 2008.

All calculation followed the methods outlined in Greg Wojcik's spreadsheet.

Ocean Slot: **DE River Summer Slot:**	**28-38"** **20-25"**
New Harvest	17,576
New Non-Comp Harvest	886
New Dead Discards	1,369
Old Dead Removals	42,478
New Removals	62,310
Percent Reduction	**18.18%**

Based on the included analysis, this proposal achieves an 18.18% reduction in total removals from pooled 2016-2017 for all size-related analysis.

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)
NA.

Section 3: Coastal Commercial Fishery
In accordance with the Board's decision, Delaware will implement an 18% reduction from the Addendum IV commercial quotas, resulting in a commercial quota of 118,970 lbs. with a 20" minimum size for gillnets in Delaware Bay and River during the spring and a 28" minimum size for all other gear and locations.

Seasons:
The spring commercial gillnet fishery will be open from February 15 through May 31. The gillnet

quota will be 113,021 lbs., 95% of the state commercial quota of 118,970 lbs. If less than 98% of the total gillnet quota is landed in the spring season, a fall gillnet season will be held from November 15 through December 31 for the remaining quota. There is no trip limit for the gillnet fishery. The commercial hook and line season will run from April 1 through December 31, with an allocation of 5,949 lbs., 5% of the total quota. A trip limit of 200 lbs/day is in effect for the commercial hook and line fishery. Delaware Bay gillnet restrictions will consist of drift nets only from February 15 – 28 (mesh size greater than 4” stretch) and May 10 – 31.

Spawning Area Closure:
No commercial or recreational harvest will be allowed in April and May on the spawning grounds, which are defined as the Chesapeake and Delaware Canal, the Delaware River north of the Canal, and the Delaware portion of the Nanticoke River.

Individual Transferable Quota (ITQ) and Tagging Requirements:
All licensed gillnetters will be allocated an equal share of the quota in pounds. For example in 2013, the gillnet quota (183,816 lbs.) was divided by the number of licensed gillnetters who applied for quota (111) to establish the ITQ for the spring fishery (1,656 lbs.). The individual quotas are transferable, provided the transfer is made prior to the issuance of the tags. The number of tags required to fill an individual quota was estimated by dividing the total quota by the expected average weight of striped bass to be landed for that gear type and season.

All striped bass in the possession of a commercial fisher are required by regulation to have a state-issued numbered tag locked through the jaw and gill. If a commercial fisher needs additional tags to fill his/her quota, the State will verify the balance of the quota remaining from reports submitted to the State by the weigh stations. All unused tags will be returned to the State with a written report of landings within 30 days of the closure of the spring and fall fishing seasons.

Weigh-Station Reporting:
Commercial fishers are required to bring all landed striped bass to one of the weigh-stations located throughout the state. The weigh-stations record the aggregate weight and apply a second locking tag to each striped bass landed. The weigh-stations maintain written logs of the date landed, number of fish, total daily weight, and also report each fisherman’s daily catch through an Interactive Voice Reporting (IVR) system.

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)
NA.

Section 5: Circle Hook Requirements
Delaware will revise its current circle hook requirement (7 Delaware Administrative Code 3502) to require the use of circle hooks, as defined in Addendum VI, when recreationally fishing with bait. The regulation will be in effect by January 1, 2021.

Delaware will provide circle hook outreach through press releases, prominent informational sections in the Delaware Fishing Guide (print and online), social media, targeted email, and other efforts.

Section 6: Timeline for Implementation

Delaware will begin the regulatory process to change striped bass regulations in December 2019. In accordance with Delaware's Administrative Procedures Act (APA), a public hearing will be held no sooner than 20 days after publication of the draft regulation in the Register of Regulations to discuss the striped bass regulation changes. Delaware will require a decision from ASMFC on its proposed recreational options before the public hearing. Public input on the recreational fishing options will be taken at the hearing and during the APA-mandated 30 day public comment period. Delaware will use the public comment as part of its decision process in choosing the recreational option to include in the final regulation. The regulation should be in effect before the spring recreational striped bass fishing season begins in April 2020. The circle hook requirement regulation will be in effect by January 1, 2021.

Delaware may need the Department of Natural Resources and Environmental Control Secretary to issue an Emergency Order to put the new commercial striped bass quota in effect for the February 2020 start of the commercial striped bass gillnet season. The Emergency Order would expire when the final regulations go into effect in April 2020.

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Delaware's Atlantic Striped Bass Addendum VI Implementation Plan

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Delaware	28-35" slot	1	Catch & release on spawning grounds Apr. 1 – May 31	Year round.
	Except in Delaware Bay and River and their tidal tributaries, 20-25"	1		July 1 – Aug. 31

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Delaware – Gillnet	28" minimum size, except 20" min in Del. Bay and River during spring season	135,350 lbs.	2.15-5.31 (2.15-3.30 for Nanticoke River) & 11.15-12.31; drift nets only 2.15-2.28 & 5.1-5.31; no fixed nets in Del. River. No trip limit
Delaware – Hook and Line	28" min	7,124 lbs.	4.1-12.31, 200 lbs/day trip limit

Section 1: Coastal Recreational Fishery

Delaware proposes a conservation equivalency (CE) option that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the Technical Committee (TC). Delaware's CE option expands board-approved the slot limit to 28 - 35" TL with a one fish bag limit year round for all state waters, with the exception of Delaware Bay and River, and their tidal tributaries, which will have a 20-25" slot size limit and a one fish bag limit during July 1-Aug. 31. Reducing from a two fish bag to one fish in the Delaware Bay and River will decrease total mortality, but at this time we do not have the data available to quantify the amount of reduction this conservation method will produce.

This option will reduce total removals by at least 20.40%, with additional reductions occurring through the reduced bag limit during the summer season. Also, our proposed Conservation Equivalency option will maintain a spawning area closure from April 1-May 31 to protect spawning adults. The spawning area is further defined in Section 2 and prohibits recreational and commercial harvest in the spawning areas during that time. Further analysis is provided. This proposal meets the data standards established by the TC.

The data sources used in the analysis are the MRIP estimates provided in Greg Wojcik's spreadsheet, and tag-recapture data collected by Delaware's Division of Fish & Wildlife to confirm that Delaware River striped bass that remain in river during the summer months comprise a resident population of males.

The MRIP data obtained by Greg Wojcik for Delaware consists of 60 individual length assignments for a total of 33,678 striped bass during 2016 through 2017. Striped bass catches in Delaware only occur in Waves 2, 3, 4, and 6. The only "non-compliant" catch in Delaware waters consists of the 20-25" resident Delaware River male striped bass caught in Wave 4 (July/August) in 2016-2017. Although classified as 'non-compliant' in the analysis, these fish were fully compliant as their harvest was allowed based on the Conservation Equivalency proposal approved by the TC and Management Board in 2008.

All calculation followed the methods outlined in Greg Wojcik's spreadsheet.

Ocean Slot: **DE River Summer Slot:**	**28-35"** **20-25"**
New Harvest	15,609
New Non-Comp Harvest	994
New Dead Discards	1,537
Old Dead Removals	42,478
New Removals	60,618
Percent Reduction	**20.40%**

Based on the included analysis, this proposal achieves a 20.40% reduction in total removals from pooled 2016-2017 for all size-related analysis.

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)
NA.

Section 3: Coastal Commercial Fishery
Delaware will implement a 1.8% reduction from the Addendum IV commercial quotas, resulting in a commercial quota of 142,473 lbs. with a 20" minimum size for gillnets in Delaware Bay and River during the spring and a 28" minimum size for all other gear and locations. The combination of a 20.40% reduction in recreational mortality with a 1.8% reduction in commercial mortality results in a total reduction of 18.4% from 2017.

Seasons:
The spring commercial gillnet fishery will be open from February 15 through May 31. The gillnet quota will be 135,350 lbs., 95% of the state commercial quota of 142,473 lbs. If less than 98% of the total gillnet quota is landed in the spring season, a fall gillnet season will be held from November 15 through December 31 for the remaining quota. There is no trip limit for the gillnet fishery. The commercial hook and line season will run from April 1 through December 31, with an allocation of 7,124 lbs., 5% of the total quota. A trip limit of 200 lbs/day is in effect for the commercial hook and line fishery. Delaware Bay gillnet restrictions will consist of drift nets only from February 15 – 28 (mesh size greater than 4" stretch) and May 10 – 31.

Spawning Area Closure:
No commercial or recreational harvest will be allowed in April and May on the spawning grounds, which are defined as the Chesapeake and Delaware Canal, the Delaware River north of the Canal, and the Delaware portion of the Nanticoke River.

Individual Transferable Quota (ITQ) and Tagging Requirements:
All licensed gillnetters will be allocated an equal share of the quota in pounds. For example in 2013, the gillnet quota (183,816 lbs.) was divided by the number of licensed gillnetters who applied for quota (111) to establish the ITQ for the spring fishery (1,656 lbs.). The individual quotas are transferable, provided the transfer is made prior to the issuance of the tags. The number of tags required to fill an individual quota was estimated by dividing the total quota by the expected average weight of striped bass to be landed for that gear type and season.

All striped bass in the possession of a commercial fisher are required by regulation to have a state-issued numbered tag locked through the jaw and gill. If a commercial fisher needs additional tags to fill his/her quota, the State will verify the balance of the quota remaining from reports submitted to the State by the weigh stations. All unused tags will be returned to the State with a written report of landings within 30 days of the closure of the spring and fall fishing seasons.

Weigh-Station Reporting:
Commercial fishers are required to bring all landed striped bass to one of the weigh-stations located throughout the state. The weigh-stations record the aggregate weight and apply a second locking tag to each striped bass landed. The weigh-stations maintain written logs of the date landed, number of fish, total daily weight, and also report each fisherman's daily catch through an Interactive Voice Reporting (IVR) system.

<u>Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)</u>
NA.

<u>Section 5: Circle Hook Requirements</u>
Delaware will revise its current circle hook requirement (7 Delaware Administrative Code 3502) to require the use of circle hooks, as defined in Addendum VI, when recreationally fishing with bait. The regulation will be in effect by January 1, 2021.

Delaware will provide circle hook outreach through press releases, prominent informational sections in the Delaware Fishing Guide (print and online), social media, targeted email, and other efforts.

Section 6: Timeline for Implementation

Delaware will begin the regulatory process to change striped bass regulations in December 2019. In accordance with Delaware's Administrative Procedures Act (APA), a public hearing will be held no sooner than 20 days after publication of the draft regulation in the Register of Regulations to discuss the striped bass regulation changes. Delaware will require a decision from ASMFC on its proposed recreational options before the public hearing. Public input on the recreational fishing options will be taken at the hearing and during the APA-mandated 30 day public comment period. Delaware will use the public comment as part of its decision process in choosing the recreational option to include in the final regulation. The regulation should be in effect before the spring recreational striped bass fishing season begins in April 2020. The circle hook requirement regulation will be in effect by January 1, 2021.

Delaware may need the Department of Natural Resources and Environmental Control Secretary to issue an Emergency Order to put the new commercial striped bass quota in effect for the February 2020 start of the commercial striped bass gillnet season. The Emergency Order would expire when the final regulations go into effect in April 2020.

Maryland’s Atlantic Striped Bass Addendum VI Implementation Plan

Introduction

In October 2019 the Atlantic States Marine Fisheries Commission finalized Addendum VI to the Interstate Fisheries Management Plan for Atlantic Striped Bass. The Addendum is intended to reduce fishing mortality by 18% beginning in the 2020 fishing year in order to address overfishing. As specified in the Addendum, states may submit an implementation plan that demonstrates equivalent conservation benefit to the plan-specified option if the state determines that alternative management actions would result in more effective and equitable management within state waters. The state of Maryland is most concerned with the high discard mortality of striped bass, particularly in Chesapeake Bay in midsummer when water/air temperatures are high and dissolved oxygen levels are depressed. Options presented here are designed to reduce both harvest and discard mortality from the recreational fishery particularly in the summer months. Maryland is also interested in extending protection for large migratory fish as they pass through the Bay to the spawning reaches. Finally, these options account for an unequal/unbalanced application of the reduction to Maryland’s recreational and commercial fisheries. Hence, the proposal considers a 1.8% reduction to Maryland’s commercial sector and a 20.6% reduction in the recreational sector to meet the overall goal of an 18% reduction statewide.

Note that options 2a through 2c use the same calculations but redistribute impacts at different times of year. Because of the short turn-around time for this proposal, Maryland may find it necessary to make minor adjustments to rebalance impacts of the proposed management elements within the year. All calculation methods would remain the same as those presented and the 20.6% reduction goal would be met in all cases.

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Maryland Atlantic & Coastal Bays Fishery	28-35”	1 fish		All year
Maryland Chesapeake Bay Fishery	Spring Trophy: 35” Summer/Fall: 19” min size, only 1 fish can be >28” (Option 2a)	Spring Trophy: 1 fish Summer/Fall: 2 fish May 16-July 4 1 fish Aug 1-Aug 31 2 fish Sept 1-Dec 6	No targeting March-April; Charter captains cannot keep fish for personal consumption; No targeting during July closure	Spring Trophy: May 1-May 15 Summer/Fall: May 16-July 4, Aug 1-Dec 6 Closed July 5-31
	Spring Trophy: 35” Summer/Fall:	Spring Trophy: 1 fish Summer/Fall: 2 fish May 16-July 4 1 fish Aug 1-Aug 31	Charter captains cannot keep fish for personal consumption; No	Spring Trophy: May 1-May 15 Summer/Fall: May 16-July 4, Aug 1-Nov 30

	19” min size, only 1 fish can be >28” (Option 2b)	2 fish Sept 1-Nov 30	targeting during July closure	Closed July 5-31
	Spring Trophy: 35” Summer/Fall: 19” min size, only 1 fish can be >28” (Option 2c)	Spring Trophy: 1 fish Summer/Fall: 2 fish May 16-July 9 1 fish Aug 1-Sept 30 2 fish Oct 1-Dec 6	No targeting April; Charter captains cannot keep fish for personal consumption; No targeting during July closure	Spring Trophy: May 1-May 15 Summer/Fall: May 16-July 9 Aug 1-Dec 6 Closed July 10-31
	Spring Trophy: 35” Summer/Fall: 19” min size, only 1 fish can be >28” for charters (Option 2d)	Spring Trophy: 1 fish Summer/Fall: 1 fish private/shore 2 fish for-hire sector	No targeting April; Charter captains cannot keep fish for personal consumption; No targeting during August closure	Spring Trophy: May 1-May 15 Summer/Fall: May 16-Aug 15, Sept 1-Dec 10; Closed Aug 16-31 and Dec 11-15

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
Maryland Atlantic Commercial Fishery	24” min	89,094	Trawl and Gill Net Jan 1 – May 31, Oct 1 – Dec 31
Maryland Chesapeake Bay Commercial Fishery	18”–36”	1,445,394 lbs	Drift Gill Net Jan 1 – Feb 29, Dec 1 – Dec 31 Hook & Line, Haul Seine June 1 – Nov 30 Pound Net June 1 – Dec 31

Section 1: Coastal Recreational Fishery

1a.) Maryland intends to implement the ASMFC Board approved coastal management option from Addendum VI - a one fish bag limit and a slot size of 28” minimum size to less than 35” total length for the coastal bays and ocean fishery.

Section 2: Chesapeake Bay Recreational Fishery (Maryland)

2a.) Under this option, Maryland would not allow any targeting (including catch and release) of striped bass in March and April and start the trophy season later (May 1 rather than the 3rd Saturday of April). For the trophy season open May 1-May 15, the minimum size would remain 35”. Maryland’s resident summer/fall fishery would start on May 16 and run through December 6 with a closure for 27 days in

July and the season ending 9 days earlier in December. The minimum size would remain 19” as it was in 2019 under Maryland’s conservation equivalency proposal. During the July closure, no targeting of striped bass would be allowed. While the bag limit would remain 2 fish for the majority of the summer/fall season, it would drop to a 1 fish bag limit for the month of August. As with current regulations, when the bag limit is 2 fish, only one of the two fish is allowed to be greater than 28”. Additionally, charter boat captains would no longer be allowed to keep one fish per trip for personal consumption in the summer/fall season.

- Maryland’s target reduction for the Chesapeake Bay recreational fishery is 20.6% to account for the commercial sectors taking a 1.8% reduction in quota. The reduction increases from 18% to 20.5% to account for the Chesapeake Bay commercial quota and to 20.6% to account for the Atlantic commercial quota (see sections 3 and 4 for more information on these calculations).
- Maryland’s 2015-2018 average inland harvest and releases by wave were used for the calculations due to the calculations mostly involving seasonal closures.
- Calculations were conducted starting at a 19” minimum size which was approved by the Striped Bass Management Board as conservationally equivalent with circle hooks to a 20” minimum size.
- Striped bass are very common in Maryland’s Chesapeake Bay and while we expect a no targeting rule to reduce the number of discards, we know that striped bass will continue to be encountered. To estimate the effect of no targeting during wave 2 (March and April), MRIP trip and catch data for 2015-2018 were used. In order to calculate how much releases would be reduced during the closure period, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. Using this method, we decremented the wave 2 releases by 0.769, the 2015-2018 average estimated reduction in releases. This decreased wave 2 releases from the 2015-2018 average of 375,468 fish to 86,883 fish. Using a 9% discard mortality rate, this reduced dead discards from 33,792 dead fish to 7,819 fish.
    - Maryland currently has no targeting rules in place for spawning reaches in the spring period. COMAR 08.02.15.03 §D defines this as: “ . . . during the period March 1 through May 31, a person may not catch, harass, harm, pursue, hunt, shoot, wound, or attempt to catch striped bass or striped bass hybrids in the striped bass spawning rivers and areas listed in §B of this regulation.” For March and April, Maryland would extend these regulations to the entire Bay and not just spawning reaches.
- By starting the trophy season on May 1, no harvest is expected in wave 2. This decreases the harvested fish by 84,874 fish, on average.
- Given concerns with the combination of low dissolved oxygen and high water and air temperatures in the summer in Chesapeake Bay, Maryland is proposing to close the season in July for 27 days. By dividing the average wave 4 harvest estimate (330,162 fish) by 62 days (the number of days in wave 4), we estimate each day of closure will reduce harvest by 5,325 fish. A 27 day closure will reduce harvest by 143,780 fish.
- Similar to our proposed measures in wave 2, Maryland would not allow the targeting of striped bass during the July closure. However, we expect that some striped bass releases will still occur.

To estimate how much discards could decrease, we used 2015-2018 MRIP catch and trip data to calculate the average reduction in striped bass releases expected during the closure. Like above, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. For 2015-2018, releases in wave 4 were estimated to be reduced 59.2%, on average. Assuming this remains constant in 2020, we estimate that each day of closure will reduce the releases by 23,512 fish on average (2,461,146/62) x 0.592). Over 27 days, this will reduce releases by 634,821 fish which will reduce dead discards from 221,503 fish to 164,369 fish.

- Currently, charter boat captains are allowed to keep 1 fish per trip for personal consumption during the summer/fall season, commonly referred to as a "boat fish". Using 2017 Maryland charter logbook data, and assuming any boat fish are only kept after the paying party has limited out, we calculated how many boat fish were reported as harvested. The 2017 data suggests that 1,538 boat fish were harvested. These fish were removed from the harvest and estimated to contribute 0.08% to the reduction in total removals.
- MRIP data from 2015-2018 were used to calculate the effect of a 1 fish bag limit in August. The bag limit analysis was identical to that used for Addendum IV and the estimate of the reduction of total removals under perfect compliance (25.5%) was used. Given the small sample sizes at the wave level, the estimate of the reduction in total removals for the entire year was used in the calculations. The Wave 4 harvest and release estimates were first divided in half to approximate the total removals only in August. The reduction in total removals was then calculated as the August total removals reduced by 25.5 %. The calculated annual reduction in total removals due to having one fish bag limit in August is estimated to be 3.46%.
- Similar calculations to the wave 4 closure were done using the wave 6 harvest estimate to calculate the effect of a 9 day closure in December. As targeting/catch and release of striped bass would still be allowed, only harvest was adjusted. Maryland's season was open until December 20 in 2017, or 50 days of wave 6. The 2015-2018 average MRIP harvest was 211,849 fish in wave 6. The average daily harvest rate would be 211,849/50 which equals 4,237 fish per day. Therefore, the 9 day closure is estimated to save 38,133 fish.
- Combining all of these measures, Maryland estimates that the total removals will be decreased by 20.8%.

2b.) Under this option, Maryland would delay the start of the trophy season to May 1 rather than the 3rd Saturday of April and it would continue to close on May 15. Targeting of striped bass pre-season (recreational catch and release) would still be allowed and the minimum size would remain 35". Maryland's resident summer/fall fishery would start on May 16 and run through November 30 with a closure for 27 days in July and the season ending 15 days earlier in December. The minimum size would remain 19" as it was in 2019 under Maryland's conservation equivalency proposal. During the July closure, no targeting of striped bass would be allowed. While the bag limit would remain 2 fish for the majority of the summer/fall season, it would drop to a 1 fish bag limit for the month of August. As with current regulations, when the bag limit is 2 fish, only one of the two fish is allowed to be greater than 28". Additionally, charter boat captains would no longer be allowed to keep one fish per trip for personal consumption in the summer/fall season.

- Maryland's target reduction for the Chesapeake Bay recreational fishery is 20.6% to account for the commercial sectors taking a 1.8% reduction in quota. The reduction increases from 18% to 20.5% to account for the Chesapeake Bay commercial quota and to 20.6% to account for the Atlantic commercial quota (see sections 3 and 4 for more information on these calculations).
- Maryland's 2015-2018 average inland harvest and releases by wave were used for the calculations due to the calculations mostly involving seasonal closures.
- Calculations were conducted starting at a 19" minimum size which was approved by the Striped Bass Management Board as conservationally equivalent with circle hooks to a 20" minimum size.
- By starting the trophy season on May 1, no harvest is expected in wave 2. This decreases the harvested fish by 84,874 fish, on average.
- Given concerns with the combination of low dissolved oxygen and high water and air temperatures in the summer in Chesapeake Bay, Maryland is proposing to close the season in July for 27 days. By dividing the average wave 4 harvest estimate (330,162 fish) by 62 days (the number of days in wave 4), we estimate each day of closure will reduce harvest by 5,325 fish. A 27 day closure will reduce harvest by 143,780 fish.
- Similar to the option described above, Maryland would not allow the targeting of striped bass during the July closure. However, we expect that striped bass releases will still occur. To estimate how much discards could decrease, we used 2015-2018 MRIP catch and trip data to calculate the average reduction in striped bass releases expected during the closure. Like above, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. For 2015-2018, releases in wave 4 were estimated to be reduced 59.2%, on average. Assuming this remains constant in 2020, we estimate that each day of closure will reduce the releases by 23,512 fish (2,461,146/62) x 0.592). Over 27 days, this will reduce releases by 634,821 fish on average which, assuming a 9% discard mortality rate, will reduce dead discards from 221,503 fish to 164,369 fish.
    - Maryland currently has no targeting rules in place for spawning reaches in the spring period. COMAR 08.02.15.03 §D defines this as: " . . . during the period March 1 through May 31, a person may not catch, harass, harm, pursue, hunt, shoot, wound, or attempt to catch striped bass or striped bass hybrids in the striped bass spawning rivers and areas listed in §B of this regulation." Similar regulations would be put in place for the July closure.
- Currently, charter boat captains are allowed to keep 1 fish per trip for personal consumption during the summer/fall season, commonly referred to as a "boat fish". Using 2017 Maryland charter logbook data, and assuming any boat fish are only kept after the paying party has limited out, we calculated how many boat fish were reported as harvested. The 2017 data suggests that 1,538 boat fish were harvested. These fish were removed from the harvest and estimated to contribute 0.08% to the reduction in total removals.
- MRIP data from 2015-2018 was used to calculate the effect of a 1 fish bag limit in August. The bag limit analysis was identical to that used for Addendum IV and the estimate of the reduction of total removals under perfect compliance (25.5%) was used. Given the small sample sizes at

the wave level, the estimate of the reduction in total removals for the entire year was used in the calculations. The Wave 4 harvest and release estimates were first divided in half to approximate the total removals only in August. The reduction in total removals was then calculated as the August total removals times (1-0.255). The calculated reduction for a one fish bag limit for the month of August is estimated to be 3.46%.

- Similar calculations as above were done using the wave 6 harvest estimate to calculate the effect of a 15 day closure in December. As targeting/catch and release of striped bass would still be allowed, only harvest was adjusted. Maryland's season was open to harvest until December 20 in 2017, or 50 days of wave 6. The 2015-2018 average MRIP harvest was 211,849 fish in wave 6. The average daily harvest rate would be 211,849/50 which equals 4,237 fish per day. Therefore, the 15 day closure is estimated to save 63,555 fish.
- Combining all of these measures, Maryland estimates that the total removals will be decreased by 20.8%.

2c.) Under this option, Maryland would not allow any targeting of striped bass in April and start our trophy season later, opening on May 1 rather than the 3rd Saturday of April and closing on May 15. The minimum size would remain 35". Maryland's resident summer/fall fishery would start on May 16 and run through December 6 with a closure for 22 days in July and the season ending 9 days earlier in December. The minimum size would remain 19" as it was in 2019 under Maryland's conservation equivalency proposal. During the July closure, no targeting of striped bass would be allowed. While the bag limit would remain 2 fish for the majority of the summer/fall season, it would drop to a 1 fish bag limit for the months of August and September. As with current regulations, when the bag limit is 2 fish, only one of the two fish is allowed to be greater than 28". Additionally, charter boat captains would no longer be allowed to keep one fish per trip for personal consumption in the summer/fall season.

- Maryland's target reduction for the Chesapeake Bay recreational fishery is 20.6% to account for the commercial sectors taking a 1.8% reduction in quota. The reduction increases from 18% to 20.5% to account for the Chesapeake Bay commercial quota and to 20.6% to account for the Atlantic commercial quota (see sections 3 and 4 for more information on these calculations).
- Maryland's 2015-2018 average inland harvest and releases by wave were used for the calculations due to the calculations mostly involving seasonal closures.
- Calculations were conducted starting at a 19" minimum size which was approved by the Striped Bass Management Board as conservationally equivalent with circle hooks to a 20" minimum size.
- Striped bass are very common in Maryland's Chesapeake Bay and while we expect a no targeting rule to reduce the number of discards, we expect that striped bass will continue to be encountered. To estimate the effect of no targeting during April, we used MRIP trip and catch data. In order to calculate how much releases would be reduced during the closure period, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. Using this method, we decremented the wave 2 releases by 0.769, the 2015-2018 average estimated reduction in releases. This decreased average wave 2 releases from 375,468 fish to 231,176 fish. Using a 9% discard mortality rate, this reduced dead discards from 33,792 dead fish to 20,806 fish.

- Maryland currently has no targeting rules in place for spawning reaches in the spring period. COMAR 08.02.15.03 §D defines this as: " . . . during the period March 1 through May 31, a person may not catch, harass, harm, pursue, hunt, shoot, wound, or attempt to catch striped bass or striped bass hybrids in the striped bass spawning rivers and areas listed in §B of this regulation." For the month of April, Maryland would extend these no targeting regulations to the entire Bay and not just spawning reaches.

- By starting the trophy season on May 1, no harvest is expected in wave 2. This decreases the harvested fish by 84,874 fish on average.
- Given concerns with the combination of low dissolved oxygen and high water and air temperatures in the summer in Chesapeake Bay, Maryland is proposing to close the season in July for 22 days. By dividing the average wave 4 harvest estimate (330,162 fish) by 62 days (the number of days in wave 4), we estimate each day of closure will reduce harvest by 5,325 fish. A 22 day closure will reduce harvest by 117,154 fish on average.
- Similar to our proposed measures in wave 2, Maryland would not allow the targeting of striped bass during the July closure. However, we expect that striped bass releases will still occur. To estimate how much discards could decrease, we used 2015-2018 MRIP catch and trip data to calculate the average reduction in striped bass releases expected during the closure. Like above, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. For 2015-2018, releases in wave 4 were estimated to be reduced 59.2%, on average. Assuming this remains constant in 2020, we estimate that each day of closure will reduce the releases by 23,512 fish (2,461,146/62) x 0.592). Over 22 days, this will reduce releases by 517,261 fish which will reduce average dead discards from 221,503 fish to 174,950 fish.
- Currently, charter boat captains are allowed to keep 1 fish per trip for personal consumption during the summer/fall season, commonly referred to as a "boat fish". Using 2017 Maryland charter logbook data, and assuming any boat fish are only kept after the paying party has limited out, we calculated how many boat fish were reported as harvested. The 2017 data suggest that 1,538 boat fish were harvested. These fish were removed from the harvest and estimated to contribute 0.08% to the reduction in total removals.
- MRIP data from 2015-2018 was used to calculate the effect of a 1 fish bag limit in August and September. The bag limit analysis was identical to that used for Addendum IV and the estimate of the reduction of total removals under perfect compliance (25.5%) was used. Given the small sample sizes at the wave level, the estimate for the entire year was used in the calculations. The wave 4 and wave 5 harvest and release estimates were first divided in half to approximate the total removals for only August and September, respectively. The reduction in total removals was then calculated as the August total removals (or September total removals) times (1-0.255). The calculated reduction is 5.85%.
- Similar calculations were done using the wave 6 harvest estimate to calculate the effect of a 9 day closure in December. As targeting/catch and release of striped bass would still be allowed, only harvest was adjusted. Maryland's season was open until December 20 in 2017, or 50 days of wave 6. The 2015-2018 average MRIP harvest was 211,849 fish in wave 6. Divided by 50, this

means a harvest closure would save, on average, 4,237 fish per day. Therefore, the 9 day closure is estimated to save 38,133 fish.

- Combining all of these measures, Maryland estimates that the total removals will be decreased by 20.7%.

2d.) Under this option, the Chesapeake Bay regulations for the spring trophy fishery would remain the same with a one fish bag limit and a 35” minimum size. However, the season would open on May 1 (rather than the 3rd Saturday of April) and continue through May 15. Additionally, the targeted catch and release of striped bass in April would be prohibited. Starting on May 16 and continuing through December 10, the private and shore sectors of the recreational fishery would have a one fish bag limit and a 19” minimum size. As part of a bonus program for Chesapeake Bay charter boats, the for-hire sector would be allowed to keep 2 fish per person per day, also with a 19” minimum size, as long as they participate in the Department’s new electronic reporting system which requires a hail and includes harvest verification. As with current regulations, when the bag limit is 2 fish, only one of the two fish is allowed to be greater than 28”. Additionally, the season will be closed 16 days in wave 4 (August 16-31) and shortened 5 days in December (closing December 10 rather than December 15) for both sectors. No targeting of striped bass would be allowed during the August closure.

- Maryland’s target reduction for the Chesapeake Bay recreational fishery is 20.6% to account for the commercial sectors taking a 1.8% reduction in quota. The reduction increases from 18% to 20.5% to account for the Chesapeake Bay commercial quota and to 20.6% to account for the Atlantic commercial quota (see sections 3 and 4 of the original Maryland implementation plan for more information on these calculations).
- Maryland’s 2015-2018 average inland harvest and releases by wave were used for the calculations due to the calculations involving seasonal closures.
- Calculations were conducted starting at a 19” minimum size which was approved by the Striped Bass Management Board as conservationally equivalent with circle hooks to a 20” minimum size.
- Striped bass are very common in Maryland’s Chesapeake Bay and while we expect a no targeting rule to reduce the number of discards, we expect that striped bass will continue to be encountered. To estimate the effect of no targeting during April, we used 2015-2018 MRIP trip and catch data. In order to calculate how much releases would be reduced during the closure period, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. Using this method, we decremented the wave 2 releases by 0.769, the 2015-2018 average estimated reduction in releases. Fish saved from not allowing striped bass to be targeted in April were calculated as the number of fish no longer released in April multiplied by the 9% discard mortality rate. This resulted in 12,986 fewer dead releases. Additionally, by starting the trophy season on May 1, no harvest is expected in wave 2. This decreases the harvested fish by 84,874 fish, based on the 2015-2018 average harvest. These two actions are estimated to reduce removals by 4.8%.
    - Maryland currently has no targeting rules in place for spawning reaches in the spring period. COMAR 08.02.15.03 §D defines this as: “ . . . during the period March 1 through

May 31, a person may not catch, harass, harm, pursue, hunt, shoot, wound, or attempt to catch striped bass or striped bass hybrids in the striped bass spawning rivers and areas listed in §B of this regulation." For the month of April, Maryland would extend these regulations to the entire Bay and not just spawning reaches.

- Bag limit reductions were calculated by sector using the 2015-2018 MRIP intercept data and the same methodology as Addendum IV. Sector specific bag limit analyses were used as it seems reasonable to expect anglers on charter boat and head boat trips to limit out more frequently than anglers on private boat or shore based trips due to the experience of the captain. The four year average estimate of the private harvest reduction under perfect compliance (23.01%) was used to adjust the private sector harvest only. By applying the 1 fish bag limit to just the private and shore modes, we assume that all charter boats would operate as they usually have under the current 2 fish bag limit. Additionally, discards are assumed to remain at the same level. This is estimated to reduce total removals by 10.0%.
    - Note: In order for for-hire anglers to keep two fish under the charter bonus program that Maryland intends to develop, Maryland will require for-hire vessel participation in our new state of the art electronic reporting system which includes daily reporting and a hailing component. While this program will be open to all Chesapeake Bay for-hire vessels, it is possible that not all will enroll. Vessels not participating in the bonus program would still be under the 1 fish bag limit that is applied to the private and shore modes. Because we are assuming in these calculations that all for-hire vessels would operate as they have previously under a 2 fish bag limit, this calculation may underestimate the reduction achieved if some portion of the for-hire vessels do not choose to enroll in the bonus fish program and are limited to 1 fish/person.
- Given concerns with the combination of low dissolved oxygen and high water and air temperatures in the summer in Chesapeake Bay, Maryland is proposing a partial closure of wave 4 (16 days of August). This closure would apply to both the private and for-hire sectors. Calculations were done using the wave 4 harvest and release estimates following the application of the 1 fish bag limit to the private sector in order to not double count savings. By dividing the new average wave 4 harvest estimate (264,422 fish) by 62 days (the number of days in wave 4), we estimate each day of closure will reduce harvest by 4,265 fish. A 16 day closure is estimated to reduce harvest by 68,238 fish.
- Similar to our proposed measures in wave 2, Maryland would not allow the targeting of striped bass during the August closure. However, we expect that some striped bass releases will still occur. To estimate how much discards could decrease, we used 2015-2018 MRIP catch and trip data to calculate the average reduction in striped bass releases expected during the closure. Like above, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. For 2015-2018, releases in wave 4 were estimated to be reduced 59.2%, on average. Assuming this remains constant in 2020, we estimate that each day of closure will reduce the releases by 23,512 fish on average (2,461,146/62) x 0.592). Over 16 days, this will reduce releases by 376,190 fish which will reduce dead discards by 33,857 fish.

- Currently, charter boat captains are allowed to keep 1 fish per trip for personal consumption during the summer/fall season, commonly referred to as a "boat fish". Using 2017 Maryland charter logbook data, and assuming any boat fish are only kept after the paying party has limited out, we calculated how many boat fish were reported as harvested. The 2017 data suggests that 1,538 boat fish were harvested. These fish were removed from the harvest and estimated to contribute 0.08% to the reduction in total removals.
- Similar calculations to the wave 4 closure were done using the wave 6 harvest estimate to calculate the effect of a 5 day closure in December. As targeting/catch and release of striped bass would still be allowed, only harvest was adjusted. Maryland's season was open until December 20 during 2015-2017 and until December 15 in 2018. This means that during the 2015-2018 period, wave 6 was open to harvest an average of 48.8 days. The 2015-2018 average MRIP harvest, following the application of a 1 fish bag limit to the private sector, was 165,369 fish in wave 6. The average daily harvest rate would be 165,369/48.8 which equals 3,392 fish per day. Therefore, the 5 day closure is estimated to save 16,961 fish.
- Combining all of these measures, the overall reduction in total removals is estimated to be 20.8%.

<u>Section 3: Coastal Commercial Fishery</u>

3a.) Maryland intends to reduce the commercial coastal fishery quota by 1.8% and the remainder of the required reductions will be taken by the Chesapeake Bay recreational sector. See the "Convert Comm Lbs to #s 16 & 17" and "2017 MRIP & % Redux Rec Takes" tabs in the accompanying Excel file for the calculations.

- The average weight of commercially harvested fish in 2016 and 2017 (weighted by number) was used in order to convert the difference in pounds to numbers of fish. Commercially harvested fish were sampled at striped bass check stations. In 2016 and 2017, a total of 205 fish were measured and weighed. Using the annual compliance report spreadsheets, the 2016-2017 N weighted average weight was 24.83 pounds.
- Given the difference between the 18% quota (74,396 pounds) and the 1.8% reduced quota (89,094 pound), the recreational sector will have to make up for 14,698 pounds which is equivalent to 592 fish (14,698/24.83).
- An 18% reduction from Maryland's 2017 recreational total removals (1,792,579 fish) results in a reduction of 322,664 fish from the recreational sector. Adding 592 more fish to this number means that Maryland's recreational fishery will have to reduce total removals by 323,256 fish, an overall reduction of 18.03%.

Maryland's 2020 coastal commercial quota will be 89,094 pounds, 1.8% less than the Addendum IV quota. Maryland's coastal commercial size limit will remain the same with a minimum size of 24". The trawl and gill net fishery will be open from January 1-May 31, 2020 and October 1-December 31, 2020.

<u>Section 4: Chesapeake Bay Commercial Fishery (Maryland)</u>

4a.) Maryland intends to reduce the commercial Chesapeake Bay quota by 1.8% and have the remainder of the required reductions be taken by the Chesapeake Bay recreational sector. See the "Convert Comm Lbs to #s 16 & 17" and "2017 MRIP & % Redux Rec Takes" tabs in the accompanying Excel file for the calculations.

- The average weight of commercially harvested fish in 2016 and 2017 (weighted by number) was used in order to convert the difference in pounds to numbers of fish. Commercially harvested fish were sampled at striped bass check stations. In 2016 and 2017, a total of 11,014 fish were measured and weighed. Using the annual compliance report spreadsheet, the 2016-2017 N weighted average weight was 5.24 pounds.
- Given the difference between the 18% quota (1,471,888 pounds) and the 1.8% reduced quota (1,445,394 pounds), the recreational sector will have to make up for 238,446 pounds which is equivalent to 45,478 fish (238,446/5.24).
- An 18% reduction from Maryland's 2017 recreational total removals (1,792,579 fish) results in a reduction of 322,664 fish from the recreational sector. Adding 45,478 more fish to this number means that Maryland's recreational fishery will have to reduce total removals by 368,142 fish, an overall reduction of 20.5%. Adding in the 592 fish from the Atlantic commercial fishery, the overall reduction needed to be taken by Maryland's Chesapeake Bay recreational fishery is ((368,142 + 592)/1,792,579) x 100 = (368,734/1,792,579) x 100 = 20.6%

This means that Maryland's 2020 Chesapeake Bay commercial quota will be 1,445,394 pounds, 1.8% less than the Addendum IV quota. Commercial size limits will remain the same with a minimum size of 18" and a maximum size of 36". Seasons will also remain the same and differ by gear. The drift gill net fishery will be open from January 1-February 29, 2020 and December 1-31, 2020. The haul seine and hook and line fisheries will be open from June 1-November 30, 2020 and the pound net fishery will be open from June 1-December 31, 2020.

Section 5: Circle Hook Requirements

Maryland put in regulations for 2018 and 2019 requiring that anglers in Chesapeake Bay and its tidal tributaries: use circle hooks when chumming or live-lining; use J hooks or circle hooks when using fish, crabs, or worms as bait or when using processed baits; and disallowed any other hooks, such as treble hooks, to be used from May 16-December 15. These regulations apply to all anglers no matter what species they are targeting. Specifically, the Code of Maryland Regulations (COMAR) 08.02.05.02.02 states:

F. Bait.

(1) When using fish, crabs, or worms as bait, or processed bait, a person recreationally angling in the Susquehanna Flats and Northeast River during the period March 1 through May 3 shall only use a:

(a) Circle hook; or

(b) "J" hook with a gap of less than or equal to 1/2 inch between the point and the shank.

(2) Except for chumming or live-lining, when using fish, crabs, or worms as bait, or processed bait, a person recreationally angling in the Chesapeake Bay and its tidal tributaries during the periods May 16, 2018 through December 15, 2018 and May 16, 2019 through December 15, 2019 shall only use a:

(a) Circle hook; or

(b) "J" hook.

(3) When chumming or live-lining, a person recreationally angling in the Chesapeake Bay and its tidal tributaries during the periods May 16, 2018 through December 15, 2018 and May 16, 2019 through December 15, 2019 shall only use a circle hook.

(4) A person may not use eels as bait while fishing with hook and line in the tidal waters of the Chesapeake Bay and its tributaries, except for a recreational, charter, or commercial hook and line fisherman authorized to participate in and fish during summer and fall striped bass seasons established in COMAR 08.02.15.

However, these regulations are set to sunset December 15, 2019. For this reason, Maryland began the regulatory process in November 2019 to make these hook requirement regulations permanent (https://dnr.maryland.gov/fisheries/Pages/regulations/changes.aspx#sbrec). Following scoping in November, proposed regulations were submitted for Administrative, Executive, and Legislative Review (AELR) in December. A public hearing will be held January 9 and public comment is open until January 21. This should have allowed the Department to have the circle hook regulations in place by March 2020 however the AELR has requested the Department hold the regulations for additional time so that the Department can address their questions and concerns. This would potentially push back the effective date to May 2020.

Maryland intends to continue their previous public education campaigns which will include printed materials for outreach events and for APAIS field interviewers to hand out, public presentations at sportsfishing shows and to fishing clubs, posts to our Facebook page, a website describing the use of circle hooks and best fish handling practices, and a piece in our annual fishing guide. Additionally, we will continue to distribute circle hooks to anglers.

Section 6: Timeline for Implementation

Commercial quotas will be set January 1, 2020.

Recreational regulations for the Chesapeake Bay spring season as well as permanent circle hook regulations for chumming and live lining within Chesapeake Bay were scoped in November. Scoping allows the public the opportunity to comment on proposed regulations before they are developed. Since then, regulations have been developed and were submitted to the Administrative, Executive, and Legislative Review (AELR) in December. A public hearing on the proposed spring regulations is scheduled for January 9 and the public comment period on them is open until January 21. While this timeline should have allowed us to have the spring regulations in place by March 1, 2020, AELR has requested the Department hold the regulations for additional time, so that the Department can address their questions and concerns. This would potentially push back the effective date to May 4, 2020.

Regulations for the Chesapeake Bay summer/fall season including closed days and bag limits will also have to go through our regulatory process. The department hopes to scope those regulations with the public in January and begin the regulatory promulgation process in February, with the expectation that these regulations would be in place by July 1, 2020, although the timing of these regulations is somewhat contingent upon when the spring regulations are ultimately adopted.

Recreational regulations for the Atlantic coast fishery can be set by public notice and will be implemented by April 1, 2020.

Appendix: Alternative Methods to Calculate Discard Reductions during Season Closures

In Maryland's original conservation equivalency proposal, all striped bass released from striped bass targeted trips (e.g. striped bass as PRIM1 or PRIM2) were assumed to no longer be released during season closures. However, releases of striped bass from trips not targeting striped bass were still assumed to occur. Given the uncertainty around how many anglers may still fish for other species during the closures and encounter/release striped bass, the Technical Committee suggested exploring other methods.

MRIP data from trips catching striped bass were subset to 2015-2018 Maryland inland trips. As the potential no targeting rules would be in place for waves 2 and 4, specific combinations of target species in these waves were explored to see what species anglers said they were fishing for when they released striped bass. While the numbers of striped bass released were variable year to year, in all years, most of the striped bass releases came from trips that were only targeting striped bass (Figures 1 and 2) followed often by trips without a declared targeted species. Other trips that contributed the most to striped bass releases included white perch, bluefish, spot, summer flounder, and Spanish mackerel.

The original methodology where all targeted striped bass releases are removed represents the maximum expected reduction or upper bound we would expect under the closure. Three other methods were explored to estimate how releases may be reduced during a closure:

1. No Striped Bass Only Trips: Under this calculation method, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. Striped bass releases would still occur for trips where either striped bass weren't targeted or trips where striped bass were targeted with a second species. These releases were assumed to be equal to the number of releases estimated by MRIP.
2. All Striped Bass Trips Still Occur: Under this calculation method, any trips where striped bass were either the primary or secondary target would still occur and release striped bass at a lower non-targeted rate. This non-targeted rate was calculated as the number of releases per trip for all trips where striped bass were not a targeted species. All striped bass releases from non-targeted trips would still occur in the numbers estimated by MRIP. This represents the "worst case" scenario where all previous striped bass trips still happen (i.e. no one stops fishing) but they switch to other fishing targets where they still encounter striped bass.
3. Combined: This method combines elements from methods 1 and 2. Under this calculation method, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate (calculated in the same way as described above). Additionally, all striped bass releases from non-targeted trips would still occur.

A summary of the estimated reductions in releases is provided below (Table 1). See the Excel spreadsheet entitled "Other Calculation Methods to Account for NonTargeting.xlsx" for the calculations.

Because so many of the Maryland inland trips report only targeting striped bass, the estimated reduction in releases from the "No Striped Bass Only Trips" and "Combined Method" are both similar to, though slightly less than, the original analysis method. The extreme option where all striped bass trips still occur has the smallest reduction in releases as all trips are assumed to still encounter striped bass though at a reduced rate of releases. Under this method in wave 2, there was actually a projected increase in releases. An increase, however, is unlikely to actually occur and this estimate is likely due to very small numbers of non-targeted intercepts in wave 2, ranging from 3-16 intercepts across the years. For this reason, rather than using an increase in discards as a sensitivity in our closure analyses for wave 2, this was set at 0 to indicate a possible no change in releases.

After examination of all options, Maryland proposes using the combined method in order to calculate the striped bass releases during a season closure. Unfortunately, we have no quantitative way to predict how many striped bass only trips might still occur by switching to other target species; however, this analysis allows us to look at the likely range of striped bass releases during a closure. It is reasonable to assume that trips that only target striped bass are likely to cease. This is because these anglers seem to be interested in only striped bass fishing based on their declaration of fishing targets. Anglers no longer fishing during the closure is likely, particularly in certain parts of Maryland's portion of Chesapeake Bay. While anglers south of the Bay Bridge fishing in higher salinity water often have a greater variety of species to fish for, particularly in wave 4, anglers north of the Bay Bridge have fewer options, mostly limited to white perch and catfish. Additionally, the combined method assumes that striped bass trips where other second target species were declared will still occur. As seen in the analysis presented, in most waves/years, striped bass are released, on average, at a lower rate when the target species was not striped bass. Given anglers would no longer be allowed to target striped bass, it seems reasonable that they would also discard them at a lower rate than when striped bass is listed as a target species.

Due to the difficulty of predicting angler choices, as demonstrated in Murphy et al. (2019), estimates of discards during season closures have some uncertainty that is difficult to quantify without separate study. However, season closures remove completely or substantially lower interactions between fishing gear and the fish and are the most efficient way to reduce recreational dead discards that currently comprise near half of the estimated total striped bass losses. For this reason, we believe these methodologies have merit and help inform the Technical Committee on the best method moving forward to estimate releases during a harvest closure.

Literature Cited

Murphy, Jr., R., S. Scyphers, S. Gray, and J.H. Grabowski. 2019. Angler attitudes explain disparate behavioral reactions to fishery regulations. Fisheries 44(10): 475-487.

Table 1. Comparison of estimated of reductions of releases between methods and years.

	2015	2016	2017	2018	Average
Wave 2	Reduction in Releases	Reduction in Releases	Reduction in Releases	Reduction in Releases	Reduction in Releases
Prop of releases that were targeted (original analysis)	-97	-80	-53	-85	-78.75
Combined Method	-94.73	-79.81	-49.05	-83.85	-76.86
No Striped Bass Only Trips	-80.59	-80.03	-48.11	-84.27	-73.25
All Striped Bass Trips Still Occur	34.92	-6.06	47.30	-30.49	11.41
Wave 4					
Prop of releases that were targeted (original analysis)	-60	-66	-73	-71	-67.50
Combined Method	-55.12	-60.71	-65.47	-55.61	-59.23
No Striped Bass Only Trips	-52.36	-60.29	-60.77	-60.32	-58.43
All Striped Bass Trips Still Occur	-16.12	-28.24	-40.32	-1.26	-21.49

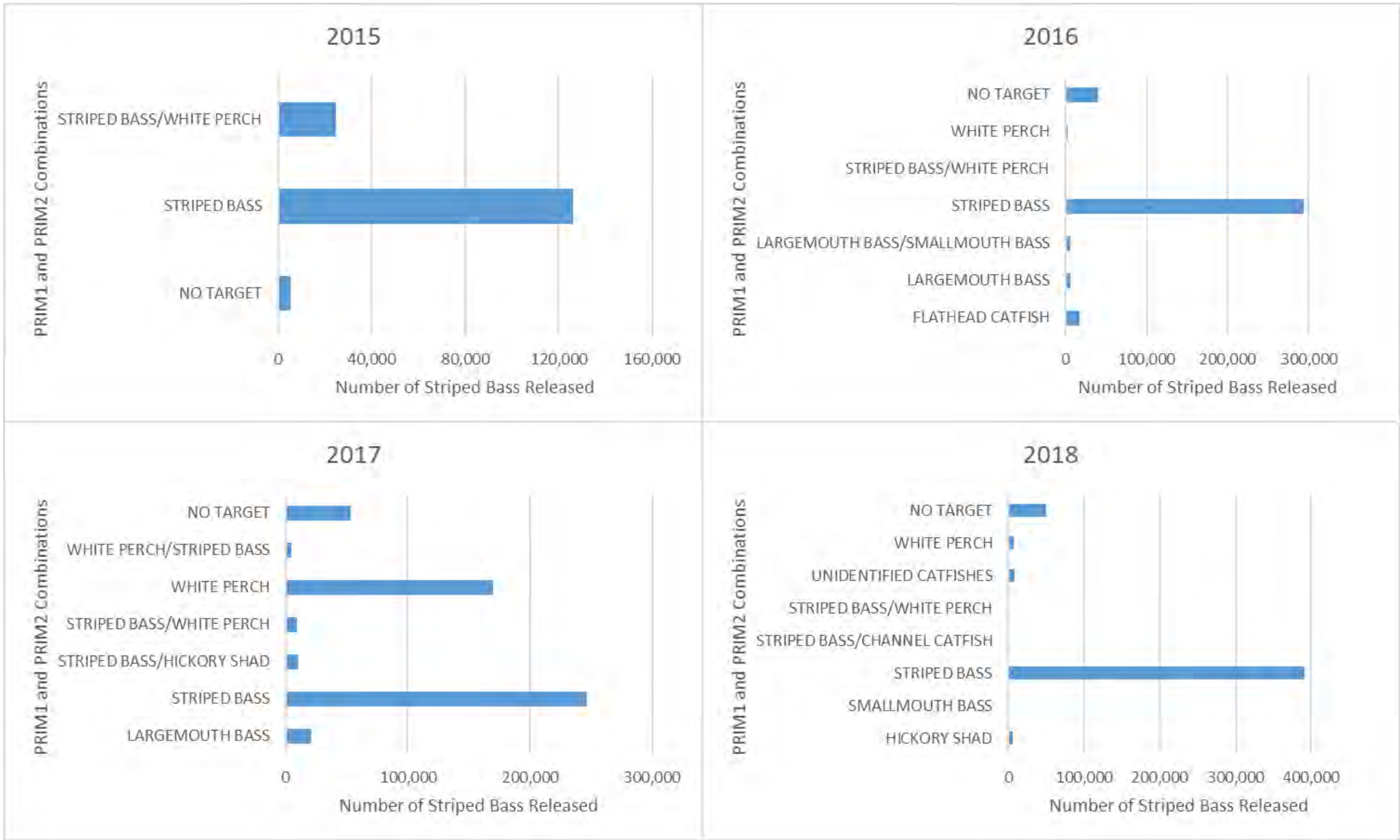

Figure 1. Releases of striped bass in wave 2 by target species (PRIM1/PRIM2) from 2015-2018.

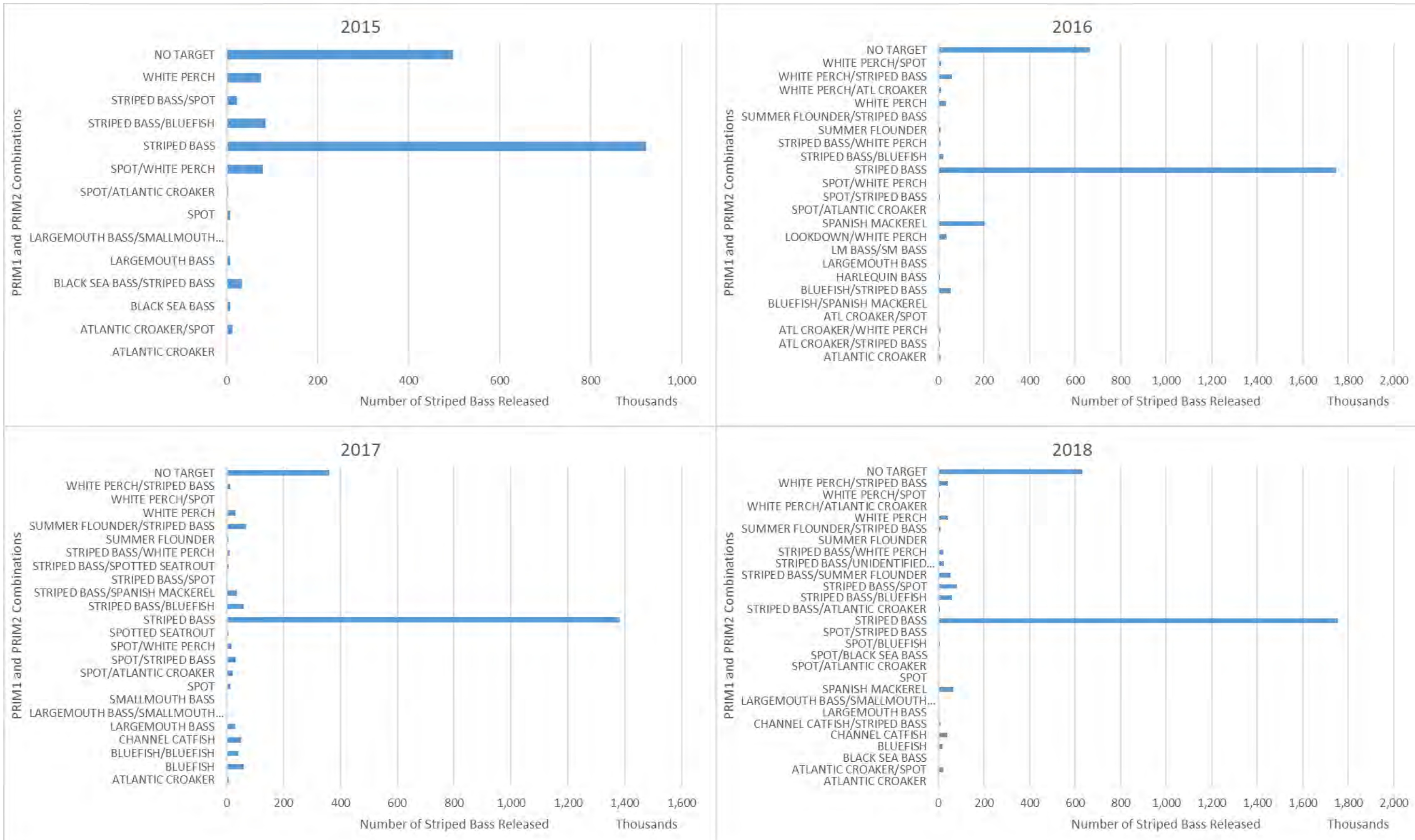

Figure 2. Releases of striped bass in wave 4 by target species (PRIM1/PRIM2) from 2015-2018.

<u>Atlantic Striped Bass Addendum VI Implementation Plan for the Potomac River</u>

Prepared for the
Atlantic States Marine Fisheries Commission
November 2019 - Revised

Potomac River Fisheries Commission
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Potomac River Fisheries Commission Addendum VI Implementation Plan for Atlantic Striped Bass

Summary of Proposed Conservation Equivalency Measures

Option #1 Recreational Fishery – 20.5% reduction (MDNR calculations)

Jurisdiction	Size Limits	Bag Limits	Other	Open Season
Potomac River Spring Season	**35" TL min**	**1 fish/person/day (incl. charter capt)**	**Downstream of Rt. 301 Bridge**	**May 1 – 15**
Potomac River Summer/Fall Fishery	**20" min**	**2 fish/person/day**	**No direct targeting during closed season**	**May 16 – July 6 Aug. 21 - Dec. 31**

Option #2 Recreational Fishery – 20.5% reduction (MDNR calculations)

Jurisdiction	Size Limits	Bag Limits	Other	Open Season
Potomac River Spring Season	**35" TL min**	**1 fish/person/day (incl. charter capt)**	**Downstream of Rt. 301 Bridge**	**May 1 – 15**
Potomac River Summer/Fall Fishery	**20" min**	**2 fish/person/day**		**May 16 - June 30 Sept. 1 - Dec. 31**

Option #3 Recreational Fishery – 20.5% reduction (VMRC calculations)

Jurisdiction	Size Limits	Bag Limits	Other	Open Season
Potomac River Spring Season	**35" TL min**	**1 fish/person/day (incl. charter capt)**	**Downstream of Rt. 301 Bridge**	**May 1 – 15**
Potomac River Fall Fishery	**20" min**	**2 fish/person/day**		**Aug. 8 - Dec. 31**

Option #4 Recreational Fishery – 20.5% reduction (VMRC calculations)

Jurisdiction	Size Limits	Bag Limits	Other	Open Season
Potomac River Spring Season	**35" TL min**	**1 fish/person/day (incl. charter capt)**	**Downstream of Rt. 301 Bridge**	**May 1 – 15**
Potomac River Fall Fishery	**20" min**	**2 fish/person/day**		**May 16 – July 6 Nov. 18 - Dec. 31**

Commercial Fishery – 1.8% reduction from 2017 quota = 572,861 lbs

Jurisdiction	Size Limits	Seasonal Quota	Open Season
Potomac River	**18" min 18" min / 36" max 18" min**	**GN – 349,405 lbs**	**Jan. 1 – Feb. 14 Feb. 15 – Mar. 25 Nov. 9 – Dec. 31**
	18" min / 36" max 18" min	**PN – 127,748 lbs**	**Feb. 15 – Mar. 25 June 1 – Dec. 15**
	18" min 18" min / 36" max 18" min	**HL – 81,959 lbs**	**Jan. 1 – Feb. 14 Feb. 15 – Mar. 25 June 1 – Dec. 31**
	18" min / 36" max 18" min	**Misc – 13,749 lbs**	**Feb. 15 – Mar. 25 June 1 – Dec. 15**

Section 1: Coastal Recreational Fishery – N/A

Section 2: Chesapeake Bay Recreational Fishery (PRFC)

Option #1 Conservation Equivalency (MDNR calculations)

Under this option, PRFC would delay the start of the spring trophy season to May 1 rather than the 3rd Saturday of April, and it would continue to close on May 15 (forfeit 13 days). The minimum size would remain at 35". PRFC's resident summer/fall fishery would start on May 16 and run through December 31, with a closure from July 7– August 20 (forfeit 45 days). The minimum size would remain at 20". During the July and August closure, no direct targeting of striped bass would be allowed.

- Using Maryland's calculations, PRFC's target reduction for the recreational fishery is 20.5% to account for the commercial sector taking a 1.8% reduction in the 2017 quota.
- Maryland's 2015-2018 average inland harvest and releases by wave were used for the calculations due to the calculations mostly involving seasonal closures. Maryland's removals were used as a proxy for PRFC removals given similar fishery regulations (seasons and size limits).
- By starting the spring trophy season on May 1, no harvest is expected in wave 2. This decreases the harvested fish by 84,874 fish, on average, which is estimated to be a 4.2% reduction in total removals.
- PRFC is proposing to close the season from July 7 – August 20. By dividing the average Maryland wave 4 harvest estimate (330,162 fish) by 62 days (the number of days in wave 4), we estimate each day closure will reduce harvest by 5,325 fish. A 45 day closure will reduce harvest by 239,634 fish (5,325.1935 x 45).
- PRFC would not allow the direct targeting of striped bass during the July and August closure; however, we expect that some striped bass releases will still occur. To estimate how much discards could decrease, we used 2015-2018 MRIP catch and trip data and calculated the average reduction of striped bass releases in Maryland using the combined method proposed by Maryland for their proposal. Under this methodology, we assumed trips that were only targeting striped bass (e.g. no other species were targeted) would no longer release any striped bass. If striped bass were targeted with a second species, these trips would still release striped bass but at a lower non-targeted rate. Additionally, all striped bass releases from non-targeted trips would still occur as estimated by MRIP. For 2015-2018, releases in wave 4 were estimated to be reduced 59.2%, on average. Assuming this remains constant in 2020, we estimate that each day of closure will reduce the releases by 23,512 fish ((2,461,146/62) x 0.5923). Multiplying 23,512 fish by 45 days, this reduces the number of releases by 1,058,035 fish.
- Combining all of these measures using the Maryland data, PRFC estimates that the total removals will be decreased by 20.7%.

Option #2 Conservation Equivalency (MDNR calculations)

Under this option, PRFC would delay the start of the spring trophy season to May 1 rather than the 3rd Saturday of April, and it would continue to close on May 15 (forfeit 13 days). The minimum size would remain at 35". PRFC's resident summer/fall fishery would start on May 16 and run through December 31, with a closure for all of wave 4 (July and August) (forfeit 62 days). The minimum size would remain at 20".

- Using Maryland's calculations, PRFC's target reduction for the recreational fishery is 20.5% to account for the commercial sector taking a 1.8% reduction in the 2017 quota.
- Maryland's 2015-2018 average inland harvest and releases by wave were used for the calculations due to the calculations mostly involving seasonal closures. Maryland's removals were used as a proxy for PRFC removals given similar fishery regulations (seasons and size limits).
- By starting the spring trophy season on May 1, no harvest is expected in wave 2. This decreases the harvested fish by 84,874 fish, on average, which is estimated to be a 4.2% reduction in total removals.
- PRFC is proposing to close the summer season for all of wave 4. Removal of the average Maryland wave 4 harvest estimate (330,162 fish) is estimated to reduce total removals by 16.3%.
- Using the Maryland data as a proxy for PRFC's landings and combining all of these measures, PRFC estimates that the total removals will be decreased by 20.5%.

Option #3 Conservation Equivalency (VMRC calculations)

Under this option, PRFC would delay the start of the spring trophy season to May 1 rather than the 3rd Saturday of April, and it would continue to close on May 15 (forfeit 13 days). The minimum size would remain at 35”. PRFC’s resident summer/fall fishery would start on August 8 and run through December 31 (forfeit 84 days). The minimum size would remain at 20”.

This proposal meets the data standards established by the TC because daily harvest rates and total releases in the Potomac River are estimated from MRIP using a four-year average (2015-2018). VMRC used expanded harvest and release estimates from MRIP intercept sites on the Potomac River in the analysis. Sample size included: 2015 – 43 intercepted trips; 2016 – 101 intercepted trips; 2017 – 83 intercepted trips; and 2018 – 77 intercepted trips. A total of 53 intercept sites are located on the Potomac River using Lat/Long and intercept sites.

VMRC used a daily average (2015-2018) harvest rate to estimate the savings from reduced season days by wave-period. The spring trophy season (3rd Saturday of april through May 15) was considered its own wave since the possession limit (1-fish) and recreational minimum size limit (35”) is different than the recreational Summer/Fall season. All other wave periods are broken down as follows: May 16 through June 30, July through August, September through October, and November through December. Excel spreadsheet is attached. Reductions to recreational season days and an 1.8% reduction in commercial quota represent an 18% reduction in total removals relative to 2017 PRFC removal levels.

Option #4 Conservation Equivalency (VMRC calculations)

Under this option, PRFC would delay the start of the spring trophy season to May 1 rather than the 3rd Saturday of April, and it would continue to close on May 15 (forfeit 13 days). The minimum size would remain at 35”. PRFC’s resident summer/fall fishery would start on May 16 through July 6, and reopen November 18 through December 31 (forfeit 134 days). The minimum size would remain at 20”.

This proposal meets the data standards established by the TC because daily harvest rates and total releases in the Potomac River are estimated from MRIP using a four-year average (2015-2018). VMRC used expanded harvest and release estimates from MRIP intercept sites on the Potomac River in the analysis. Sample size included: 2015 – 43 intercepted trips; 2016 – 101 intercepted trips; 2017 – 83 intercepted trips; and 2018 – 77 intercepted trips. A total of 53 intercept sites are located on the Potomac River using Lat/Long and intercept sites.

VMRC used a daily average (2015-2018) harvest rate to estimate the savings from reduced season days by wave-period. The spring trophy season (3rd Saturday of April through May 15) was considered its own wave since the possession limit (1-fish) and recreational minimum size limit (35”) is different than the recreational Summer/Fall season. All other wave periods are broken down as follows: May 16 through June 30, July through August, September through October, and November through December. Excel spreadsheet is attached. Reductions to recreational season days and an 1.8% reduction in commercial quota represent an 18% reduction in total removals relative to 2017 PRFC removal levels.

Section 3: Coastal Commercial Fishery – N/A

Section 4: Chesapeake Bay Commercial Fishery (PRFC)

4a.) The Potomac River Fisheries Commission’s 2017 commercial quota was 583,362 pounds. Instead of the 18% reduction as required in Addendum IV, the Potomac River Fisheries Commission decided to adopt a conservation equivalency measure and approved a 1.8% reduction, resulting in a 2020 commercial quota of 572,861 pounds. As in the past, the gill net fishery will operate from January 1 through February 14, 2020 with an 18” minimum size limit; February 15 through March 25, 2020 with an 18 – 36” slot limit; and reopen November 9 through December 31, 2020 with an 18” minimum size limit. The pound net and miscellaneous (haul seine and fyke net) fisheries will operate from February 15 through March 25, 2020 with an 18 – 36" slot limit, and from June 1 through December 15, 2020 with an 18" minimum size limit. The hook & line fishery will operate from January 1 through February 14, 2020 with an 18" minimum size limit; February 15 through March 25, 2020 with an 18 – 36" slot limit, and from June 1 through December 31, 2020 with an 18" minimum size limit.

PRFC intends to reduce the commercial quota by 1.8% and have the remainder of the required reductions be taken by the recreational sector. See the "Convert Comm Lbs to #s 16 & 17" and "2017 MRIP & % redux Rec Takes" tabs in the Maryland Excel file for the calculations.

- The average weight of commercially harvested fish in 2016 and 2017 (weighted by number) in Maryland was used in order to convert the difference in pounds to numbers of fish. Commercially harvested fish were sampled at striped bass check stations. In 2016 and 2017, a total of 11,014 fish were measured and weighed. Using the annual compliance report spreadsheet, the 2016-2017 N weighted average weight was 5.24 pounds.
- Given the difference between the 18% quota (1,471,888 pounds) and the 1.8% reduced quota (1,445,394 pounds), the recreational sector will have to make up for 238,446 pounds which is equivalent to 45,478 fish (238,446/5.24).
- An 18% reduction from Maryland's 2017 recreational total removals (1,792,579 fish) results in a reduction of 322,664 fish from the recreational sector. Adding 45,478 more fish to this number means that Maryland's recreational fishery will have to reduce total removals by 368,142 fish, and overall reduction of 20.5%.

Section 5: Circle Hook Requirements

In order to comply with the circle hook requirement, the PRFC proposes to initiate angler education beginning in 2020 and continuing in perpetuity going forward. Angler education will be achieved by providing resources to educate anglers on the technical benefits of circle hooks, and methodologies for their proper use. Strategies to deliver this information to anglers will include (but not be limited to):

- Development of website content
- Social media content (Facebook, Instagram and Twitter)
- Development and dissemination of literature (brochures and other handouts)
- Presentations at PRFC Finfish Advisory Committee meetings
- Outreach to fishing clubs and events (fishing expositions and fairs)
- Providing samples of non offset circle hooks (contingent upon funding)

Section 6: Timeline for Implementation

PRFC plans to implement proposed measures prior to the start of the 2020 fishing season for each sector. Addendum VI requires the mandatory use of circle hooks when fishing with bait, effective in 2021. In order to comply with this, Law Enforcement officers (Maryland Natural Resources Police and Virginia Marine Resources Commission) on the Potomac River will be provided with educational handouts and will begin interacting with fishermen on the water in 2020 to let them know the use of circle hooks, when fishing for striped bass with bait, will be mandatory in 2021. PRFC will scope regulatory language in 2020, and adopt regulations to comply with the Addendum's circle hook requirements, effective January 1, 2021.

Washington DC - Atlantic Striped Bass Addendum VI Implementation Plan

Implementation Plans are due November 30, 2019

Please use the following template when submitting implementation plans. Please be as concise as possible and use bullets to ensure inclusion of all important information. This template references data standards established by the Technical Committee (TC) and detailed in the TC memo (M19-084).

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Washington DC	**18**	**1**		**May 16-Dec 31**

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season

Section 1: Coastal Recreational Fishery

1a.) A one fish bag limit and a slot size limit of 28" minimum size to less than 35" total length may be implemented for the ocean fishery without further analysis. The same fishing seasons as in 2017 is required.

OR

1b.) A conservation equivalency (CE) proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required.

If submitting CE, please address the following questions,

- What is your state proposing for a conservation equivalency measure?
- Does your proposal meet the data standards established by the TC?
- What data sources are used in the analysis (include mode or season specific if applicable)?
- Sample size summary by mode, season, or state and/or data source as applicable.
- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.

Note: Whether implementing 1a or 1b, please indicate the open and close dates of a season. Also specify if regulations are different by geographical area if applicable (e.g., ocean, bay, river) and the specific season dates of those areas. Also, more conservative regulations may be implemented without pursuing CE. Please contact Max Appelman mappelman@asmfc.org to confirm that proposed measures are more conservative.

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)

3a.) Implementation of a one fish bag limit and an 18" minimum size limit for the Chesapeake Bay fishery may be implemented without further analysis.

The District will implement a 18" minimum size limit with a one fish bag limit.

OR

3b.) A CE proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required. Please follow the outline as described in Section 1.

Section 3: Coastal Commercial Fishery

2a.) Implementation of an 18% reduction from the Addendum IV quotas. The reduced quotas in Addendum VI account for previously approved CE programs, therefore, states do not need to submit for CE if they choose to maintain 2017 size limits in its commercial fisheries.

OR

2b.) If a state chooses to modify 2017 size limits, the state needs to submit a CE proposal adjusting its quota relative to the new Addendum VI quota baseline (i.e., 18% reduction from the quota as listed in Addendum IV).

Note: Whether implementing 2a or 2b, please include a list of commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type). Also, please be brief when submitting commercial fishery CE proposals and follow a similar outline as described in Section 1.

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)

4a.) Implementation of an 18% reduction from the Addendum IV Chesapeake Bay commercial quota. After this reduction, the total Chesapeake Bay commercial quota amounts to 2,558,603 lbs. Please indicate what your state/jurisdictions commercial quota will be for 2020, and the commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type).

Section 5: Circle Hook Requirements

Provide draft regulatory language and/or briefly describe the process the state/jurisdiction is taking to develop appropriate regulations. Please also briefly describe the public education and outreach campaigns the state/jurisdiction will develop to promote awareness and compliance with a circle hook requirement.

The District is currently working on drafting regulatory language for the circle hook requirement. The District recently approved a Fisheries Omnibus Regulation that should be put into effect on January 1, 2020 that will allow the DOEE Fisheries and Wildlife Division to quickly make changes to regulation that will be effective immediately upon approval and announcement from the Director of DOEE.

The District is going to use the 2020 season as an education and outreach year. The District is considering making the circle hook requirement mandatory for all species where a hook size 1/0 or larger is used. The education will be conducted through two activities that are regularly conducted within the District: the spring and summer creel survey as well as weekly enforcement education and outreach conducted by law enforcement.

Section 6: Timeline for Implementation

Briefly describe the timeline for implementation of management measures as well as the start of your state's fisheries relative to your proposed implementation date. **Note:** States are required to implement circle hook requirements by January 1, 2021. All other provisions of Addendum VI must be implemented by April 1, 2020.

The District will implement the size and bag limit regulations by the start of the 2020 striped bass fishing season. The circle hook requirement will be implemented on January 1, 2021 after a year of education and outreach in 2020.

Atlantic Striped Bass Addendum VI Implementation Plan for Virginia

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Virginia (Chesapeake Bay)	**20"-36"**	**1**	**Removed Spring Trophy Season**	**May 16 –June 15, October 4 – December 31**
Virginia (Ocean)	**28"-36"**	**1**	**Removed Spring Trophy Season**	**January 1 – March 31, May 16 – December 31**

Commercial Fishery

State	Size Limits	Seasonal Quota	Other	Open Season
Virginia (Chesapeake Bay)	**18" minimum, 28 maximum (March 15 – June 15) 11 days added to commercial max size limit season (formerly March 26 – June 15)**	**983,393 pounds (7.66% reduction in Add. IV baseline quota)**	**7" commercial maximum mesh size for gill nets in the Chesapeake Bay.**	**January 16 – December 31**
Virginia (Ocean)	**28" minimum**	**125,034 pounds (9.81% reduction in Add. IV baseline quota)**	**9" commercial maximum mesh size for gill nets on the coast**	**January 16 – December 31**

Section 1: Coastal Recreational Fishery

1a.) A one fish bag limit and a slot size limit of 28" minimum size to less than 35" total length may be implemented for the ocean fishery without further analysis. The same fishing seasons as in 2017 is required.

OR

1b.) A conservation equivalency (CE) proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required.

If submitting CE, please address the following questions,

- What is your state proposing for a conservation equivalency measure?
  - Virginia is proposing a 36" recreational maximum size limit (28"-36") instead of a 35" recreational maximum size limit on the coast.

- Does your proposal meet the data standards established by the TC?
  - Yes, Virginia implemented a 36" recreational maximum size limit on the coast to keep recreational maximum size limits consistent with recreational maximum size limits in Virginia's portion of the Chesapeake Bay (20"-36"). Total removals on the coast were provided from MRIP (2017). In 2016, no striped bass were recreationally harvested (A+B1) from VA coastal waters. In 2017, a total of 98 fish were harvested (A+B1) and 76,147 fish were released alive (B2) from Virginia's coast. All harvested fish (A+B1) from VA coastal waters in 2017 were 32" FL. Total coastal removals in 2017 (6,951 fish) is equal to the 2017 total coastal harvest (98 fish) plus 2017 total coastal dead discards (6,853 fish). Dead discards were estimated by applying a 9% hooking mortality to the number of coastal releases in 2017.

- What data sources are used in the analysis (include mode or season specific if applicable)?
  - 2017 MRIP total harvest and release estimates from ocean waters (All modes combined).

- Sample size summary by mode, season, or state and/or data source as applicable.
  - Total 2017 coastal harvest and release estimates (numbers of fish) in Virginia were provided from MRIP. Sample sizes are not applicable for total removals by area.

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
  - Coastal removals in 2020 would remain unchanged relative to 2017 removal levels.

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
  - See tables 1-3 at bottom of the document and attached spreadsheet

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - <u>See tables 1-3 at bottom of the document and attached spreadsheet.</u>

Note: Whether implementing 1a or 1b, please indicate the open and close dates of a season. Also specify if regulations are different by geographical area if applicable (e.g., ocean, bay, river) and the specific season dates of those areas. Also, more conservative regulations may be implemented without pursuing CE. Please contact Max Appelman mappelman@asmfc.org to confirm that proposed measures are more conservative.

<u>Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)</u>

3a.) Implementation of a one fish bag limit and an 18" minimum size limit for the Chesapeake Bay fishery may be implemented without further analysis.

OR

3b.) A CE proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required. Please follow the outline as described in Section 1.

- What is your state proposing for a conservation equivalency measure?
    - <u>Virginia is proposing to maintain current minimum size limits in the Chesapeake Bay (minimum size limit = 20" TL) , implement a 36" recreational maximum size limit and lower the recreational possession limit from two to one-fish per angler.</u>

- Does your proposal meet the data standards established by the TC?
    - <u>Yes, all data are provided through MRIP (2017).</u>

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - <u>2017 MRIP Inland Harvest and releases (all modes combined).</u>

- Sample size summary by mode, season, or state and/or data source as applicable.
    - <u>Summary data provided from MRIP. Sample sizes are not applicable for total removals by area</u>

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - <u>I used the same bag limit analysis for Chesapeake Bay options in Draft Addendum VI, specific to VA Inland intercepts only.</u>

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.

- See tables 1-3 at the bottom of the document and attached spreadsheet.

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - All reductions in Chesapeake Bay removals are estimated from lowering the bag limit from 2 to 1-fish per angler. Recreational maximum size limits (36") in the Chesapeake Bay are not included in savings.

Section 3: Coastal Commercial Fishery

2a.) Implementation of an 18% reduction from the Addendum IV quotas. The reduced quotas in Addendum VI account for previously approved CE programs, therefore, states do not need to submit for CE if they choose to maintain 2017 size limits in its commercial fisheries.

OR

2b.) If a state chooses to modify 2017 size limits, the state needs to submit a CE proposal adjusting its quota relative to the new Addendum VI quota baseline (i.e., 18% reduction from the quota as listed in Addendum IV).

Note: Whether implementing 2a or 2b, please include a list of commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type). Also, please be brief when submitting commercial fishery CE proposals and follow a similar outline as described in Section 1.

- What is your state proposing for a conservation equivalency measure?
    - Virginia is proposing to lower the coastal commercial quota by 9.81%, relative to baseline Addendum IV coastal quota in Virginia. Virginias revised coastal commercial quota for 2020 will be 125,034 pounds (previously 138,640 pounds).

- Does your proposal meet the data standards established by the TC?
    - Yes, commercial landings are provided from ASMFC compliance reports.

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - ASMFC compliance reports and SAW 66 discard mortality estimates from the coast.

- Sample size summary by mode, season, or state and/or data source as applicable.
    - Not applicable

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - I used revised recreational removal estimates in 2020 to estimate the commercial removal target in 2020 that would achieve an 18% reduction in total removals (sectors combined) relative to 2017 removal levels. The necessary reduction in

coastal commercial removals was applied to the average 2017 coastal commercial weight to lower the coastal commercial quota.

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
  - See tables 1-3 at the bottom of the document and attached spreadsheet.

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
  - See tables 1-3 at the bottom of the document and attached spreadsheet. Implementing commercial gill net maximum mesh size restrictions on the coast (9" max mesh size) was not counted towards reductions in coastal commercial removals. Instead, coastal removals were adjusted through reductions in coastal commercial quota.

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)

4a.) Implementation of an 18% reduction from the Addendum IV Chesapeake Bay commercial quota. After this reduction, the total Chesapeake Bay commercial quota amounts to 2,558,603 lbs. Please indicate what your state/jurisdictions commercial quota will be for 2020, and the commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type).

- What is your state proposing for a conservation equivalency measure?
  - Virginia is proposing to lower the Chesapeake Bay commercial quota by 7.66%, relative to baseline addendum IV Chesapeake Bay quota in Virginia. Virginias revised Chesapeake Bay commercial quota for 2020 will be 983,393 pounds (previously 1,064,997 pounds).
- Does your proposal meet the data standards established by the TC?
  - Yes, commercial landings are provided from ASMFC compliance reports.

- What data sources are used in the analysis (include mode or season specific if applicable)?
  - ASMFC compliance reports and SAW 66 discard mortality estimates from the Chesapeake Bay.

- Sample size summary by mode, season, or state and/or data source as applicable.
  - Not applicable

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).

- Virginia used revised recreational removal estimates in 2020 to estimate the commercial removal target in 2020 that would achieve an 18% reduction in total removals (sectors combined) relative to 2017 removal levels. The reduction in commercial Chesapeake Bay removals was applied to the average 2017 commercial Chesapeake Bay weight to lower the Chesapeake Bay commercial quota.

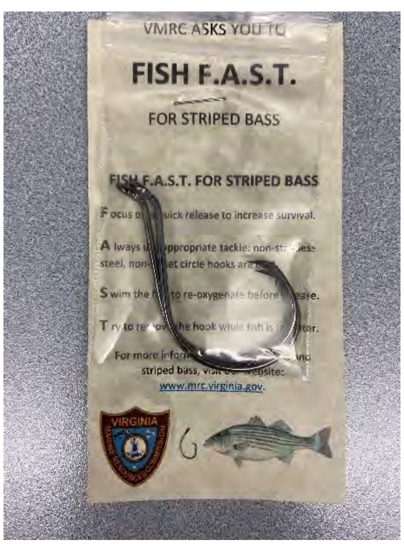
- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - See tables 1-3 at the bottom of the document and attached spreadsheet

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - See tables 1-3 at the bottom of the document and attached spreadsheet. Implementing commercial gill net maximum mesh size restrictions in the Chesapeake Bay (7" max mesh size) was not counted towards reductions towards Chesapeake Bay commercial removals. Instead, Chesapeake Bay removals were adjusted through reductions in the Chesapeake Bay commercial quota.

Section 5: Circle Hook Requirements

Provide draft regulatory language and/or briefly describe the process the state/jurisdiction is taking to develop appropriate regulations. Please also briefly describe the public education and outreach campaigns the state/jurisdiction will develop to promote awareness and compliance with a circle hook requirement.

Virginia will be distributing circle hooks in 2020 from hook donations received from ASMFC (meetings, events, etc.). In addition, Virginia will be promoting the use of circle hooks in 2020 on our website and social media. Virginia plans to make circle hooks mandatory prior to the start of the 2020 Chesapeake Bay Fall Season. Regulatory language is not available at this time.



Section 6: Timeline for Implementation

Briefly describe the timeline for implementation of management measures as well as the start of your state's fisheries relative to your proposed implementation date. **Note:** States are required to implement circle hook requirements by January 1, 2021. All other provisions of Addendum VI must be implemented by April 1, 2020.

- Virginia has already implemented recreational measures for the 2019 fishing season. Adjustments to Virginia's Chesapeake Bay and coastal commercial quotas were approved by our Commission on November 26, 2019 with an effective date of December 1 for the 2020 commercial fishing season.

Table 1. Total Removals (numbers of fish) of Striped Bass in Virginia, by Sector, in 2017.

Virginia Removals (2017)	Removals (numbers of fish) from the Chesapeake Bay	Removals (numbers of fish) from the Coast	Total Removals (numbers of fish)	Total Removals (%)
2017 Va. Recreational Removals	223,385	6,951	230,336	61.73%
2017 Va. Commercial Removals	134,620	8,193	142,813	38.27%
2017 Va. Total Removals	358,005	15,144	373,149	100.00%

18% reduction from 2017 Virginia total removals	**305,982** ←	2017 Virginia total removals (373,149 fish) lowered by **18%**

Table 2. Total Revised Removals of Striped Bass, by Sector, in 2020

Sectors	Numbers of fish	Sector - specific reductions in 2020	
Recreational revised removals (2020)	176,545	**-23.35%**	← Bag limit reduction (%)
Commercial revised removals (2020)	129,437	**-9.37%**	
Adjusted removals from 2017 (18% reduction)	**305,982**		

Table 3. Revised Virginia Chesapeake Bay and Coastal Commercial Quotas in 2020

Reductions to the Commercial Sector	Chesapeake Bay Area	Coastal Area	Total
Reduction in numbers of fish (9.37% x 2017 Removals)	12,608	767	13,376
Reduction in pounds of fish (avg. weight * no. fish)	81,604	13,606	95,210
Revised 2020 quota (pounds)	983,393	125,034	1,108,427
% change relative to 2019 quota	**-7.66%**	**-9.81%**	**-7.91%**

Atlantic Striped Bass Addendum VI Implementation Plan for Virginia

Summary of Proposed Measures (Option 2)

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
Virginia (Chesapeake Bay)	20”-36”, 1 fish per person per year >36” with special permit	1	Removed Spring Trophy Season	May 16 –June 15, October 4 – December 31
Virginia (Ocean)	28”-36”, 1 fish per person per year >36” with special permit	1	Removed Spring Trophy Season	January 1 – March 31, May 16 – December 31

Commercial Fishery

State	Size Limits	Seasonal Quota	Other	Open Season
Virginia (Chesapeake Bay)	18” minimum, 28 maximum (March 15 – June 15) 11 days added to commercial max size limit season (formerly March 26 – June 15)	983,393 pounds (7.66% reduction in Add. IV baseline quota)	7” commercial maximum mesh size for gill nets in the Chesapeake Bay.	January 16 – December 31
Virginia (Ocean)	28” minimum	125,034 pounds (9.81% reduction in Add. IV baseline quota)	9” commercial maximum mesh size for gill nets on the coast	January 16 – December 31

Section 1: Coastal Recreational Fishery

1a.) A one fish bag limit and a slot size limit of 28" minimum size to less than 35" total length may be implemented for the ocean fishery without further analysis. The same fishing seasons as in 2017 is required.

OR

1b.) A conservation equivalency (CE) proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required.

If submitting CE, please address the following questions,

- What is your state proposing for a conservation equivalency measure?
    - Virginia is proposing a 36" recreational maximum size limit (28"-36") instead of a 35" recreational maximum size limit on the coast. However, anglers can harvest 1 fish per year greater than 36" with a special permit.

- Does your proposal meet the data standards established by the TC?
    - Yes, Virginia implemented a 36" recreational maximum size limit on the coast to keep recreational maximum size limits consistent with recreational maximum size limits in Virginia's portion of the Chesapeake Bay (20"-36"). Total removals on the coast were provided from MRIP (2017). In 2016, no striped bass were recreationally harvested (A+B1) from VA coastal waters. In 2017, a total of 98 fish were harvested (A+B1) and 76,147 fish were released alive (B2) from Virginia's coast. All harvested fish (A+B1) from VA coastal waters in 2017 were 32" FL. Total coastal removals in 2017 (6,951 fish) is equal to the 2017 total coastal harvest (98 fish) plus 2017 total coastal dead discards (6,853 fish). Dead discards were estimated by applying a 9% hooking mortality to the number of coastal releases in 2017.

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - 2017 MRIP total harvest and release estimates from ocean waters (All modes combined).

- Sample size summary by mode, season, or state and/or data source as applicable.
    - Total 2017 coastal harvest and release estimates (numbers of fish) in Virginia were provided from MRIP. Sample sizes are not applicable for total removals by area.

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - Coastal removals in 2020 would remain unchanged relative to 2017 removal levels.

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - See tables 1-3 at bottom of the document and attached spreadsheet

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - See tables 1-3 at bottom of the document and attached spreadsheet.

Note: Whether implementing 1a or 1b, please indicate the open and close dates of a season. Also specify if regulations are different by geographical area if applicable (e.g., ocean, bay, river) and the specific season dates of those areas. Also, more conservative regulations may be implemented without pursuing CE. Please contact Max Appelman mappelman@asmfc.org to confirm that proposed measures are more conservative.

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)

3a.) Implementation of a one fish bag limit and an 18" minimum size limit for the Chesapeake Bay fishery may be implemented without further analysis.

OR

3b.) A CE proposal that achieves at least an 18% reduction from 2017 total recreational removals following the criteria established by the TC (see TC memo). If selecting this option, further analysis is required. Please follow the outline as described in Section 1.

- What is your state proposing for a conservation equivalency measure?
    - Virginia is proposing to maintain current minimum size limits in the Chesapeake Bay (minimum size limit = 20" TL) , implement a 36" recreational maximum size limit and lower the recreational possession limit from two to one-fish per angler. However, anglers can keep 1 fish greater than 36" per year with the use of a special permit.

- Does your proposal meet the data standards established by the TC?
    - Yes, all data are provided through MRIP (2017).

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - 2017 MRIP Inland Harvest and releases (all modes combined).

- Sample size summary by mode, season, or state and/or data source as applicable.
    - Summary data provided from MRIP. Sample sizes are not applicable for total removals by area

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).

- I used the same bag limit analysis for Chesapeake Bay options in Draft Addendum VI, specific to VA Inland intercepts only.

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - See tables 1-3 at the bottom of the document and attached spreadsheet.

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - All reductions in Chesapeake Bay removals are estimated from lowering the bag limit from 2 to 1-fish per angler. Recreational maximum size limits (36") in the Chesapeake Bay are not included in savings.

Section 3: Coastal Commercial Fishery

2a.) Implementation of an 18% reduction from the Addendum IV quotas. The reduced quotas in Addendum VI account for previously approved CE programs, therefore, states do not need to submit for CE if they choose to maintain 2017 size limits in its commercial fisheries.
OR
2b.) If a state chooses to modify 2017 size limits, the state needs to submit a CE proposal adjusting its quota relative to the new Addendum VI quota baseline (i.e., 18% reduction from the quota as listed in Addendum IV).

Note: Whether implementing 2a or 2b, please include a list of commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type). Also, please be brief when submitting commercial fishery CE proposals and follow a similar outline as described in Section 1.

- What is your state proposing for a conservation equivalency measure?
    - Virginia is proposing to lower the coastal commercial quota by 9.81%, relative to baseline Addendum IV coastal quota in Virginia. Virginias revised coastal commercial quota for 2020 will be 125,034 pounds (previously 138,640 pounds).

- Does your proposal meet the data standards established by the TC?
    - Yes, commercial landings are provided from ASMFC compliance reports.

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - ASMFC compliance reports and SAW 66 discard mortality estimates from the coast.

- Sample size summary by mode, season, or state and/or data source as applicable.
    - Not applicable

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - I used revised recreational removal estimates in 2020 to estimate the commercial removal target in 2020 that would achieve an 18% reduction in total removals (sectors combined) relative to 2017 removal levels. The necessary reduction in coastal commercial removals was applied to the average 2017 coastal commercial weight to lower the coastal commercial quota.

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - See tables 1-3 at the bottom of the document and attached spreadsheet.

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - See tables 1-3 at the bottom of the document and attached spreadsheet. Implementing commercial gill net maximum mesh size restrictions on the coast (9" max mesh size) was not counted towards reductions in coastal commercial removals. Instead, coastal removals were adjusted through reductions in coastal commercial quota.

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)

4a.) Implementation of an 18% reduction from the Addendum IV Chesapeake Bay commercial quota. After this reduction, the total Chesapeake Bay commercial quota amounts to 2,558,603 lbs. Please indicate what your state/jurisdictions commercial quota will be for 2020, and the commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type).

- What is your state proposing for a conservation equivalency measure?
    - Virginia is proposing to lower the Chesapeake Bay commercial quota by 7.66%, relative to baseline addendum IV Chesapeake Bay quota in Virginia. Virginias revised Chesapeake Bay commercial quota for 2020 will be 983,393 pounds (previously 1,064,997 pounds).
- Does your proposal meet the data standards established by the TC?
    - Yes, commercial landings are provided from ASMFC compliance reports.

- What data sources are used in the analysis (include mode or season specific if applicable)?
    - ASMFC compliance reports and SAW 66 discard mortality estimates from the Chesapeake Bay.

- Sample size summary by mode, season, or state and/or data source as applicable.

- o Not applicable

- Describe in one sentence how you did the analysis (e.g., used methods outlined in Greg Wojcik's spreadsheet, used SAS code provided by Mike Celestino, alternative analysis described briefly).
    - o Virginia used revised recreational removal estimates in 2020 to estimate the commercial removal target in 2020 that would achieve an 18% reduction in total removals (sectors combined) relative to 2017 removal levels. The reduction in commercial Chesapeake Bay removals was applied to the average 2017 commercial Chesapeake Bay weight to lower the Chesapeake Bay commercial quota.

- Provide a table of results as presented in Greg Wojcik's spreadsheet or equivalent spreadsheet that is comparable with your analysis.
    - o See tables 1-3 at the bottom of the document and attached spreadsheet

- Clearly identify that at least an 18% reduction in total removals is achieved from pooled 2016-2017 for all size-related analysis or pooled 2015-2018 data for seasonal and mode-based analyses.
    - o See tables 1-3 at the bottom of the document and attached spreadsheet. Implementing commercial gill net maximum mesh size restrictions in the Chesapeake Bay (7" max mesh size) was not counted towards reductions towards Chesapeake Bay commercial removals. Instead, Chesapeake Bay removals were adjusted through reductions in the Chesapeake Bay commercial quota.

Section 5: Circle Hook Requirements

Provide draft regulatory language and/or briefly describe the process the state/jurisdiction is taking to develop appropriate regulations. Please also briefly describe the public education and outreach campaigns the state/jurisdiction will develop to promote awareness and compliance with a circle hook requirement.

Virginia will be distributing circle hooks in 2020 from hook donations received from ASMFC (meetings, events, etc.). In addition, Virginia will be promoting the use of circle hooks in 2020 on our website and social media. Virginia plans to make circle hooks mandatory prior to the start of the 2020 Chesapeake Bay Fall Season. Regulatory language is not available at this time.

<u>Section 6: Timeline for Implementation</u>

Briefly describe the timeline for implementation of management measures as well as the start of your state's fisheries relative to your proposed implementation date. **Note:** States are required to implement circle hook requirements by January 1, 2021. All other provisions of Addendum VI must be implemented by April 1, 2020.

- <u>Virginia has already implemented recreational measures for the 2019 fishing season. Adjustments to Virginia's Chesapeake Bay and coastal commercial quotas were approved by our Commission on November 26, 2019 with an effective date of December 1 for the 2020 commercial fishing season.</u>

Table 1. Total Removals (numbers of fish) of Striped Bass in Virginia, by Sector, in 2017.

Virginia Removals (2017)	Removals (numbers of fish) from the Chesapeake Bay	Removals (numbers of fish) from the Coast	Total Removals (numbers of fish)	Total Removals (%)
2017 Va. Recreational Removals	223,385	6,951	230,336	61.73%
2017 Va. Commercial Removals	134,620	8,193	142,813	38.27%
2017 Va. Total Removals	358,005	15,144	373,149	100.00%

18% reduction from 2017 Virginia total removals **305,982**

2017 Virginia total removals (373,149 fish) lowered by **18%**

Table 2. Total Revised Removals of Striped Bass, by Sector, in 2020

Sectors	Numbers of fish	Sector - specific reductions in 2020
Recreational revised removals (2020)	176,545	**-23.35%**
Commercial revised removals (2020)	129,437	**-9.37%**
Adjusted removals from 2017 (18% reduction)	**305,982**	

Bag limit reduction (%)

Table 3. Revised Virginia Chesapeake Bay and Coastal Commercial Quotas in 2020

Reductions to the Commercial Sector	Chesapeake Bay Area	Coastal Area	Total
Reduction in numbers of fish (9.37% x 2017 Removals)	12,608	767	13,376
Reduction in pounds of fish (avg. weight * no. fish)	81,604	13,606	95,210
Revised 2020 quota (pounds)	983,393	125,034	1,108,427
% change relative to 2019 quota	**-7.66%**	**-9.81%**	**-7.91%**

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

STEPHEN W. MURPHEY
Director

North Carolina's Atlantic Striped Bass Addendum VI Implementation Plan

Summary of Proposed Measures

Recreational Fishery

State	Size Limits	Bag Limits	Other	Open Season
North Carolina	28-35 inches TL	1/person/day	N/A	Jan. 1-Dec. 31

Commercial Fishery

State	Size Limits	Seasonal Quota	Open Season
North Carolina	28 inches TL	295,495 pounds	Dec. 1-Nov. 30*

***Commercial fishery opened and closed via proclamation (not opened for the entire period)**

Section 1: Coastal Recreational Fishery

1a.) North Carolina will implement a one fish bag limit and a slot size limit of 28 inches to less than 35 inches total length and an open season from January 1 through December 31. These regulations only apply to NC's state ocean waters (estuarine fisheries are managed by NC since they are not a significant part of the coastal migratory stock).

Section 2: Chesapeake Bay Recreational Fishery (MD, VA, PRFC, DC)

N/A

Section 3: Coastal Commercial Fishery

Note: Whether implementing 2a or 2b, please include a list of commercial fishery management measures being implemented (including but not limited to size limits, seasons by gear type). Also, please be brief when submitting commercial fishery CE proposals and follow a similar outline as described in Section 1.

2a.) North Carolina will implement an 18% reduction from their Addendum IV quota, which is 295,495 pounds. The quota will be evenly distributed (~98,498 pounds) among the three target gear types: beach seines, gill nets and trawls. The minimum size limit for the commercial fishery will remain 28 inches total length. The gear requirements for the commercial striped bass fisheries will also remain the same. The gear-specific seasons will open and close via proclamation authority from December 1 to November 30 (the fishery will not remain open the entire period; it is typically prosecuted from December through February and is closed by proclamation). Possession limits will vary among fisheries and available quota. Fishermen are required to possess an Atlantic Ocean Striped Bass Commercial Gear Permit and dealers must possess an Atlantic Ocean Striped Bass Dealer Permit, tag all striped bass with commercial tags at the point of landing, and report landings daily on quota monitor logs that are sent to the NC Division of Marine Fisheries.

These regulations only apply to NC's state ocean waters (estuarine fisheries are managed by NC since they are not a significant part of the coastal migratory stock).

Section 4: Chesapeake Bay Commercial Fishery (MD, VA, PRFC)

N/A

Section 5: Circle Hook Requirements

North Carolina will implement the circle hook requirement for its recreational striped bass fishery in the ocean via proclamation by no later than January 1, 2021. Consistent with Addendum VI, anglers possessing or fishing for striped bass with natural bait must use non-offset circle hooks. North Carolina Division of Marine Fisheries (NCDMF) staff will develop the specific circle hook regulation language in the coming months.

The NCDMF will continue to distribute ethical angler information to the public (http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=4426632&name=DLFE-141479.pdf) and will distribute circle hooks to anglers when available.

Section 6: Timeline for Implementation

Briefly describe the timeline for implementation of management measures as well as the start of your state's fisheries relative to your proposed implementation date. **Note:** States are required to implement circle hook requirements by January 1, 2021. All other provisions of Addendum VI must be implemented by April 1, 2020.

North Carolina will implement the 28-35-inch slot limit for its ocean recreational fishery via proclamation on January 1, 2020. This coincides with when striped bass are available in North Carolina's state waters.

North Carolina will manage its commercial fishery under the Addendum VI state quota starting on December 1, 2019 to coincide with the commercial quota season.

North Carolina will implement the circle hook requirement for its recreational striped bass fishery in the ocean via proclamation by no later than January 1, 2021.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

January 8, 2020

To: **Atlantic Striped Bass Management Board**

From: **Tina Berger, Director of Communications**

RE: **Advisory Panel Nomination**

Please find attached a nomination to the Atlantic Striped Bass Advisory Panel – Bob Humphrey, a commercial rod and reel fisherman and for-hire Captain from Maine. Please review this nomination for action at the next Board meeting.

If you have any questions, please feel free to contact me at (703) 842-0749 or tberger@asmfc.org.

Enc.

cc: Max Appelman

M19-94

ATLANTIC STRIPED BASS ADVISORY PANEL

Bolded names await approval by the Atlantic Striped Bass Management Board January 8, 2020

Maine
Vice-Chair - David Pecci (rec)
144 Whiskeag Road
Bath, ME
04530

Phone (o): (207) 442-8581
Phone (c): (207) 841-1444
FAX: (207) 442-8581
dave@obsessioncharters.com
Appt. Confirmed 5/23/02
Appt Reconfirmed 5/10

Bob Humphrey (comm. rod and reel/for-hire)
727 Poland Range Road
Pownal, ME 04069
Phone (day): 207.688.4966
Phone (eve): 207.688.4854
bob@humphrey.com

New Hampshire
Peter Whelan (rec)
100 Gates Street
Portsmouth, NH 03801
Phone (o): (603) 205-5318
Phone (h): (603) 427-0401
pawhelan@comcast.net
Appt. Confirmed 2/24/03
Appt Reconfirmed 5/10

Massachusetts
Douglas M. Amorello (comm. rod & reel)
68 Standish Street
Pembroke, MA 02359
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sashamysportfishing@gmail.com
Appt. Confirmed 3/23/11
Appt. Reconfirmed 8/18

Patrick Paquette (rec/for-hire/comm)
61 Maple Street
Hyannis, MA 02601
Phone: (781)771.8374
Email: basicpatrick@aol.com
Appt. Confirmed 8/16

Rhode Island
J. Edwin Cook (rec)
106 Briarbrook Drive
North Kingstown, RI 02852
Phone: (401) 885-0679
edcookcharters@cox.net
Appt. Confirmed 2/22/06
Appt Reconfirmed 5/10

Vacancy (rec)

Connecticut
Kyle Douton (rec/tackle shop owner)
5 Rockwell Street
Niantic, CT 06357
Phone (day): (860)739-7419
Phone (eve): (860)739-8899
FAX: (860)739-9208
kyle@jbtackle.com
Appt. Confirmed 5/13/14

Vacancy (rec)

New York
John G. McMurray (charter/conservation)
2887 Alfred Court
Oceanside, NY 11572
Phone: (718)791-2094
FAX: (212)362-4831
john@nycflyfishing.com
Appt. Confirmed 8/15/07

Vacancy (comm)

New Jersey
C. Louis Bassano, Chair
1725 West Central Avenue
Ortley Beach, New Jersey 08751
Phone (c): (908) 241-4852
FAX: (908) 241-6628
lbassano@comcast.net
Appt. Confirmed 10/15/01
Appt. Reconfirmed 2/9/06; 5/17/10; 4/14/14

Capt. Al Ristori (charterboat)
1552 Osprey Court
Manasquan Park, NJ 08736
Phone: (732) 223-5729
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cristori@aol.com
Appt. Confirmed 10/17/94
Appt. Reconfirmed 9/15/98; 9/15/02; 2/9/06; 5/17/10

Pennsylvania
John Pedrick (rec)
936 Langstroth Lane
Bensalem, PA 19020
Phone: (215) 633-6777
jjpedrick@verizon.net
Appt Confirmed 3/23/11

Delaware
Leonard Voss, Jr. (com)
2854 Big Oak Road
Smyrna, DE 19977
Phone: (302) 653-7999
Appt. Confirmed 4/21/94
Appt. Reconfirmed 7/27/99; 7/03 and 7/07

Steven Smith (rec)
59 Burnham Lane
Dover, DE 19901
Phone (day): (302)744-9140
Phone (eve): (302)674-5186
smithbait@verizon.net
Appt. Confirmed 10/23/18

Maryland
Vacancy – for-hire

David Sikorski (rec)
4637 Willowgrove Drive
Ellicot City, MD 21042
Phone: (443) 621-9186
FAX: (410) 772-5805
Davidsikorski@mac.com
Appt Confirmed 3/23/11

Virginia
Kelly Place (comm; reappted chair 10/2010)
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Phone (c): (757) 897-1009
FAX: (757) 259-9669
kelltron@aol.com
Appt. Confirmed 5/23/02
Appt Reconfirmed 5/06 and 5/10

William Edward Hall Jr. (rec)
PO Box 235
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Phone (eve): (757)894-0416
FAX: (757)854-0698
esangler@verizon.net
Appt. Confirmed 5/13/14

North Carolina
Riley W. Williams (com)
336 Selwin Road
Belvidere, NC 27919
Phone: (252) 312-8457
Appt. Confirmed 11/10/04
Appt Reconfirmed 11/08; 8/18

Vacancy (rec)

District of Columbia
Joe Fletcher (rec)
1445 Pathfinder Lane
McLean, VA 22101
Phone: (703) 356-9106
Email: jmfletcher@verizon.net
Appt. Confirmed 10/30/95
Appt. Reconfirmed 9/15/99; 9/03 and 9/07

Potomac Fisheries River Comm.
Kyle J. Schick (marina owner, seafood restaurateur, rec/com)
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PO Box 400
Colonial Beach, VA 22443
Phone (o): (804) 224-7230
Phone (c): (804) 761-1729

FAX: (804) 224-7232
Email: kyle@cbycmarina.com
Appt. Confirmed 8/15/07

ATLANTIC STATES MARINE FISHERIES COMMISSION

Advisory Panel Nomination Form

This form is designed to help nominate Advisors to the Commission's Species Advisory Panels. The information on the returned form will be provided to the Commission's relevant species management board or section. Please answer the questions in the categories (All Nominees, Commercial Fisherman, Charter/Headboat Captain, Recreational Fisherman, Dealer/Processor, or Other Interested Parties) that pertain to the nominee's experience. If the nominee fits into more than one category, answer the questions for all categories that fit the situation. **Also, please fill in the sections which pertain to All Nominees (pages 1 and 2). In addition, nominee signatures are required to verify the provided information (page 4), and Commissioner signatures are requested to verify Commissioner consensus (page 4). Please print and use a black pen.**

Form submitted by: Pat Keliher, Commissioner State: Maine
(your name)

Name of Nominee: Bob Humphrey

Address: 727 Poland Range Road

City, State, Zip: Pownal, ME 04069

Please provide the appropriate numbers where the nominee can be reached:

Phone (day): (207) 688-4966 Phone (evening): (207) 688-4854

FAX: ____________ Email: bob@bobhumphrey.com

FOR ALL NOMINEES:

1. Please list, in order of preference, the Advisory Panel for which you are nominating the above person.

   1. Striped Bass
   2. ____________
   3. ____________
   4. ____________

2. Has the nominee been found in violation of criminal or civil federal fishery law or regulation or convicted of any felony or crime over the last three years?

   yes________ no X

3. Is the nominee a member of any fishermen's organizations or clubs?

   yes ________ no X

   If "yes," please list them below by name.

4. What kinds (species) of fish and/or shellfish has the nominee fished for during the past year?

striped bass	tuna
groundfish	mackerel
sharks	

5. What kinds (species) of fish and/or shellfish has the nominee fished for in the past?

striped bass	sharks
bluefish	tuna
groundfish	sailfish

FOR COMMERCIAL FISHERMEN:

1. How many years has the nominee been the commercial fishing business? 2 years
2. Is the nominee employed only in commercial fishing? yes_______ no X
3. What is the predominant gear type used by the nominee? rod and reel
4. What is the predominant geographic area fished by the nominee (i.e., inshore, offshore)? offshore

FOR CHARTER/HEADBOAT CAPTAINS:

1. How long has the nominee been employed in the charter/headboat business? 22 years
2. Is the nominee employed only in the charter/headboat industry? yes _______ no_______

   If "no," please list other type(s)of business(es) and/occupation(s): Outdoor Writer, consulting biologist
3. How many years has the nominee lived in the home port community? 30 years

   If less than five years, please indicate the nominee's previous home port community.

FOR RECREATIONAL FISHERMEN:

1. How long has the nominee engaged in recreational fishing? 55 ________ years

2. Is the nominee working, or has the nominee ever worked in any area related to the fishing industry? yes x______ no ________

   If "yes," please explain.

I was a commercial salmon fisherman in Alaska in 1983 and a commercial tuna fisherman in Maine in 2018 and 2019

FOR SEAFOOD PROCESSORS & DEALERS:

1. How long has the nominee been employed in the business of seafood processing/dealing?
   ________________years

2. Is the nominee employed only in the business of seafood processing/dealing?

   yes ______ no x______ If "no," please list other type(s) of business(es) and/or occupation(s):

3. How many years has the nominee lived in the home port community? 30 ______ years

   If less than five years, please indicate the nominee's previous home port community.

FOR OTHER INTERESTED PARTIES:

1. How long has the nominee been interested in fishing and/or fisheries management? 55 ______ years

2. Is the nominee employed in the fishing business or the field of fisheries management?
   yes x_____ no ______

   If "no," please list other type(s) of business(es) and/or occupation(s):

FOR ALL NOMINEES:

In the space provided below, please provide the Commission with any additional information which you feel would assist us in making choosing new Advisors. You may use as many pages as needed.

Nominee Signature: ______________________ Date: 12/23/19

Name: Bob Humphrey
(please print)

COMMISSIONERS SIGN-OFF (not required for non-traditional stakeholders)

____
State Director

____
State Legislator

____
Governor's Appointee

Max Appelman

From: G2W2
Sent: Tuesday, November 12, 2019 10:15 AM
To: Max Appelman
Subject: FW: Menhaden quotas

-----Original Message-----
From: JPR [mailto:ricbuilds1@yahoo.com]
Sent: Friday, November 1, 2019 6:59 PM
To: G2W2 <G2W2@asmfc.org>
Subject: Menhaden quotas

It was a Good thing to hear people properly managing our national resources, and bounties.
It was a Pleasure
Jpr
John in Virginia

Sent from my iPhone

Max Appelman

From: G2W2
Sent: Tuesday, November 12, 2019 10:15 AM
To: Max Appelman
Subject: FW: Disappointed

Striped bass public comment

From: Patrick Perrotto [mailto:patrickperrotto@gmail.com]
Sent: Saturday, November 2, 2019 11:18 AM
To: G2W2 <G2W2@asmfc.org>
Subject: Disappointed

I have listened to most webinars with regards to the current state of the striped bass fishery. I feel like my participation has been a complete waste of my time as you ignored the majority of the public's comments. I have lost all faith in the commission's ability to protect this fishery and I now fear for the future. I hope that my 1 year old son will be able to experience striped bass fishing.

Patrick Perrotto

[External] Striped Bass Lacking in Florida - Message (HTML)

FILE MESSAGE ACROBAT

Ignore Junk Delete | Reply Reply All Forward Meeting More | Spot/Croaker D... To Manager Team Email | Move Rules OneNote Actions | Mark Unread Categorize Follow Up | Translate Find Related Select | Zoom

Delete Respond Quick Steps Move Tags Editing Zoom

Sun 1/19/2020 8:16 AM

Erika Ritter <acruisingdowntheriver@gmail.com>

[External] Striped Bass Lacking in Florida

To Comments

Cc Lisa Rinaman

You forwarded this message on 1/21/2020 11:50 AM.

Sorry to not reply before the deadline on management.
I am concerned that Florida is causing some of the loss of Striped Bass. A dam across a river on Florida's east coast has made it impossible for them to spawn successfully. We now rely on a fish hatchery. The Ocklawaha River prior to Rodman Dam was the only river long enough with the right current speed and temperature to allow their eggs to mature and hatch. The Ocklawaha River has lost Atlantic Striped Bass. The dam is placed 12 miles upstream from the St John's River. It reduced the access for Striped Bass to 12 miles and not the full length of the river which is 72 miles. Bass were historically about to reach Silver Springs in Marion County to spawn annually. Please consider evaluating the impact of this lost river on Striped Bass populations. Thanks.

7:59 AM Sun Jan 19 100%

books.google.com

the surficial aquifer.

Prior to the creation of Rodman Reservoir, several springs existed between Eureka and Rodman Dam. A research paper dated 1971 by a University of Florida Geology student, Elizabeth Abbott, describes 20 springs that existed before the reservoir was created. Abbott (1971) observed some of these springs, and the others were described and located on aerial photos by local people. At the time of her research, some of the higher springs were altered, but still present, and the lower ones were flooded as a result of the dam. Many of the springs have been inundated under the full retention of the reservoir. Figure 4-4 shows the locations of springs as described by Abbott (1971).

4.10 Fish Populations

Estuarine fish species have access to the Ocklawaha River through the St. Johns River, and some take advantage of saltwater wedges that move upstream through the St. Johns River beyond the confluence of the Ocklawaha River. Although some migratory fish are passing through the Buckman Lock, the dam appears to pose a barrier to the spread of a variety of migratory fishes that historically used the system.

The historical data reviewed for the Ocklawaha River and the Rodman Reservoir produced a list of 69 fish species and 22 families. Forty-two species of fish from 18 families were found during the SJRWMD study (1994). The decrease is probably due to the change from a flowing river system to a standing reservoir system. Individual fish biomass is expected to be greater under the full retention (no action) alternative.

Reid (1970) reported 110 fish species in the Ocklawaha River, including such migratory species as striped bass and mullet. Several species on the list have not been recorded from the reservoir since routine fishery sampling began in 1971. These fish include relatively uncommon species such as the dusky and bluenose shiner, the Southern tessellated darter, and snail bullhead. The lack of these species may be due to the change in overall habitat from a flowing system to the reservoir, which favors species that thrive in lakes and are associated with the dense vegetation found in the reservoir.

Two major fish kills have occurred in Rodman Reservoir during the 1980s. In August 1985, an estimated 8.5 million fish died. Spotted sunfish, warmouth, redear sunfish, largemouth bass, and bluespotted sunfish represented 52 percent of the total dead fish. The second kill occurred in October 1988 when an estimated

See more about Erika Ritter.

Atlantic States Marine Fisheries Commission

Coastal Sharks Management Board

February 4, 2020
3:15 – 4:00 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(C. Batsavage)*	3:15 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2019	3:15 p.m.
3.	Public Comment	3:20 p.m.
4.	Update on Implementation of CITES Appendix II Provisions for Atlantic Shortfin Mako (*USFWS Staff*)	3:30 p.m.
5.	Update from November 2019 ICCAT Meeting on Atlantic Shortfin Mako (*K. Rootes-Murdy*)	3:45 p.m.
6.	Other Business/Adjourn	4:00 p.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW

Coastal Sharks Management Board Meeting
February 4, 2020
3:15 – 4:00 p.m.
Arlington, Virginia

Chair: Chris Batsavage (NC) Assumed Chairmanship: 5/2019	Vice Chair: Mel Bell (SC)	Law Enforcement Committee Representative: Greg Garner
Coastal Shark Technical Committee Chair: Bryan Frazier (SC)	Coastal Shark Advisory Panel Chair: Vacant	Previous Board Meeting: October 2019
Voting Members: MA, RI, CT, NY, NJ, DE, MD, VA, NC, SC, GA, FL, NMFS, USFWS (14 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the Agenda. Individuals that wish to speak at this time must sign in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Update on Implementation of CITES Appendix II Provisions for Atlantic Shortfin Mako (3:30-3:45 p.m.)
Background • CITES is a global treaty that aims to ensure international trade of plants and animals do not threaten their survival in the wild. Species protected under CITES are listed in one of three appendices. • In 2019 Atlantic Shortfin Mako Sharks was listed under CITES Appendix II, which includes species that, although not currently threatened with extinction, may become so without trade controls. The Appendix II listing will require new permits for exporting shortfin mako sharks.
Presentations • Implementation of CITES Appendix II Provisions for Atlantic Shortfin Mako by USFWS Staff

5. Update from November 2019 ICCAT Meeting (3:45-4:00 p.m.)
Background • The 2017 ICCAT assessment on Atlantic Shortfin Mako Sharks indicated the resource to be overfished and experiencing overfishing. In response to the results, ICCAT member countries including the US were required to implement measures to protect shortfin mako sharks. • At the November ICCAT meeting, the Standing Committee on Research and Statistics presented updated projections for shortfin mako sharks and the effects of current measures implemented in response to the 2017 assessment.
Presentations • Update from November 2019 ICCAT Meeting by K. Rootes-Murdy

6. Other Business/Adjourn

Coastal Sharks

Activity level: Low

Committee Overlap Score: low (some overlap with South Atlantic Board species)

Committee Task List
• TC – August 1st: Annual compliance reports due

TC Members: Bryan Frazier (SC, TC Chair), Donna McDowell (GA), Brent Winner (FL), Greg Skomal (MA), Chris Scott (NY), Lee Paramore (NC), Conor McManus (RI), Greg Hinks (NJ), Jack Musick (VIMS), Angel Willey (MD, Vice Chair), Matt Gates (CT), Karyl Brewster-Geisz (NOAA), Michael Frisk (NY), Enric Cortes (NOAA), Scott Newlin (DE), Julie Neer (SAFMC), Kirby Rootes-Murdy (ASMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

COASTAL SHARKS MANAGEMENT BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 30, 2019

These minutes are draft and subject to approval by Coastal Sharks Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of Proceedings of April 2019** by consent (Page 1).

3. **Consider Postponed Motion from April 2019 Meeting** (Page 1).
   Move to require, for state waters, the use of circle hooks on lines intended to catch sharks.

4. **Motion to Substitute**
   Move to substitute to require the use, in state waters, of non-offset, corrodible, non-stainless steel circle hooks when fishing for sharks recreationally, except when fishing with flies or artificial lures, implemented no later than July 1, 2020 (Page 3). Motion by Lewis Gillingham; second by Jason McNamee. Motion carried (Page 7).

   Main Motion as Substituted
   Move to require the use, in state waters, of non-offset, corrodible, non-stainless steel circle hooks when fishing for sharks recreationally, except when fishing with flies or artificial lures, implemented no later than July 1, 2010. Motion carried (Page 7).

5. **Move to approve the 2020 coastal sharks specifications via an email vote after NOAA Fisheries publishes the final rule for the 2020 Atlantic Shark Commercial Fishing season** (Page 8). Motion by Roy Miller; second by Jim Estes. Motion carried (Page 8).

6. **Move to accept the 2019 FMP Review for Coastal Sharks, state compliance reports, *de minimis* status for Massachusetts specific to the possession limit and fishery closure requirements for the Aggregate Large Coastal and Hammerhead species groups** (Page 10). Motion by Emerson Hasbrouck; second by Malcolm Rhodes. Motion carried (Page 10).

7. **Motion to nominate Mel Bell (SC) as Vice-Chair to the Coastal Sharks Board** (Page 10). Motion by Malcolm Rhodes; second by Doug Haymans. Motion carried (Page 10).

8. **Motion to adjourn** by consent (Page 10).

ATTENDANCE

Board Members

Dan McKiernan, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
Rep. Sarah Peake, MA (LA)
Jason McNamee, RI (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Heather Corbett, NJ, proxy for J. Cimino (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Stewart Michels, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Mike Luisi, MD, proxy for B. Anderson (AA)
Russell Dize, MD (GA)
Phil Langley, MD, proxy for Del. Stein (LA)
Lewis Gillingham, VA, proxy for S. Bowman (AA)
Bryan Plumlee, VA (GA)
Chris Batsavage, NC, proxy for S. Murphey (AA)
Jerry Mannen, NC (GA)
Mike Blanton, NC, proxy for Sen. Steinburg (LA)
Mel Bell, SC, proxy for R. Boyles (AA)
Malcolm Rhodes, SC (GA)
Sen. Ronnie Cromer, SC (LA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Rep. Thad Altman, FL (LA)
Karyl Brewster-Geisz, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Doug Messeck, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Kirby Rootes-Murdy
Dustin Colson Leaning
Maya Drzewicki
Tina Berger

Guests

Bill Anderson, MD DNR
Michael Bailey, USFWS
Delores Boghdan, Hamilton, MA
Kalil Boghdan, Hamilton, MA
Robert T. Brown, MWA
John Clark, DE DFW
Paul Diggins, SBCBA
Zak Greenberg, PEW Trusts
Aaron Kornbluth, PEW Trusts
Arnold Leo, E. Hampton, NY
Carl Lobue, TNC
Charles Lynch, NOAA
Glenn Normandeau, NH F&G
Derek Orner, NOAA
Dale Pike, CCA
Nick Popoff, USFWS
Michael Toole, Stratham, NH
Jack Travelstead, CCA
Mike Waine, ASA
Jenni Wallace, NOAA

The Coastal Sharks Management Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Wednesday, October 30, 2019, and was called to order at 1:15 o'clock p.m. by Chairman Chris Batsavage.

CALL TO ORDER

CHAIRMAN CHRIS BATSAVAGE: Good afternoon my name is Chris Batsavage; I'm the Administrative Proxy for North Carolina, I'll be serving as Chair.

APPROVAL OF AGENDA

CHAIRMAN BATSAVAGE: Start with the approval of the agenda. Is there any objections to the agenda as written, or does anyone have any modifications? Okay seeing none that is approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN BATSAVAGE: Next is the approval of proceedings from the April, 2019 Board meeting. Does anyone have any changes or modifications to the proceedings? Those are also approved.

PUBLIC COMMENT

CHAIRMAN BATSAVAGE: Next is public comment for any items. For public comment, is there anyone in the audience that would wish to speak about anything for coastal sharks not on the agenda?

CONSIDER POSTPONED MOTION FROM APRIL 2019 BOARD MEETING

CHAIRMAN BATSAVAGE: There isn't, so next is the fourth item is Consider the Postponed Motion from the April 2019 Board meeting. With that I'll pass it over to Kirby for his presentation.

MR. KIRBY ROOTES-MURDY: I have a quick presentation I'll go through, and then turn it over to Doug Messeck to provide the Law Enforcement Committee's report out on this task. As an outline I'll give you all an overview, go through some background information quickly, briefly summarize the AP report, as I said turn it over to Doug, take any questions you guys have, and then it is for this Board to consider the postponed motion.

The Board will consider today the following postponed motion from May, 2019 for recreational shark fishing, which is move to require for state waters the use of circle hooks on lines intended to catch sharks. The Board had requested the Law Enforcement Committee and Advisory Panel to provide feedback to help inform consideration of this action.

For background, NOAA's Highly Migratory Species Division approved Amendment 11 this year, and what it does is implements new commercial and recreational measures for HMS permit holders to address overfishing, and rebuild the overfished North Atlantic shortfin mako shark stock. Those recreational measures include; a new minimum size limit for shortfin makos of 71 inches fork length for males, and 83 inches fork length for females.

Additionally, it requires the use of circle hooks for HMS recreational permit holders, those with a shark endorsement in all areas now. NOAA Fisheries had put forward to this Board a request to implement complementary measures in state waters for consistency. In terms of this circle hook requirement. It has been in place for HMS permit holders since 2017, as part of Amendment 5B. Specifically it outlines the use of non-offset non-stainless steel circle hooks, except when fishing with flies or artificial lures. It was also area specific, so it covered most of the Atlantic coast south of 41°43'north latitude, so near Chatham, Massachusetts. The aim was to reduce discard mortality with this measure. Research has demonstrated that circle hooks reduce gut hooking, and increase post-release survival for shortfin makos.

Now, Amendment 11 extends this requirement further north than that area, so it's all areas along the Atlantic coast where individuals with these permits are fishing for sharks.

ADVISORY PANEL REPORT

MR. ROOTES-MURDY: Now, the Commission had an Advisory Panel meeting on this topic earlier this month. There were four AP members in attendance, and we included that summary from that call in the briefing materials.

Just to go over it quickly, given we are short on time today, all AP members indicated, who were on this call, support for requiring circle hooks for the recreational shark fishery. Reasons cited was that a number of states have already moved to implement these measures, and they didn't perceive there to be an enforcement issue, rather that there may be challenges if the same measure is not adopted for all states and state waters, given this is now a requirement for federal permit holders with a shark endorsement.

Their recommendation was to use circle hooks for the recreational fishery with two stipulations. The first is that given the motion that was postponed from the May meeting, their recommendation was to have that language be adjusted to mirror the federal regulatory language on circle hook requirements, including an exemption for fishing with flies or artificial lures.

Just for background for this Board, the regulatory text from Amendment 11 reads as the following. A person onboard a vessel that has been issued or is required to be issued a permit with a shark endorsement under this part, and who is participating in an HMS registered tournament that bestows points, prizes, or awards for Atlantic sharks, must deploy only non-offset corrodible circle hooks when fishing for retaining, possessing, or landing sharks, except when fishing with flies, or artificial lures.

That is the language in the Amendment. There is a compliance guide that NOAA provides on their website to help anglers who are looking for more simple versions of these regulations. That language states; All HMS permit holders are required to use non-offset, non-stainless steel circle hooks when fishing for sharks recreationally, except when fishing with flies or artificial lures in federal waters.

LAW ENFORCEMENT COMMITTEE REPORT

MR. ROOTES-MURDY: That is the Advisory Panel report. I'll turn it to Doug Messeck, and he can provide the LEC report.

CHAIRMAN BATSAVAGE: Doug.

MR. DOUG MESSECK: Good afternoon! Earlier in September we had a conference call, and then we discussed it at length again. We did send out a memorandum that I believe everyone has had a chance to look over. What I want to read from is an excerpt that the Law Enforcement Committee therefore reiterates the position that despite the recognized potential value of a circle hook requirement to reduce release mortality in the recreational fishery. Strict enforcement of a rule that depends on proving targeting or intent to catch sharks with prohibited gear would be very difficult. Therefore, if the Board were to implement such requirement, the LEC emphasized the importance of using intensive education and outreach to garner support for circle hook regulation. It was the consensus amongst the Board that there be one definition of a circle hook that could be applied across all states as much as possible, and into the federal waters. Also in absence of a strict definition that defined targeting, it was going to be a very hard regulation to enforce, as to what a person was fishing for.

We did look at some examples that Florida used, Florida for their shore-based angler has certain gear requirements and accessories that goes to prove the intent that you are shark fishing. But absent of any of that it's a very hard regulation to enforce. We believe that as a compliance measure, because of the recognized benefits of the circle hook, compliance would be high throughout the user group, and that we would continue to support intensive outreach and education if this regulation was to move forward.

CHAIRMAN BATSAVAGE: Any questions for Kirby or Doug, yes, Doug Haymans?

MR. DOUG HAYMANS: Kirby, would you back up two slides maybe. The HMS requirement for circle hooks is only for tournaments? Is that the way I read it, because it says and who is participating in an HMS registered tournament.

MR. ROOTES-MURDY: I'm going to defer to Karyl Brewster-Geisz who is here. She can provide a little more context on this language in Amendment 11.

CHAIRMAN BATSAVAGE: Karyl.

MS. KARYL BREWSTER-GEISZ: It does not apply only to tournaments; this is just one paragraph that Kirby grabbed. We have other paragraphs that apply to everybody outside of tournaments.

CHAIRMAN BATSAVAGE: Thanks, Karyl. Are there any other questions for Kirby or Doug, yes, Mike Luisi?

MR. MICHAEL LUISI: Maybe to Karyl if that's okay.

CHAIRMAN BATSAVAGE: Yes.

MR. LUISI: Karyl, when you were going through this rulemaking, was there any consideration for a minimum size for the circle hooks? Did you guys ever explore, you know establishing some size limitation that you couldn't use hooks smaller than that when fishing for sharks?

MS. BREWSTER-GEISZ: No, we didn't look at the sizes for sharks, because sharks come in all sizes.

MR. LUISI: I'm sorry, I meant for the hook itself. Okay, thanks.

CHAIRMAN BATSAVAGE: Okay any further questions? Okay seeing none Kirby, I guess if we can get the postponed motion up on the screen. At this point we'll be looking to take action on this motion or entertain a substitute motion, so I'll open it up to the Board for either discussion or a substitute motion. Tom Fote.

MR. THOMAS P. FOTE: Do we need a maker and a seconder, because there are no names up there.

MR. ROOTES-MURDY: Tom, my understanding is that, given the Board voted to postpone this motion, it's now a motion of this body.

MR. FOTE: Okay.

CHAIRMAN BATSAVAGE: Lewis Gillingham.

MR. LEWIS GILLINGHAM: I think as Law Enforcement indicated, it would be helpful if the language was identical to what's in federal waters, which means **that I would suggest that we apply an exemption for artificial lures, which includes flies.**

CHAIRMAN BATSAVAGE: Okay, would you like to make that substitute motion?

MR. GILLINGHAM: Yes, I'll make it at this time.

CHAIRMAN BATSAVAGE: We'll see if we can get that up on the screen, substitute motion to provide an exemption for the use of artificial

lures and flies from the circle hook requirement.

MR. ROOTES-MURDY: Lewis, in an effort to try to help this Board, given there was consideration from both the LEC and the AP about specificity with this language, we've included kind of a draft substitute motion that has more specificity of the circle hook requirement, or the specifications of what a circle hook is. My question to you is do you want to have that included in your substitute motion, or would you prefer to just have it specific to an exemption of artificial lures and flies?

MR. GILLINGHAM: I would like to hear some input from Karyl first. Is it defined in federal waters? I know the corrodible part is there. Again, what I'm looking for is something that is seamless between federal waters and state waters, as requested by Law Enforcement, or suggested.

CHAIRMAN BATSAVAGE: Karyl.

MS. BREWSTER-GEISZ: We do have the non-offset, non-stainless steel in our federal regulations.

MR. GILLINGHAM: I would like to include that in the substitute motion then.

CHAIRMAN BATSAVAGE: If you want to include that language, if you don't mind reading, and I guess inserting that language in on what's on the screen might be the easiest way to do it.

MR. GILLINGHAM: Non-offset corrodible hooks.

CHAIRMAN BATSAVAGE: Lewis, does that read how you would like it?

MR. GILLINGHAM: I'm serving as a go between really. Karyl, I don't think you include, do you use the term non-stainless steel, or corrodible?

CHAIRMAN BATSAVAGE: Karyl.

MS. BREWSTER-GEISZ: We use both. We actually define what corrodible is to mean non-stainless steel.

MR. GILLINGHAM: Okay, yes. They apparently use both. I again was looking for a seamless definition, between state and federal.

CHAIRMAN BATSAVAGE: Would you mind just reading the motion up on the screen into the record, please, and then I'll see if I can get a second?

MR. GILLINGHAM: Sure. Move to substitute to require the use of non-offset corrodible; non-stainless steel circle hooks when fishing for sharks recreationally, except when fishing with flies or artificial lures in state waters.

CHAIRMAN BATSAVAGE: Okay, substitute motion by Lewis Gillingham, can I get a second? Jay McNamee. Is there any discussion on the substitute motion? Roy Miller.

MR. ROY W. MILLER: I'm thinking about what Doug Messeck said. I'm really not that troubled about difficulties in enforcing this, because honestly I think compliance, particularly over a period of time will be pretty good with this. The tackle shops will come onboard, tackle shops will be pushing circle hooks for anyone wanting to do shark fishing. Even if they can't make every single case, I think it is still a step in the right direction, and I think the greater good will overcome the difficulties in enforcement.

CHAIRMAN BATSAVAGE: Any other discussion on this, yes Doug Haymans?

MR. HAYMANS: I may have missed it in Lewis's discussion a moment ago, but why the non-stainless? It's not in the regulation; I may have missed that discussion.

MR. BATSAVAGE: I may pass it over to Karyl, but I think she said the language, I guess both were found in the regulations. But I'll hand it over to Karyl to answer that one.

MS. BREWSTER-GEISZ: Yes we define corrodible in our regulations to mean non-stainless steel

MR. HAYMANS: It's defined separately from the circle hook regulation, because the F and whatever, handline K just talk about non-offset corrodible circle hooks, it doesn't say non-stainless.

MS. BREWSTER-GEISZ: Correct. In our definition section we define what corrodible means, and I'm looking so I can read it directly for you. Corrodible hooks means a fishing hook composed of any material other than stainless steel.

CHAIRMAN BATSAVAGE: Okay further discussion, yes, Karyl?

MS. BREWSTER-GEISZ: Did the Board want to consider a definition of what circle hooks should be?

CHAIRMAN BATSAVAGE: Do we want to do that or I guess ASMFC has a definition of circle hooks. Does the Board think that that definition is sufficient for this action? Tom Fote.

MR. FOTE: I don't think we do have a definition of circle hooks. I know Maryland has a definition that we're going to try and use in striped bass. I don't know if we have a definition of circle hooks for the Commission.

CHAIRMAN BATSAVAGE: Bob Beal.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Tom, I believe the Commission does have a definition. I don't have it in front of me right now. It was part of the Law Enforcement exploration of circle hooks a while ago, and I think they came up with a general definition that they felt would be more or less enforceable by all the states. We can try to find that. It's in one of our documents; I just have to dig it out.

CHAIRMAN BATSAVAGE: Mike Luisi.

MR. LUISI: To Bob's point. Yes Tom, I remember specifically that we used the language directly from ASMFC when we crafted our mandate for circle hook use in the Bay.

CHAIRMAN BATSAVAGE: Further discussion or questions? Kirby I just have one, just to make sure I'm clear and the Board is clear. This motion would also include the required use of circle hooks for smooth dogfish? I guess to Karyl, with the federal regulations are smooth dogfish included with sharks for the use of circle hooks?

MS. BREWSTER-GEISZ: Yes.

CHAIRMAN BATSAVAGE: Kirby.

MR. ROOTES-MURDY: To mirror what Karyl said, yes. This would apply to that as well.

CHAIRMAN BATSAVAGE: Okay so we're consistent, just so the Board is clear that includes basically all the coastal sharks in the FMP. Lewis.

MR. GILLINGHAM: Actually Mr. Chairman, this is a question for Karyl if I might.

CHAIRMAN BATSAVAGE: Yes sure.

MR. GILLINGHAM: Karyl, does that mean for spiny dogfish that we would not be required to use circle hooks?

CHAIRMAN BATSAVAGE: Karyl.

MS. BREWSTER-GEISZ: HMS doesn't manage spiny dogfish, so yes it doesn't apply there.

CHAIRMAN BATSAVAGE: Okay any further questions or comments? I guess I'll start with is there any objection to the substitute motion, or do people need time to caucus before we do that? Then we need a 30 second caucus, we'll go do that. Is everyone ready? Actually, Dan has a comment.

MR. DANIEL McKIERNAN: It's more of a question. The final expression in the memo, in state waters, should that be move up earlier in the motion so that it's clear that it's not just exempting flies and artificial lures in state waters? Should we say move to require the use in state waters? Would that be clearer?

CHAIRMAN BATSAVAGE: Yes.

MR. McKIERNAN: Can I make that as a friendly amendment?

CHAIRMAN BATSAVAGE: Let's actually look for some, I saw Doug's hand.

MR. HAYMANS: Another question once you finish with that.

CHAIRMAN BATSAVAGE: All right so Lewis, are you okay with that modification, and Jay. Doug Haymans.

MR. HAYMANS: What's the implementation date for this if it passes?

MR. ROOTES-MURDY: This is a substitute motion right, to the previous motion. If you went with this motion you can specify the implementation date. That might be the cleanest way to deal with this so that it's clear across if this is substituted and it passes, then it would be just final action on that substitute motion. Again, if this Board would like to make that clear in this substitute motion that might be best.

CHAIRMAN BATSAVAGE: Any thoughts on, I guess including an implementation date in this substitute motion? Lewis.

MR. GILLINGHAM: Now in fact I was going to, once this was approved then I was going to bring up that issue. I think it's an excellent idea, but again it comes down to, and they had this discussion yesterday, when can the states all do it? We do have some of the legislatures that meet; we're coming up on that. I would like to give people enough time to get it done, realizing it doesn't become an issue until the state waters warm to at least 65 or 70 degrees. If it was put off until spring, if that would give all the states a chance to implement it.

CHAIRMAN BATSAVAGE: Would that work for the other states, or do any states have concerns just relative to their administrative process for changes like this? Looking for any states who would have a problem with implementing this by next spring. A date in the spring would be good.

MR. GILLINGHAM: May 1st.

CHAIRMAN BATSAVAGE: Does anyone object to adding the date of May 1st? Doug.

MR. HAYMANS: How about July 1. I'm in the middle of rulemaking right now, having to go up to 83 inches, so I'm going to have to stop the rulemaking process and basically start it over again. I generally don't do that during the middle of a legislative session. I was planning to have it finished by December, but I'll just put the brakes on until we get to April, and then restart it and be done by July. July would work better for us, assuming this is going to pass.

MR. GILLINGHAM: I would be fine with that date, realizing that a lot of states will get it done sooner if they haven't already. At least it gives everyone something to shoot for.

CHAIRMAN BATSAVAGE: Implemented no later than July 1, any comments on that? Tom Fote.

MR. FOTE: Since we have an August meeting, why don't we just do it by the August meeting? This way it will be, and compliance reports will be given in the August meeting.

CHAIRMAN BATSAVAGE: Kirby.

MR. ROOTES-MURDY: In follow up, in preparation of the August meeting, we tend to try to pull together that information ahead of time, so having a report out by August would be best, so if there is implementation date before that meeting, we can best report out on the status of it to this Board.

CHAIRMAN BATSAVAGE: Okay any other comments on the substitute motion? **Okay it's changed a little bit; I'll go ahead and read it into the record; move to substitute to require the use in state waters of non-offset, corrodible, non-stainless steel circle hooks when fishing for sharks recreationally, except when fishing with flies or artificial lures, implemented no later than July 1, 2020.** I think everyone had time to caucus earlier. Do you need a caucus again based on this modified language?

Okay, if not is there any objection to the substitute motion? Seeing none it becomes the main motion. This will be final action, so we'll need to do a roll call vote, unless there is no objection. Is there any objection to the main motion? We'll get it up on the screen. **Okay the main motion is up on the screen, the same language as the substitute motion I just read into the record, so is there any objection to the main motion? Seeing none, it's approved.**

SET SPECIFICATIONS FOR 2020

CHAIRMAN BATSAVAGE: The next item is to set the 2020 specifications. I'll hand that over to Kirby for his presentation.

MR. ROOTES-MURDY: I will go through this very quickly, as this is an item for this Board to consider now, but ultimately if we proceed as we've done in recent years, it would be a vote taken following this Board meeting. As background, the Proposed Rule for the 2020 coastal shark's specifications from NOAA HMS Division was published on September 19. It puts forward status quo quotas for 2020 that are the same as what has been in place the last three years.

It proposes to open all shark management groups fishing for those groups on January 1, 2020, and it also put forward status quo retention limits starting at 25 large coastal sharks, other than sandbar sharks, per vessel per trip and adjust as needed, as was done over the past few years. Up on the screen is what these quotas would look like.

We sent out to the Board for your consideration last month, when it was published, each of these different values. Aggregated large coastal sharks, the proposed quota would be 372,000 metric tons, hammerheads 59,763 pounds, non-blacknose small coastal sharks 582,333 pounds, blacknose sharks 37,921 pounds, and smoothhound sharks 3,973,902 pounds.

For the no regional quotas, we have non-sandbar large coastal sharks; we have sandbar sharks, blue sharks, porbeagle sharks, and pelagic sharks other than porbeagle or blue. If the Board wishes to proceed as it had in previous years, once the final rule is published later this fall, the Board can approve those specifications by e-mail vote. That is for your consideration today. If so, we would need a motion to do so. I'll take any questions, thanks.

CHAIRMAN BATSAVAGE: Any questions for Kirby, Karyl?

MS. BREWSTER-GEISZ: It's not a question so much as whether or not you wanted to hear an update on where we were and what comments we received.

CHAIRMAN BATSAVAGE: Yes that would be helpful, thanks.

MS. BREWSTER-GEISZ: Okay so Kirby explained what we proposed, but we also included in that questions for the public about the percentage at which we then adjust downward, and we also had specific questions about the retention limit. The reason for that is that the quota has not been taken in recent years.

This year, for those of you who pay attention, we actually have the retention limit all the way up at 55, which is the highest we can go, and we are still let's just say way, way, way below quotas for all the large coastals. We received a lot of comments. A lot of people wanted to go up higher in the starting retention limit.

A lot of people asked for a 36-start retention limit, going back to where we were in 2012, as opposed to the 25 that we've used in recent years. There was also a lot of comment with people saying, instead of 20, range somewhere between 30 and 40 percent, in terms of when we make the adjustment downward. We are considering all those comments, and we hope to have the Final Rule out by the end of November.

CHAIRMAN BATSAVAGE: Any questions for Karyl, just based on that information she provided? Okay, yes as Kirby mentioned, we've got to wait for the Final Rule to be published before taking action. We did that by e-mail vote after this meeting. **What I'm looking for is a motion to approve the coastal sharks specs by an e-mail vote after NOAA Fisheries publishes their Final Rule, so if someone would like to make that motion. Yes, motion by Roy.**

MR. MILLER: Yes, I would make that motion. Do we have wording for that to put up?

CHAIRAMN BATSAVAGE: Yes, we're getting that up on the screen. Motion by Roy Miller, do I have a second? Jim Estes**. Okay, the motion is move to approve the 2020 coastal shark's specifications via e-mail vote after NOAA Fisheries publishes the final rule for the 2020 Atlantic Shark commercial fishing season. Is there any discussion on the motion, any objection to the motion, okay the motion passes.**

CONSIDER APPROVAL OF 2019 FMP REVIEW AND STATE COMPLIANCE

CHAIRMAN BATSAVAGE: Next is to consider approval of the 2019 FMP Review and State Compliance Reports, Kirby.

MR. ROOTES-MURDY: We have not in the past been able to pool together this FMP review report for this Board's consideration by this meeting, given the timing of when we get commercial landings, normally. That normally is published later on in the year by NOAA Fisheries in early part of the winter, so January/February normally.

We've often had to delay, but we worked I think very well this year, between ACCSP and NOAAs HMS branch to try to pull that information together beforehand. I've got a brief presentation to go through, and then it will be for you to consider action on this.

STATUS UPDATE ON STATE IMPLEMENTATION OF NORTH ATLANTIC SHORTFIN MAKO RECREATIONAL MEASURES

MR. ROOTES-MURDY: I'll walk through the status of the FMP.

Just a couple of the stocks that have had recent changes in our understanding of their population, and then commercial and recreational landings, and then there was a compliance component that we were going to provide this Board an update on. As you all are aware, the Coastal Sharks Management Board operates under a complementary FMP to NOAA HMSs coastal sharks management.

The Commission approved that FMP in 2008, and basically we're managing it through Addendas I through V. Addenda V was approved last year and it provides the Board more flexibility in adjusting measures through Board action, rather than through addendum, in order to create more consistency with state and federal management when there are changes in federal waters.

In 2019 the Board also approved new shortfin mako recreational size limits, and I will get into that later on, in terms of the status of states implementing those changes. There are multiple coastal shark species under this FMP, and it's important to understand that not all of them have been assessed.

But, some of the recent assessments that this Board has been considering action on over the years that, I think, it's just important to reiterate again. Shortfin mako in 2017 was found through an ICCAT Assessment to be overfished and experiencing overfishing. Sandbar shark also assessed in 2017 through SEDAR 54, is overfished but not experiencing overfishing, and dusky sharks that assessment completed in 2016 through SEDAR 21, found that the resource is overfished and experiencing overfishing. In terms of a summary of commercial landings, commercial landings of Atlantic large coastal shark species in 2018 were approximately 434,000 pounds dress weight, which is a 14 percent increase from 2017 landings. Commercial landings of small coastal shark species in 2018 were approximately 407,000 pounds, which is a 37 percent increase from 2017.

This graph here shows you these different management groups stacked on top of each other, to get a sense on how collectively they've faired as a trend over time. In terms of recreational numbers, approximately 114,212 sharks were harvested during the 2018 recreational fishing season, which is a decrease from 2017 landings of approximately 38 percent. The non-blacknose and small coastal shark group and pelagic group both comprise about 35 percent of the overall recreational harvest.

In terms of compliance and *de minimis* status, all states have implemented the required measures for 2018. Addendum V did not adjust any of the specific management measures, so the states were still in compliance with measures that have been established previously. Massachusetts requests continuation of their *de minimis* status.

In terms of an update on the shortfin mako recreational measures, as I noted in my previous presentation, NOAA implemented different size limits for shortfin makos for recreational federal permit holders, 71 inches fork length for males and 83 inches fork length for females. The Board approved complementary measures to this for state waters, with an implementation date of January 1, 2020.

In terms of an update of where we're at on that. Nearly all states have either begun the process of implementing these regulations, or have done so already. The one state I have not heard back from, we can see if they have any comments on the record today, is Connecticut regarding this change in regulations.

If there are any other updates that states want to provide on this regulatory change, it would be greatly appreciated. Again, there is Board action to be considered today, which is accepting the 2019 FMP Review for coastal sharks, state compliance and *de minimis* status for Massachusetts. I think given this management board, there is a name attached to it.

I would be remiss not to mention that there is a certain type of shark that has been captivating baseball fans in our nation's capital recently, it's known as baby shark, and it has become synonymous with the Washington Nationals. Its season has been on the brink of closure multiple times this year, and hopefully will end tonight with the Nationals winning the World Series. With that I'll take any questions, and go Nats! (Applause)

CHAIRMAN BATSAVAGE: Questions for Kirby on his report, or any updates from states on implementing the recreational mako shark measures for next year. Justin Davis.

DR. JUSTIN DAVIS: I guess Kirby we should talk maybe after the meeting. I think maybe there has been a communication disconnect, because I thought we had provided affirmation or communication that we were in compliance with those regulations, so if we can talk after the meeting.

CHAIRMAN BATSAVAGE: Doug.

MR. HAYMANS: Like I said earlier on the circle hooks, I may back up for a minute, because I don't want to do a rule for circle hook only, when I've got the exact same rule making its way through. I may not hit the January date; it may be the July date to have it all in place.

CHAIRMAN BATSAVAGE: Is the Board okay with that delay, it is unforeseen? They were in the process of rulemaking, but there are definitely challenges of having to do it twice. There are efficiencies of just going through rulemaking once, so is there any concern by the Board regarding Georgia?

Okay seeing none, I think we can accommodate that Doug, thank you. We will need a motion to approve the FMP Review and the *de minimis* request, looking for a motion. Okay, motion by Emerson Hasbrouck. Emerson if you don't mind reading the motion up on the screen.

MR. EMERSON C. HASBROUCK: Move to accept the 2019 FMP Review for coastal sharks, State Compliance Reports, *de minimis* status for Massachusetts, specific to the possession limits and fishery closure requirements for the aggregate large coastal and hammerhead species groups.

CHAIRMAN BATSAVAGE: Okay do I have a second, Malcolm Rhodes? Is there any objection to the motion? Okay it passes unanimously.

ELECT VICE-CHAIR

CHAIRMAN BATSAVAGE: The next item is to elect a Vice-Chair, looking for a motion on that Malcolm Rhodes.

DR. MALCOLM RHODES: I would like to nominate Mel Bell as Vice-Chairman of the Coastal Sharks Management Board.

CHAIRMAN BATSAVAGE: **Can I get a second? Doug Haymans. Are there any objections to the motion? Congratulations, Mel!**

ADJOURNMENT

CHAIRMAN BATSAVAGE: Is there any other business to come before the Coastal Sharks Management Board? Okay if not then we are adjourned, thanks everyone.

(Whereupon the meeting adjourned at 2:00 o'clock p.m. on October 30, 2019)

Atlantic States Marine Fisheries Commission

Bluefish Management Board

February 4, 2020
4:15 – 5:00 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order (*C. Batsavage*)	4:15 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from April 2018	4:15 p.m.
3.	Public Comment	4:20 p.m.
4.	Consider Approval of Conservation Equivalency Proposals **Final Action** (*D. Colson Leaning*) • Review of Conservation Equivalency Proposals • Technical Committee Report • Law Enforcement Committee Report	4:30 p.m.
5.	Elect Vice-Chair (*C. Batsavage*) **Action**	4:55 p.m.
6.	Other Business/Adjourn	5:00 p.m.

The meeting will be held at The Westin Crystal City, 1800 S. Eads Street, Arlington, VA; 703.486.1111

MEETING OVERVIEW

Bluefish Management Board Meeting
February 4, 2020
4:15 – 5:00 p.m.
Arlington, Virginia

Chair: Chris Batsavage (NC) Assumed Chairmanship: 12/19	Technical Committee Chair: Mike Celestino (NJ)	Law Enforcement Committee Representative: Rob Kersey (MD)
Vice Chair: Vacant	Advisory Panel Chair: Vacant	Previous Board Meeting: December 10, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (17)		

2. Board Consent
- Approval of Agenda
- Approval of Proceedings from April 2018

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Consider Approval of Conservation Equivalency Proposals (4:25-5:00 p.m.) Action
Background • In December 2019, the Board approved and the Council recommended a 3-fish bag limit for private and shore-based anglers and a 5-fish bag limit for for-hire fishermen as coastwide measures for the 2020 recreational fishery. The Board also allowed for states to submit alternative recreational measures under the Commission's conservation equivalency (CE) Policy. • The Technical Committee (TC) met in December and January to establish technical guidelines for state CE proposals, review proposals, and develop recommendations. **(Supplemental Materials)** • In addition, the Law Enforcement Committee (LEC) met to provide comments on state proposals. **(Supplemental Materials)**
Presentations • Review of state CE proposals, TC report, and LEC report by D. Colson Leaning
Board actions for consideration at this meeting • Consider approval of state CE proposals

5. Elect Vice-Chair

6. Other Business/Adjourn

Bluefish Technical Committee Task List

Activity Level: Medium

Committee Overlap Score: Medium

Committee Task List
• Meets twice a year to recommend commercial and recreational measures • Biological Monitoring Program requirement to collect a minimum of 100 bluefish to enhance age and length data used in stock assessments • Annual state compliance reports are due May 1

TC Members
Michael Celestino (NJ DEP – Chair), Amy Zimney (SC DNR), Sandra Dumais (NY DEC), Eric Durell (MD DNR), Jim Gartland (VA VIMS), Kurt Gottschall (CT DMF), BJ Hilton (GA DNR), Nicole Lengyel (RI DEM), Joseph Munyandorero (FL FWC) Lee Paramore (NC DENR), Melissa Smith (ME DMR), Kevin Sullivan (NH FGD), Sam Truesdell (MA DMF). Richard Wong (DE DFW), Tony Wood (NEFSC), Matt Seeley (MAFMC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

BLUEFISH MANAGEMENT BOARD

AND

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

The Westin Crystal City
Arlington, Virginia
April 30, 2018

These minutes are draft and subject to approval by the Bluefish Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of agenda by consent** (Page 1).

2. **Approval of proceedings of February, 2012 by consent** (Page 1).

3. **Move to approve the draft scoping document for public comment as modified today** (Page 5).
MAFMC: Motion by Chris Batsavage; second by Peter deFur. Motion carried (Page 6).
ASMFC: Motion by Chris Batsavage; second by Dave Borden. Motion carried (Page 6).

4. **Adjourn by consent** (Page 7).

ATTENDANCE

Board Members

Doug Grout, NH (AA)
Sen. David Watters, NH (LA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
David Pierce, MA (AA)
Bob Ballou, RI, proxy for J. McNamee (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
David Borden, RI (GA)
Matt Gates, CT, proxy for P. Aarrestad (AA)
James Gilmore, NY (AA)
John McMurray, NY, proxy for Sen. Boyle (LA)
Emerson Hasbrouck, NY (GA)
Tom Fote, NJ (GA)
Jeff Brust, NJ, proxy for L. Herrighty (AA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Mike Luisi, MD, proxy for D. Blazer (AA), Chair
Russell Dize, MD (GA)
Steve Bowman, VA (AA)
Rob O'Reilly, VA, Administrative proxy
Chris Batsavage, NC, proxy for S. Murphey (AA)
Mike Blanton, NC, proxy for Rep. Steinburg (LA)
Jim Estes, FL, proxy for J. McCawley (AA)
Marty Gary, PRFC
Mike Pentony, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Robert Beal
Toni Kerns
Jessica Kuesel
Caitlin Starks

Guests

John Almeida, NOAA
Russ Babb, NJ MFA
Peter DeFur, MAFMC
Tony DiLernia, MAFMC
G. Warren Elliott, MAFMC
Steve Heins, MAFMC
John Maniscalco, MAFMC
Stew Michels, DE DFW
Laurie Nolan, MAFMC
Moira Kelly, NMFS
Matt Seeley, MAFMC

These minutes are draft and subject to approval by the Bluefish Management Board.
The Board will review the minutes during its next meeting.

The Bluefish Management Board of the Atlantic States Marine Fisheries Commission jointly with the Mid-Atlantic Fishery Management Council convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Tuesday, April 30, 2018, and was called to order at 3:15 o'clock p.m. by Chairman Michael Luisi.

CALL TO ORDER

CHAIRMAN MICHAEL LUISI: I would like to call this meeting of the Bluefish Management Board and the Mid-Atlantic Fisheries Management Council to order. Good afternoon everyone. My name is Mike Luisi; and I have the pleasure to serve you as Chair of both the Bluefish Board and the Mid-Atlantic Council here today.

APPROVAL OF AGENDA

CHAIRMAN LUISI: The first item on the agenda is Board Consent and approval of the agenda. Does anyone have anything they would like to offer? Seeing none; consider the agenda approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN LUISI: Next we have approval of the proceedings from February, 2012. I thought that was a typo at first. This Board hasn't met very much in the past few years.

If we move forward with the scoping materials, as we're going to hear about today, we'll certainly be getting together more often in the coming year or two. Is there any objection to approval of the proceedings from February, 2012? Seeing none.

PUBLIC COMMENT

CHAIRMAN LUISI: I'm going to look out to the public. I did not receive anybody on the list that would like to offer any public comment on something that is not on the agenda. But I'll look out to the public now. Seeing no one from the public.

CONSIDER APPROVAL OF DRAFT SCOPING AND PUBLIC INFORMATION DOCUMENT FOR ALLOCATION AMENDMENT

CHAIRMAN LUISI: We're going to move on to Item Number 4, which is Consider Approval of Draft Scoping and Public Information Document for Allocation Amendment.

We're joined here today by Matt Seeley and Caitlin Starks. Matt is going to be providing us with the presentation. Whenever you're ready Matt; the floor is yours.

MR. MATTHEW SEELEY: Can everyone hear me all right? I'm excited to talk to you guys today about the Bluefish Allocation Amendment. The objectives are jointly for the Council and Board to review the Draft Scoping Document or Public Information Document. You can call it what you want.

It's the same document, just for the different Council and Board, and hopefully to approve this document for public scoping hearings. I want to emphasize that these are not public hearings on alternatives; we're simply trying to survey the public on issues they feel are important to try to include in the amendment. We understand the new MRIP numbers will be out soon; and things will change. But again, the point here is to simply survey the public on issues that they think should be incorporated into the amendment. As part of the Council's 2018 implementation plan, we initiated this Bluefish Allocation Amendment. This initiation came from comments made by different stakeholders; some of which were Council and Board members. The motion that was set in December of 2017 was to initiate a bluefish amendment to review; and if necessary revise allocations between the commercial and recreational fisheries, the commercial allocations to the states, review the goals and objectives and transfers.

To date thus far we have formed our Fishery Management Action Team, the FMAT. The FMAT consists of Council and Commission staff, GARFO and Science Center staff, as well as the TC Chair. We had our first meeting; where we reviewed the action plan and the scoping document, went through multiple edits back and forth.

Obviously, those two documents are prepared. You should have had an opportunity to see them; if not, you should be able to see them today. Presented here is a tentative Amendment timeline. There is a slightly more detailed version in the actual scoping document. Looking forward in the summer of 2018, we are hoping to hold the scoping hearings and the public comment period.

Into the fall of 2018, the Council and Commission will identify priority issues for inclusion in the Amendment. Later on in 2018 and early '19, development of different options and alternatives, the Council and Commission will then review and draft the range of options. Later in spring of 2019, that range of options will be refined and approved.

In spring/summer of 2019, we'll select those preferred options and hold public hearings. Then fall, 2019 into summer 2020, way down the road, hopefully considering public comments, final action, and eventually rulemaking. As far as the scoping process goes, it is a NEPA requirement for the Council for all EIS actions.

Public scoping hearings are done to inform the development of the range of alternatives. We plan to hold these hearings potentially in a range from Maine all the way to Florida; most likely in June to July. There will be a written comment period lasting about 30 days, and those comments can be submitted either to the Council or the Commission.

Next, I'm going to go through the different issues that are potentially going to be covered in this Amendment. It's not subject to just these issues though. The first issue is a review of the objectives of the FMP; which are listed here as well as in the scoping document. These have been the same since 1990; and so this Amendment will consider updating them.

I'm not going to go through them all; but they are listed out in the document. The second issue is related to the commercial and recreational allocations. These allocations were set in Amendment 1; back in 1999 at 83 percent recreational, 17 percent commercial of the total allowable landings.

This is developed from 1981 to 1989 landings data. The third potential issue is the commercial allocations to the states. Again, these were developed in Amendment 1 using catch histories from 1981 to 1989. Trends in state harvest have shifted; especially with yearly state-to-state transfers in the recent years. The fourth issue is the quota transfers; commercial state-to-state quota transfers occur on a yearly basis and become repetitive amongst a few states, especially in recent years, and transfers from the recreational to commercial sector have occurred in every year since 2001. The fifth issue, fairly important, this issue is in place to allow the public to identify any other associated issues with the fishery that they would want involved in this Amendment. Again, these comments don't need to be limited to issues included in the Scoping Document.

As far as public comment is concerned, the scoping process was going to seek comments on current measures and strategies that should or should not be modified; new measures and strategies that should or should not be considered, fishery trends that managers should consider, and any other issues or concerns that should be considered or addressed in the Amendment.

Considering next steps, we hope to approve this Public Scoping Document today. We'll move right into public scoping hearings once they get set. The dates are currently to be determined, and locations. The written comments and hearing summaries will be compiled for review by both the Council and Commission.

Then either the joint meeting in August or December of 2018 will review the comments and identify those priorities for inclusion in this Amendment. Moving forward, so Caitlin and I will work with state representatives via e-mail and some of you today if available to discuss interest in having scoping hearings in your states, and that's it. I will take any questions or comments.

CHAIRMAN LUISI: Any questions for Matt? John Maniscalco.

MR. JOHN MANISCALCO: Do you intend to incorporate data into the scoping document; including the new MRIP estimates?

MR. SEELEY: We don't plan to include any of that information into this scoping document; as we stand now.

CHAIRMAN LUISI: Would that be something, John that you would want to see in the document; as a follow up to your question?

MR. MANISCALCO: I mean I think it certainly has large implications for the commercial/recreational shift; and since we are talking about that it would help, yes.

CHAIRMAN LUISI: Matt, follow up.

MR. SEELEY: My direction and understanding is that the point of this scoping document is to simply go out and survey the public. We're not trying to develop any ranges of alternatives; simply just see what other issues are out there that the public would like to consider, and potentially have involved in this amendment.

CHAIRMAN LUISI: Okay thank you, Matt. This is the opportunity if there is something about the document that you want to make a comment to. If there is anything in addition, I'm sorry, David Pierce.

DR. DAVID PIERCE: Yes, it's a good document. One thing that is missing though is on Page 6, why is this action being proposed? Obviously that's quite an important question to ask; and in the text of that particular section it references that we are, the Council and Commission, proposing this set of actions due to changing conditions in the bluefish fishery.

One important change in condition that is identified in the document is apparent shifts in bluefish distribution; potentially related to the effects of climate change. Yet there is nothing in the document, I don't think that touches on that. The public is going to ask questions; okay what do we have? What evidence do we have that the distribution has changed as a consequence of climate change; or anything else for that matter?

In addition, the end of that section talks about possible changing fishery conditions; so it suggests that we know that the fishery conditions have changed. There needs to be more information in the scoping document that would address those issues; so we're able to give the public a more informed understanding as to why we're proposing this action.

CHAIRMAN LUISI: Matt, Caitlin, is that something that we can work to include?

MR. SEELEY: Yes that's a very good point. That is definitely something that we can include; and we can work with the FMAT to get that into the document.

CHAIRMAN LUISI: Tom Fote.

MR. THOMAS P. FOTE: I wasn't sure that we were doing this because of the effects of climate change on bluefish. I've had really no effects that I know of bluefish. It's always been a fish that's been from Florida to Maine, and it depends on years it actually receded back to the Mid-Atlantic and it hasn't gone back up to Maine. I'm not sure climate change is playing any role. I thought we were doing it to look at commercial/recreational allocations on bluefish. Maybe I'm missing something.

CHAIRMAN LUISI: Caitlin.

MS. CAITLIN STARKS: I'll just make a note and Matt can follow up if he has something to add; but I agree with you, Tom that I think the Amendment was initiated to kind of look at all of these issues. This isn't necessarily saying that climate change is causing these shifts; but it's just something that we want to look into. During this scoping period we would be asking for information on that topic.

CHAIRMAN LUISI: Tom, did you want to follow up to that?

MR. FOTE: Yes, because I just never heard anything about bluefish because of climate change. There are other reasons, because of bait distribution and things like that but not climate change. That's why I was just curious.

CHAIRMAN LUISI: I had Roy Miller.

MR. ROY W. MILLER: Just harking back to a remark Jim Gilmore made earlier about potentially one trip biasing catch estimates. If you look at Table 1, I just want to point out something strange in Table 1 with regard to Delaware's landings in 2016 and before, relative to their landing in 2017.

It almost looks like there is an order of magnitude typo there. It's such an enormous jump in landings. If it's not a typo, then I wonder what happened that landings would be nine times greater in one year; when you don't see concurrent leaps in landings in neighboring states of New Jersey and Maryland, for instance.

MR. JOHN CLARK: We had a couple of days with very successful interviews, Roy.

MR. MILLER: Yes that is what I'm afraid of; a couple of days where the interviewers, just by chance, happened to catch a bluefish targeted trip. It looks like an anomaly of low sample size to me; thank you.

CHAIRMAN LUISI: You're questioning MRIP Roy, right? Okay, I just wanted to get that clear; David Watters.

SENATOR DAVID H. WATTERS: Thank you, Senator Watters; New Hampshire. To Tom Fote's point, it does seem to me that who knows whether the relative absence of bluefish in the Gulf of Maine has anything to do with the several degrees of water temperature rise. It's hard to tell whether we would be able to find out whether ocean acidification is starting to have any effect on this species.

But given the opportunity this presents, I would hope that we would at least look at those things in the context of, in Number 5 where it says look at potential ecosystem changes. Why not see what our scientists might be able to say? There may be really nothing for bluefish; but it's something to think about.

CHAIRMAN LUISI: John McMurray.

MR. JOHN G. McMURRAY: Regarding Issue 2. There was a recent discussion at the NOAA Recreational Fishing Summit a few weeks ago about, well during one of the breakout sessions we talked about managers considering recreational encounters and availability, instead of just yield.

Given the history of the bluefish fishery, and the fact that on the recreational side this is really a fishery that is valued for sport rather than meat, it's mostly a release fishery. At least it is now. I would like to see some analysis of quantification of those fish release. Maybe there should be some analysis regarding what the value of keeping fish in the water is; rather than just abstracting them.

I think that should definitely be considered when reviewing allocations. I guess what I'm talking about is maybe part of the recreational quota could be considered in regard to keeping fish in the water for anglers to encounter. I mean I don't see any discussion of that in the document; and maybe that's something that needs to be brought up by the public during scoping. But that certainly is I think a valid concern with the recreational fishing community.

CHAIRMAN LUISI: Yes John, I think I can probably fold in maybe some language to that. But as far as getting in the weeds of an analysis, I'm not so sure that this is the place and time, but maybe as a follow up to the public comment; if you're okay with that. Are you guys okay with that?

Anyone else from the Board of the Council have any other thoughts for Matt and Caitlin? Okay seeing no other comments or questions; I am looking for, we do need to take an action today, and that action would be to approve this document as presented and modified, based on the comment. Chris Batsavage.

MR. CHRIS BATSAVAGE**: I move to approve the document for public comment as modified today; and I'll make that on behalf of the Council and the Board.**

CHAIRMAN LUISI: Okay, so we have a motion made by Chris Batsavage for both the Council and the Board. Peter deFur is going to second that for the Council. Do I have another Board member that would like to second it? David Borden. Okay, so we do have a motion before us. But Caitlin has asked for a second for clarification. Caitlin.

MS. STARKS: I just wanted to ask if we could get some clarification on how to add in language on looking at an analysis of percent release versus kept. I have a suggestion for just add that in as a bullet under Issue 5, so that it is in the document and we can take that out for public comment, and see if anyone has comments on that issue. Does that sound good?

CHAIRMAN LUISI: I think that was a question to you, John.

MR. McMURRAY: I'm sorry, I wasn't paying attention. Can you ask that question again?

CHAIRMAN LUISI: Caitlin just wanted to know if the issue that you brought up, if it would be reasonable just to add it under other issues on Issue 5 as just a bullet, with very little description. But at least it would be in there for the public to make comment about.

MR. McMURRAY: Yes, I think that would be acceptable, just something that would generate some input on that level I think that would be useful. Thank you.

CHAIRMAN LUISI: Okay, any other discussion on the motion to approve the document. Tony DiLernia.

MR. ANTHONY DiLERNIA: Yes Mr. Chairman, I'm going to abstain on the motion. I know you want to move it forward; and I think it's a good idea moving it forward. But moving it forward without having the MRIP estimates put in place I think could get us in trouble later on. I argued against it the last time we discussed this, and I lost. I'm not going to oppose you this time. I am going to abstain on it; because I think we could be making a mistake doing this without the new MRIP estimates.

CHAIRMAN LUISI: Thank you, Tony, I appreciate the comment. Tom Fote.

MR. FOTE: God, this is twice in one day I agree with Tony. When we look at striped bass, it's called the glory fish. When we look at bluefish in the recreational fishing community it's called the money fish; because when you have a blitz of bluefish on the beach or in the boat, people have to go buy so much more tackle.

You know striped bass fishermen use the same plug for 22 years, change the hooks, repaint it and everything else; but bluefish doesn't give you that option. They're the ones that make the money; and then when they're not around that's when the party and charterboats can't really make a lot of trips, because they're the ones they book to take the tourists out and everything else.

As I said, it's the money fish, because anybody can catch a bluefish and they fight like hell. I have concerns over this. I also want to see what the MRIP data is, because we're getting closer and closer that we're not having any transfer of quota, and that is because we're starting to fully utilize that with all the restriction of the species in the recreational fishing community. At some point we need to look at the economics of this, and what the transfer would do.

CHAIRMAN LUISI: Seeing no other hands; does anyone from the audience have anything they would like to offer to the motion? Greg DiDomenico.

MR. GREG DiDOMENICO: I'll wait to make the bulk of my comments when you take it out to public hearing; but I would also, John McMurray's comment sort of reminded me that could we also do an analysis on the other end, which is what would be the cost of leaving under used quota in the water. Thank you.

CHAIRMAN LUISI: Thanks for that Greg. We'll take that under consideration. Okay, seeing no other comments; I'm going to bring it back to the table. I'm going to read the motion and then I'm going to call the question first for the Council; and then we'll take a Board vote after the Council vote. **Okay, the motion is move to approve the draft scoping document for public comment as modified today**.

All those members of the Council please indicate by raising your right hand if you approve; that is 12, any null votes, I'm sorry, any no votes, we did have an abstention, one abstention. To the Board, all those in favor; that's 11 in favor, all those opposed same sign with one opposed, any null votes, any abstentions? Okay the motion carries. Caitlin, Matt, do we have any other business before the Bluefish Management Board and/or the Council at this time?

MR. SEELEY: I think that's it.

CHAIRMAN LUISI: Caitlin.

MS. STARKS: I'll just end by saying we'll follow up with the Board and Council state representatives on whether you're interested in having a state hearing.

ADJOURNMENT

CHAIRMAN LUISI: Okay, with that if there is no other business to come before the Board and the Council at this time, meeting is adjourned.

(Whereupon the meeting adjourned at 4:45 o'clock p.m. on April 30, 2018)

Dustin C. Leaning

From: Brian Marks <bkm072@gmail.com>
Sent: Thursday, January 2, 2020 6:39 PM
To: Dustin C. Leaning
Subject: Re: [External] Bluefish

Thank you for your reply. The fact that people take between one and three fish does indicate the fishery has been in trouble no one is denying that but when you load your boat up with gas purchase $150 with the bait and head out for a fun day with the family if you did get lucky the three fish limit is ridiculous and insulting also giving the party boats more fish makes me really wonder. Can you speak a little bit about the limits that the commercial guys have seems to be a lot of confusion about that? But more importantly let me tell you I have been actively fishing for over 30 years But let me tell you my experience we see bait stores closing up and only have a few in our area marine fuel is now a challenge to find I guess I'm telling you that you were going to continue to destroy the recreational fishery and with that many other business ventures you're a limit of three fish is ridiculous many people online have commented does that count for snappers and I guess it does so people will be out there with their children catching 3. 10 inch snappers and calling it a day or maybe not what can I say we are guys who just want to go out and bring a few fishing for the table it's becoming Harder and harder to justify the time and expense I also am always wondered if you guys making these regulations ever go fishing? And how you really think you know how many fish there are floating around in the ocean? But again thank you for your response hope you think about this because I will be sending these notes to my congressman and senator State Senator at City Councilman we have to try to stick up for ourselves

Sent from my iPhone

> On Jan 2, 2020, at 4:15 PM, Dustin C. Leaning <DLeaning@asmfc.org> wrote:
>
> Hi Brian,
>
> Thank you for your email. Hopefully I can help by providing some additional information.
>
> Unfortunately, the 2019 operational stock assessment found that Bluefish is overfished. This had a negative effect on the 2020 recreational harvest limit, a reduction of 18% from 2019 to 2020. Under current regulations, coastwide recreational landings is projected to exceed 2020's new recreational harvest limit by 28%. The Council and the Commission worked with stakeholder input to approve new management measures that would restrict harvest to the limit.
>
> Very few anglers actually take home 15 fish when they go fishing. Access Point Angler Intercept Survey (APAIS) data shows that most anglers take home only 1-3 fish per trip. This means that reducing the bag limit from let's say 15 to 10 fish has a very small impact on the number of fish that are landed coastwide. The bluefish technical committee's analysis indicated that the bag limit needed to be reduced to 3 to achieve a 28% reduction in landings.
>
> I hope this helps increase transparency in the process. The Commission and the Council were faced with a difficult decision following the overfished designation. The hope is that by preventing overfishing in the near term, Bluefish has a better chance at recovering to a healthy level that will support sustainable recreational fishing in the future.

Best,

Dustin Colson Leaning
Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200A-N
Arlington, VA 22201
703.842.0714
dleaning@asmfc.org
www.asmfc.org

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

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From: Brian Marks [mailto:bkm072@gmail.com]
Sent: Tuesday, December 24, 2019 10:16 AM
To: info <info@asmfc.org>
Subject: [External] Bluefish

hi how is an 18% reduction in bluefish result in 15 fish going to 3 in nys? we have less bait stores and marine fuel outlets each year. the confusing and difficult rules are making fishing a thing of the past. please explain your math and the conflicting rules in ny nj and ct. your ststem lacks credibility MAYBE MY CONGRESSMAN AND SENATOR CAN EXPLAIN WHAT HAPPENED TO COMMON SENSE? bkm072@gmail.com

Atlantic States Marine Fisheries Commission

Atlantic Menhaden Management Board

February 5, 2020
8:30 a.m. – 12:00 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order (*N. Meserve*)	8:30 a.m.
2. Board Consent • Approval of Agenda • Approval of Proceedings from October 2019	8:30 a.m.
3. Public Comment	8:35 a.m.
4. 2019 Single-Species and Ecological Reference Point Benchmark Stock Assessments and Peer Review Reports **Action** • Overview of Single-Species Assessment *(A. Schueller)* • Overview of Ecological Reference Point Assessment (*M. Cieri*) • Presentation of Peer Review Reports *(M. Jones)* • Consider Acceptance of 2019 Benchmark Stock Assessments and Peer Review Reports for Management Use *(N. Meserve)*	8:45 a.m.
5. Consider Management Response to 2019 Benchmark Stock Assessments *(N. Meserve)* **Action**	10:15 a.m.
6. Other Business/Adjourn	12:00 p.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW

Atlantic Menhaden Management Board Meeting
February 5, 2020
8:30 a.m. – 12:00 p.m.
Arlington, Virginia

Chair: Nichola Meserve (MA) Assumed Chair: 05/18	Technical Committee Chair: Joey Ballenger (RI)	Law Enforcement Committee Representative: Maj. Robert Kersey (MD)
Vice Chair: Spud Woodward (GA)	Advisory Panel Chair: Jeff Kaelin (NJ)	Previous Board Meeting: October 28, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (18 votes)		

2. Board Consent
- Approval of Agenda
- Approval of Proceedings from October 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. 2019 Menhaden Single-Species and Ecological Reference Point Benchmark Stock Assessments and Peer Review Reports (8:45 – 10:15 a.m.) Action
Background • The 2019 single-species and ecological reference point (ERP) benchmark stock assessments for Atlantic menhaden were peer-reviewed by a panel of independent experts at SEDAR 69 the week of November 4, in Charleston, SC. The assessments inform management of the species in an ecological context; they evaluate the health of the coastwide population and account for the species role as a forage fish. • The full combined single-species and ERP assessment reports are available on the ASMFC Atlantic Menhaden webpage (http://www.asmfc.org/species/atlantic-menhaden) under the "Stock Status" section**.** Each document contains the respective assessment report, peer review report, and supporting analysis.
Presentations • Overview of single-species assessment by A. Schueller • Overview of ecological reference point assessment by M. Cieri • Presentation of Peer Review reports by M. Jones
Board Actions for Consideration • Accept the 2019 benchmark stock assessment and peer review reports for management use

5. Consider Management Response to 2019 Benchmark Stock Assessments (10:15 a.m. – 12:00 p.m.) Action
Background • The Board should determine how best to incorporate the assessment information into the management program. • The assessments provide a tool to evaluate the tradeoffs of menhaden harvest and predator biomass in a quantitative and transparent way. • There is no one “right” ERP for Atlantic menhaden because the appropriate harvest level for menhaden depends on the management objectives for the ecosystem. • An example ERP is provided, however, the Board can request additional information (model runs) from the ERP Work Group to explore other ERP scenarios. • The assessments provide a potential first step towards fully realized ecosystem-based fishery management via integrated management board decision making.
Board Actions for Consideration • Consider management response to 2019 benchmark stock assessments

6. Other Business/Adjourn

Atlantic Menhaden

Activity level: High

Committee Overlap Score: High (SAS, ERP WG overlaps with American eel, striped bass, northern shrimp, Atlantic herring, horseshoe crab, weakfish)

Committee Task List
• TC, SAS, ERP WG – various taskings relating to management response to the 2019 benchmark stock assessments • TC – April 1st: Annual compliance reports due

TC Members: Joey Ballenger (SC, TC Chair), Jason McNamee (RI), Lindsey Aubart (GA), Jeff Brust (NJ), Matt Cieri (ME), Ellen Cosby (PRFC), Micah Dean (MA), Corrin Flora (NC), Kurt Gottschall (CT), Jesse Hornstein (NY), Rob Latour (VIMS), Chris Swanson (FL), Ray Mroch (NMFS), Josh Newhard (USFWS), Derek Orner (NMFS), Amy Schueller (NMFS), Alexei Sharov (MD), Jeff Tinsman (DE), Kristen Anstead (ASMFC), Max Appelman (ASMFC)

SAS Members: Amy Schueller (NMFS, SAS Chair), Matt Cieri (ME), Micah Dean (MA), Robert Latour (VIMS), Chris Swanson (FL), Ray Mroch (NMFS), Jason McNamee (RI), Alexei Sharov (MD), Jeff Brust (NJ) Kristen Anstead (ASMFC), Max Appelman (ASMFC), Joey Ballenger (SC, TC chair)

ERP WG Members: Jason Boucher (DE), Matt Cieri (ME, BERP Chair), Michael Celestino (NJ), David Chagaris (FL), Micah Dean (MA), Rob Latour (VIMS), Jason McNamee (RI), Amy Schueller (NFMS), Alexei Sharov (MD), Howard Townsend (NFMS), Jim Uphoff (MD), Kristen Anstead (ASMFC), Katie Drew (ASMFC), Sara Murray (ASMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC MENHADEN MANAGEMENT BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 28, 2019

These minutes are draft and subject to approval by the Atlantic Menhaden Management Board.
The Board will review the minutes during its next meeting.

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INDEX OF MOTIONS

1. **Approval of Agenda** by Consent (Page 1).

2. **Approval of Proceedings of February 2019** by Consent (Page 1).

3. **Move that the Atlantic Menhaden Management Board recommend to the ISFMP Policy Board that the Commonwealth of Virginia be found out of compliance, for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic menhaden.**

   The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons. The implementation of this measure is necessary to achieve the goals and objectives of the FMP, and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resources on a long term basis (Page 18). Motion by John McMurray; second by Rep. Sarah Peake. Motion carried (Page 18).

4. **Motion to adjourn** by Consent (Page 18).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Stephen Train, ME (GA)
Sen. David Miramant, ME (LA)
Cheri Patterson, NH, proxy for D. Grout (AA)
Ritchie White, NH
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Rep. Sarah Peake, MA (LA)
Nichola Meserve, MA, Administrative proxy (Chair)
Raymond Kane, MA (GA)
Bob Ballou, RI, proxy for J. McNamee (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Rep. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Andy Shiels, PA, proxy for T. Schaeffer (AA)
Loren Lustig, PA (GA)
Roy Miller, DE (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Lynn Fegley, MD, proxy for B. Anderson (AA)
Phil Langley, MD, proxy for Del. Stein (LA)
Steve Bowman, VA (AA)
Bryan Plumlee, VA (GA)
Pat Geer, VA, proxy for Sen. Mason (LA)
Chris Batsavage, NC, proxy for S. Murphey (AA)
Jerry Mannen, NC (GA)
Mike Blanton, NC, proxy for Rep. Steinburg (LA)
Mel Bell, SC, proxy for R. Boyles (AA)
Malcolm Rhodes, SC (GA)
Spud Woodward, GA (GA)
Doug Haymans, GA (AA)
Rep. Thad Altman, FL (LA)
Martin Gary, PRFC
Derek Orner, NMFS
Mike Millard, USFWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Bob Beal
Toni Kerns
Max Appelman
Maya Drzewicki
Katie Drew
Kristen Anstead

Guests

Robert Atwood, NH F&G
Robert T. Brown, MWA
Matt Cieri, ME DMR
Sen. Ronnie Cromer, SC (LA)
Monty Deihl, Ocean Fleet Svcs.
Doug Grout, NH F&G
Joseph Gordon, PEW
Rebecca Heiss, NH F&G
Pete Himchak, Omega Protein
Kris Kuhn, PA Fish & Boat
Alix, Laferriere, TNC
Ben Landry, Omega Protein
Tom Lilly, Menhaden Project
Carl Lobue, TNC
Shanna Madsen, NJ DFW
Chris Moore, CBF
Brandon Muffley, MAFMC
Trish Murphey, AP NEP
Conor O'Donnell, NH F&G
Susan Olsen, NMFS
Patrick Paquette, MSBA
Dale Pike, CCA
Bob Ross, Boxford, MA
Jocelyn Runnebaum, TNC
John Satterly, VSSA
Bret Scholtes, Omega Protein
Geoffrey Smith, TNC
Ken Staples, NE Reg. Ocean Council
Michael Toole, Newburyport, MA
Jack Travelstead, CCA
Peter Whelan, ASWGA
Phil Zalzack, S. MD Rec. Fishing

These minutes are draft and subject to approval by the Atlantic Menhaden Management Board.
The Board will review the minutes during its next meeting.

The Atlantic Menhaden Management Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Monday, October 27, 2019, and was called to order at 1:00 o'clock p.m. by Chairman Nichola Meserve.

CALL TO ORDER

CHAIRMAN NICHOLA MESERVE: Good afternoon. If Commissioners and members of the public can please take their seats, the Menhaden Board will come to order. My name is Nichola Meserve; I am from Massachusetts Division of Marine Fisheries, and have the honor to be your chair person today.

APPROVAL OF AGENDA

CHAIRMAN MESERVE: We'll start by looking at our agenda. You will note that we're starting 15 minutes early. We're going to try to keep to that schedule, reserving that 15 minutes for our Item 5. Are there any other changes to the agenda today? Seeing none, we'll consider that approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN MESERVE: You also have your proceedings from August of 2019.

Are there any changes or revisions to the minutes from August of 2019? Seeing none, we'll consider those approved as well.

PUBLIC COMMENT

CHAIRMAN MESERVE: We'll now move on to public comments. This is for items that are not on the agenda. I have a sign in sheet that has three people listed on it that would like to speak, including Phil Zalzack, Tom Lilly and Patrick Paquette.

In order to try to stick with our time, are there other people that would like to speak to topics not on the agenda? Seeing none, we have ten minutes on the agenda for this, so Phil if you can try to keep it to three minutes that would be great. Please state your name and affiliation for the record, thank you.

MR. PHIL ZALZACK: Phil Zalzack, I'm President of the Southern Maryland Recreational Fishing Organization. I'm here to talk on behalf of recreational fishermen of Chesapeake Bay. That is about 240,000 people in Virginia and Maryland. I would like to direct your attention to your goals and objectives under Amendment 3, which talk to equitable, ecological and economic benefits. Recreational fishermen are part of that. They fall under that goal as those who extract and utilize predators, which rely on menhaden as a source of prey.

What do I want to talk about? I want to talk about three basic facts and two scientific studies. The first fact is, if you recall from about 1973 to 1980, reduction fisheries took on the order of 200,000 metric tons. According to Dr. Michael Wilberg that is over a billion fish out of the Chesapeake Bay for eight years. You think that would have any impact on the menhaden? If you recall there was a striped bass moratorium following that. All right that is Fact Number 1. Fact Number 2, data provided me by the state of Maryland, Virginia, the Potomac River Fisheries Commission, Marty Gary, I'm looking at him right now. They show that the commercial harvest for the last 20 years, this is for the Potomac River and the Chesapeake Bay for striped bass has declined by 34 percent, weakfish by 99 percent, bluefish by 85 percent, summer flounder by 92 percent, and 80 percent for Spanish mackerel. Perhaps we're starving these predators to death. Maybe we're not overfishing them.

Fact Number 3, according to the 2019 special fishing report, Page 22, which talks of saltwater fishing; the first part of it is freshwater. There has been 11 percent decline in the American saltwater fishing participants. Based on data that I've gotten from the state of Maryland and Virginia, in the case of Maryland we've lost 50,000 saltwater fishermen since 2004.

Virginia has lost 36,000 fishermen since 2013, so that is a 36 percent decline and a 20 percent decline or about 85,000 fewer recreation saltwater fishermen. All right so those are the three basic facts. People say there has been no scientific evidence, there is a problem. Well, I beg to differ with that.

I've got two sources of information, one is Dr. Michael Wilberg, you may have heard of him. He coauthored a paper that was published last November, and what did it say? They reviewed data on about a million fish that were tagged along the coast. What did they find? They found that basically in what he called Region 2, which is the area right off the state of Maryland that the fish really don't migrate that much between about June and October.

That is a core area or a core time when reduction fishing is taking place. If you devastate a region, you may still be within the quota for the entire Atlantic coast, but you've not only devastated the Atlantic menhaden, you've devastated all the predators who feed on those. That is scientific study number one.

There is another one that just came out here recently, one of the coauthors was Dr. Thomas Miller, who is a Director of the Chesapeake Biological Lab, and they talk about and I'll quote, "Striped bass were most sensitive to increase in Atlantic menhaden fishing, largely due to their strong dietary reliance on prey species, but other higher tropic level groups, birds, highly migratory species, sharks and marine mammals were also negatively impacted. That is three facts, two scientific studies. Thirty seconds more.

CHAIRMAN MESERVE: Thirty seconds, thank you.

MR. ZALZACK: According to the latest striped bass report, the economic impact of striped bass and what has happened to them involves a total of 7.7 billion coastwide and 104,000 jobs. That's pretty significant. That is one predator out of 22. I've got the following recommendations.

One shut down the Atlantic Menhaden reduction fishery in the Chesapeake Bay, and reduce the fishing season. Two recognize recreational fishermen as equal stakeholders in the future predator fishery by reallocating Atlantic menhaden status quota on sound conservation principals, not reduction fishery, and three fully fund Atlantic menhaden biomass survey as proposed by the Chesapeake Biological Laboratory. I've already talked to Michael Wilberg, it will cost between 200 and $400,000.00. It's an investment we have to make, because we need to find out where we are. With that I will thank the Chairman and I'll thank this Board for your time.

CHAIRMAN MESERVE: Thank you, Mr. Zalzack. Tom Lilly, and please try to keep to three minutes, please Tom.

MR. TOM LILLY: Chairman Meserve, thank you for the opportunity. I am here representing the Menhaden Project in Chesapeake Bay, and that is a very hard act to follow but I will give it a shot. You know we heard Phil talk about the 80,000 people, saltwater fishermen that aren't there anymore. I would like to add a little parenthesis to that.

You know that number doesn't include the kids that aren't fishing, because if you're a kid in Maryland at least, and you're under 16 years of age, you haven't got to have a fishing license. But a lot of these kids aren't fishing anymore in Maryland on the Chesapeake Bay. I know this hits home, because my grandchildren who eight or nine years ago they were loving starting fishing, and now it seems like they always have something else to do.

They've lost interest. You know I could go on and one, but I know every one of you knows that that is something that's going on up and down the coast. It's the people that count in this thing, folks. That is who you really should be thinking about. It's the people. It's the 400,000 Marylanders that are fishermen, yes.

But it's also millions of Marylanders who love the Chesapeake Bay and treasure those Maryland and Virginia traditions. That is what we're really talking about here. You know to a lot of the people it's a bunch of statistics. It's a bunch of formulas. But for a lot of us it's our lives that we're talking about here. Have I got another minute?

CHAIRMAN MESERVE: You do.

MR. LILLY: Okay. I just wanted to be as quick as I can on this. One thing I would like for you to be thinking about as the spring rolls around that there are two things going on out there on the Atlantic coast. You've got a bunch of menhaden coming down towards the Chesapeake Bay, and in May and June we know roughly how many; because we know what the factory fishing catches. They catch about 30,000 tons, about a third of their quota in those two months.

I wish you would look at the NOAA statistics out of Beaufort on the monthly catch, and what you're going to see is in April and May there are very few menhaden out there coming toward the Bay. Think about those eight purse seiners out there relentlessly after those schools in April and May, and take a look at how few schools are really there. It's about 15,000 schools total, 20,000 menhaden schools.

Okay that is happening. The menhaden are coming down in those schools toward the Bay, but there is another thing going on too, as you all know. There is spawning female spawning stock, rockfish. There are about a million of them or more are in the Bay. Those fish are coming down, and those rockfish are in there. The question that you all have to decide is will they get together? Will those rockfish get together with those menhaden? You are the people that are in control of that. It's an allocation decision in April and May. Who gets allocated those 1500 schools of menhaden? Who do they go to? Now I don't have to tell you Amendment 3 makes it very clear how you are to make that value judgment.

CHAIRMAN MESERVE: Tom, I'm just going to ask you to wrap it up, please.

MR. LILLY: Okay. Think about those two things, those two interests colliding, because it is just that simple. We have all this complexity. But what it really comes down to is are those 1500 schools of menhaden going to get to those fish that need that food so badly? Please think about how you can make that work, because it's not working right now. Those fish are being caught.

CHAIRMAN MESERVE: Thank you, Tom and up next is Patrick Paquette.

MR. PATRICK PAQUETTE: Patrick Paquette, Recreational Fishing Advocate for Massachusetts. I'm a member of the Menhaden AP. I come before you today on behalf of the Mass Striped Bass Association, and a group of over 40 recreational sportfishing clubs that have identified themselves for many years before this Commission as the Menhaden Coalition.

I also in full disclosure, do a little bit of work on behalf of the Teddy Roosevelt Conservation Partnership on this issue. That being said, my comments are process related and not details related, and that is in regard to openness and transparency with the ongoing and soon to be peer reviewed stock assessment.

In the past on the SEDAR website, within weeks of the peer review a draft stock assessment report has been posted. We have played the game according to your rules. We have engaged scientists to participate in stock assessments, and we have identified some things and had some concerns regarding natural mortality and some assumptions regarding natural mortality that were expressed during the stock assessment meetings.

What we are not able to see prior to the peer review, which is unusual as compared to other SEDAR process that we have participated in, is the draft Stock Assessment Report. I am also aware that in different regions and in some states, some of our organizations or in related organizations have actually tried to go through legal means to try and make this happen.

I come before you today to ask one specific thing. Treat this menhaden stock assessment process at SEDAR exactly like others have been, and post the draft Stock Assessment Report on the SEDAR website as has been done before. Please adhere to the SEDAR policies and procedures regarding complete documentation, public involvement, and transparency. Thank you.

CHAIRMAN MESERVE: Thank you, Patrick. I guess just a follow up to ask if there has been a deviation from the process, and if those draft reports are planned to be released prior to the peer review?

EXECUTIVE DIRECTOR ROBERT E. BEAL: Under the ASMFC Peer Review Process, the publication of draft peer review documents are not shared publically, and SEDAR is indicating they're deferring to us on this one to use ASMFC process. The reason we do that. I don't want to just say we don't want you guys to see what's going on is we've got a number of examples in the past where draft documents have been published and folks have taken those, and the draft results have shown up in newspaper articles and all over the internet and those sorts of things.

Then we get to the peer review and things significantly change, and then we end up with this sort of competing stock assessment information from the draft documents to the final post peer review document. That is why the Commission process was modified to not share those documents prior to peer review.

CHAIRMAN MESERVE: Does anyone around the table have any comment or thoughts on that or we're okay? The ASMFC process seems an appropriate way to move forward. That was the end of the public comment for Item 3, and we'll move on to a Progress Update on the 2019 Single Species and Ecological Reference Point Stock Assessments.

PROGRESS UPDATE ON THE 2019 SINGLE SPECIES AND ECOLOGICAL REFERENCE POINT STOCK ASSESSMENTS

CHAIRMAN MESERVE: I've been informed that we're going to go straight to Dr. Drew for the ERP Benchmark Stock Assessment update, and that there is nothing particularly new from Dr. Anstead on the single species assessment, although she is here if there are any questions, so Dr. Drew.

DR. KATIE DREW: Just to remind you guys where we are in this process. The Assessment Reports are complete and have been submitted to the peer review. The peer review is occurring next week, and we'll have the final results and the peer review report available for the February meeting. That will be part of your meeting materials.

But we wanted to take a step to sort of as we've completed the assessment, to start you guys thinking about how you want to respond to this assessment. I want to talk briefly about what's next. I'm not going to be talking really about specific answers or specific numbers. But one of the things that because as Bob said these things can change during peer review.

I think overall though we've explored a lot of models and the final answer is really that there is no one right answer for ecological reference points for Atlantic menhaden, because it depends on what you guys want the ecosystem to look like. How abundant do you want your predators to be? How hard do you want to be able to fish your predators and your other prey species in the ecosystem?

All of these considerations will have implications for the right amount of menhaden that you can take off. What we are providing is essentially a tool for you guys to evaluate these questions. We have a number of different models from very simple to very complex. The very complex models include basically 61 different species and species groups within the ecosystem.

But, we also focused on some intermediate complexity models that included Atlantic menhaden, striped bass, bluefish, weakfish, spiny dogfish and Atlantic herring. These had the best available data. They are all significant predators on menhaden, and they are all of interest to ASMFCs management process. The important thing to consider is that all of these species already have management goals and objectives, in terms of what their biomass target is, what their F target is. To a certain extent that limits what this management board can do with this information. The Board needs to start thinking about not just how they're going to manage menhaden, but how they Commission itself is going to manage menhaden.

The question is, do you want to manage to the existing FMP objectives for these predators, or do you want to redefine these objectives in consultation and in tradeoff with the Atlantic menhaden fishery? If you want to consider redefining your predator objectives, ISFMP Policy Board and NOAA Fisheries will need to weigh in on how we're redefining these.

Atlantic Menhaden Board can't say I want to keep striped bass here, and have the Striped Bass Board having a different reference point. In order to have successful management out of this process, we all need to be on the same page. One option is certainly to say these existing reference points have been set by these single-species FMPs, and that sort of creates a limited environment that we can move menhaden around in, and think about how much we want to fish menhaden in.

But if you want to expand that framework you are going to need to bring in other stakeholders, other management boards, other management agencies, to really have a full ecosystem-based fishery management process, which will of course take a lot longer. I think the Board needs to start thinking about (we're not going to have this conversation today because we have other bigger conversations to have), but when you come back in February you need to start thinking about what are our next steps from here.

Is the Atlantic Menhaden Board only going to focus on existing FMP objectives for other species? Is that your first step? Is the next step to expand this process to the Full Commission? Are we going to manage to predator targets? Are we going to manage to predator thresholds that exist?

All of these are sort of questions that you should be thinking about, so that when you come back in February and see the results, hopefully that have passed peer review that we can provide you with a tool that will let you make these tradeoffs, and let you see some of the options that you have in terms of menhaden reference points, in terms of allowable harvest.

Thinking about this ahead of time will let you guys provide us with better information right from the get go. You guys I'm assuming will have some scenarios of what the ecosystem should look like that you would like us to evaluate. We can come back and we can bring that back to you and show you the answers. I think to have that process move quickly and move efficiently, the more you guys can be prepared to think about do you like your striped bass targets?

Do you like your bluefish targets? Do you want the target, do you want the threshold? Those kinds of questions, so that we can lay out some scenarios for the technical group to evaluate in an efficient way, and move this process forward rather than a lot of back and forth. I can take questions now on that. But I think this is really more about you guys getting ready, going back and thinking about what do you want, not just menhaden but the entire ecosystem to look like, so you can give us some direction, in terms of providing you with options.

CHAIRMAN MESERVE: I'm looking at the Policy Board's agenda later this week, and there is a topic about ecological reference point implications. Is that a continuation of this conversation?

DR. DREW: Yes. It's also on the Policy Board because one of the options for this Board would be to say we want the full blown ecosystem-based management right out of the gate. We have to be able to address, adjust and evaluate targets for predators, as well as targets for menhaden, in which case we need to bring the full Policy Board in on this conversation.

I think we also want the full Policy Board to kind of have an opinion on how ecosystem-based management is going to work for the entire Commission. Is this just a menhaden thing, and that menhaden is the only thing we're going to worry about, and we're just going to keep everything else – all other management – the same? Is this the first step in a much larger evolution for the Commission? We're going to start that conversation at Policy Board.

CHAIRMAN MESERVE: Are there specific questions about this for menhaden today, or if the Board wants to hold questions to the Policy Board meeting when it's going to be talked about in a larger context? Lynn Fegley.

MS. LYNN FEGLEY: Just real quickly, Dr. Drew to your point. There was a survey that was done on striped bass, what did we want out of our striped bass fishery? Is that being considered as a starting point for this? Are you thinking about rerunning that?

DR. DREW: Right now we've developed some example targets and thresholds based on what are currently the targets and thresholds for striped bass that are in management right now. I think that certainly is an example of the Striped Bass Board has been considering changing reference points or changing what they want the striped bass fishery to look like.

That's the kind of a feedback process where, do you want to do that in isolation or do you want to loop menhaden in? It's absolutely a question for the future. But for now we're just going based on the example that we're presenting is going to be based on what's an existing FMP.

CHAIRMAN MESERVE: Any other questions, John McMurray?

MR. JOHN G. McMURRAY: It was mentioned that if we go the full blown ecosystem management we have targets for predators as well as targets for menhaden, and it will take considerably longer. How much longer? Are we talking half a dozen years, a decade, or are we just talking a couple of year?

DR. DREW: It becomes a matter not on the science side, but more on the management side. That is how long is it going to take you guys to come to agreement on what striped bass and menhaden should look like together, let alone looping in NOAA on this? I think the key is we really, as a working group, as a technical group, we see this assessment as this is the first step.

There are steps along the way that you can take to get to maybe the end evolution of the Commission is there is no single-species boards anymore. There is only a Policy Board where we do these evaluations for all of our species coherently. That is 10 or 20 years down the road. Maybe we take the first step at the next meeting and say, we're going to manage menhaden to sustain predators at their existing objectives. We can put those measures in place pretty quickly, relative to that kind of technical work. Those numbers are set essentially, almost. Then we can work on the next step, which is how do we incorporate striped bass and menhaden conversations together?

That's a longer process. That's a management process question. But it doesn't have to be is that the first step that the Board wants to jump to, or does the Board want to take some baby steps in between, and focus on what's already written down on paper?

CHAIRMAN MESERVE: Are there any other questions? John Clark, please.

MR. JOHN CLARK: Thank you for the presentation, Katie. Just following up on what has been asked already. Obviously with striped bass and with other species we're seeing huge changes in the estimated biomass out there from the MRIP figures. I know you're still working on quite a few different multispecies models right now. How flexible and how easily would it be? You're calling these tools that when something does change in these that whatever model is chosen could give really useful feedback in a reasonable amount of time.

DR. DREW: That's a good question. First of all I would like to say all of the species that actually are going into the new models do use the new MRIP data. All of that is completely up to date for the predator species. They are all using the new MRIP data, or at least for our key focal species they are all using the new MRIP data.

Our intermediate complexity models were chosen so that as new stock assessments became available they could more easily be incorporated into these models, as opposed to some of the more complicated models that do require very intensive data sources, and would require a lot of effort to update. The intermediate complexity models could be updated on something that is more aligned with the standard single-species assessment timelines, as long as we get those assessments lined up correctly.

CHAIRMAN MESERVE: Follow up.

MR. CLARK: Just quickly. You anticipate having several different multispecies models that would be part of the tools that would be used here?

DR. DREW: Not as part of the tools, as part of the assessment itself we explored a number of different tools, so that we could compare sort of the effects of very simple models versus very complex models. But the tool that we're recommending is, again this is why we don't want to get too much into it, because it depends on what the peer review panel thinks about all of this. But we're going to recommend one specific tool to approach this. But there are other models being explored to kind of look at some of the effects of those model assumptions and the complexity and the data availability.

CHAIRMAN MESERVE: Tom Fote.

MR. THOMAS P. FOTE: I was wondering what the extra money would cost in all these stock assessments, and the time and effort from the staff that the Commission would take. I'm thinking we're not politicians, and we're also not on the Board of Directors. We don't have to worry about really getting short term in. We can look at the long term effects over things we're doing, because we don't have to worry about the next election.

But again, I don't want to be here. My predecessor I replaced in 1990 was here at 94. I am not going to be here 22 years from now at 94, basically sitting around this table. I'm looking at realistically how much money and how much time and effort by Commission staff would be required to do all these steps?

CHAIRMAN MESERVE: I'm not going to turn to Katie to try to answer that question. I don't think it's fair for her to have to handle or not. I'm going to kind of take it as a bit of a rhetorical question, Tom that you know we're all looking for answers sooner than 22 years. I'm not sure I want to be here in 22 years either.

Are there other questions around the table? If not, Katie has given us a lot to think about in preparation for our next Board meeting, so thank you for that some big questions to keep us up at night.

UPDATE ON THE 2019 REDUCTION FISHERY HARVEST FROM CHESAPEAKE BAY

CHAIRMAN MESERVE: We'll move on to Issue 5, an Update on the 2019 Reduction Fishery Harvest from Chesapeake Bay.

I think everyone is aware at this point that Omega Protein has exceeded Amendment 3's Chesapeake Bay Reduction Fishery Cap of 51,000 metric tons. That occurred on September 6. The latest reports that I have are that the reduction landings from the Bay are now about 65,000 metric tons, so our agenda item does address the Board to consider compliance with the FMP on this issue.

This is a largely familiar discussion, as we've had it several times already. But I'll just set the stage and quickly recover the actions that the Board has taken previously on this topic, which will bring us back about a year and a half ago to when the Board first reviewed state compliance with Amendment 3's implementation deadline.

That was when the Board realized that the Virginia Legislature had not reduced the Bay cap from the Amendment 2 level of 87,216 metric tons to the Amendment 3 level of 51,000 metric tons. A motion was made to recommend noncompliance for not fully and effectively implementing and enforcing Amendment 3.

That motion was postponed until August of 2018, to in the interim send a letter to Virginia to detail the contents of the motion. In August of 2018, when the Board reconvened, the noncompliance motion was again postponed until February of 2019. Both of those postponements sought to give the Virginia Legislature additional time to act, given the political realities of a noncompliance finding.

August was the meeting when NOAA Counsel provided some input that helped us in that discussion. The postponement in 2018 also recognized that the Bay cap was unlikely to be exceeded that year, and at the end of the year we knew that the landings did come in under the cap at about 32,000 metric tons for 2018. Then moving to February, the noncompliance motion was postponed indefinitely, provided that the reduction harvest from the Bay did not exceed 51,000 metric tons. The motion also committed the Board to consider action to modify the Bay cap after it completes action on the ERPs.

Things went along smoothly, you could say, for a couple months until September, when middle of the month the ASMFC leadership notified the states that Omega had exceeded the Bay cap. Prior to that from the documents that are in your briefing book, you should be aware that both VMRC and the ASMFC had urged Omega otherwise, and have stressed the importance of cooperation and following the cap.

Omega released a statement regarding the cap, and said it would stay within the codified level in Virginia's law that being the one from Amendment 2, and then there was additional communication from Omega justifying its action, and committing to a self-imposed 67,000 metric ton harvest limit.

That brings us to today. In a sense not much has changed from our previous discussions on this point, other than the fact that the Bay cap has now been exceeded. We know that despite the best efforts of VMRC, Virginia has not been able to implement or enforce an FMP requirement, a situation upon which the Atlantic Coastal Act would direct ASMFC to do a noncompliance finding.

However, we also recognize that the Secretary of Commerce is directed in the same Act to also consider whether the measure is necessary for the conservation of the fishery in question. This last slide is just the language from the Commission's Charter, as a reminder that if there is to be a noncompliance motion considered that it should include a statement as to how the failure to implement or enforce the required measure jeopardizes the conservation of the resource.

As defined in the charter conservation does refer to not just the coastal fishery resource that being menhaden, but also to the marine environment and other coastal fishery resources. Lastly, just before turning to the Board for discussion on this, I'll point out that there were a large number of comments in your supplemental materials about this topic.

They speak to the passion of stakeholders on this issue, as does the public comment records for Amendment 3. I am confident that everyone here had a chance to look at those, and because of the time constraints and the extensive feedback the Board has already had on this issue, public comment may be limited during this meeting on the topic.

But I hope the public understands that those around this table are seriously engaged on the issue, and recognize your views and appreciate that input as we move forward. I think to move us forward quickly. You know we've had a lot of discussions. If there are any questions first about where we stand with the Bay Cap or the Amendment 3 requirements or anything like that let's try to address those first, any questions? Pat Keliher.

MR. PATRICK C. KELIHER: I really don't have a question, but the 800 pound gorilla here is really how Omega is going to respond. Since I was happy to put somebody on the spot in the Lobster Board meeting, I'm wondering if we can't put Omega on the spot here today, since they're in the room, and ask them to give us some additional background on this issue. The thing that I struggle most about this is while we deal with compliance issues on a state-by-state issue, here it's a company. It's a single company. I think we should hear from that company.

CHAIRMAN MESERVE: Is there any opposition to the Board to inviting Omega Protein to the microphone, if they are so willing? I understand that there are some members here. Adam Nowalsky.

MR. ADAM NOWALSKY: I don't object to that route. I would just highlight that while I can't dispute that there is one company prosecuting this fishery. We talked a little bit about precedent before. It's really the state that we're responsible for responding to the management actions that we implement. I think we should just be very careful with our tone towards specific companies, and how it might apply to any other noncompliance finding, because it's the states that are beholden to complying with what we ask them to do.

CHAIRMAN MESERVE: With that said, Adam, I think that's a good point. For that reason, you know I expect that there may be a motion and public comment will be allowed in a limited fashion at that time. If at that time Omega Protein wishes to be part of the public comment on a motion, then I will turn to them first. Pat. Are there any questions? If not, to kind of direct our conversation I think it would be helpful to have a motion to consider at this point. John McMurray.

MR. McMURRAY: I have such a motion.

CHAIRMAN MESERVE: Go ahead please, if staff has it, John.

MR. McMURRAY: Move that the Atlantic Menhaden Management Board recommend to the ISFMP Policy Board that the Commonwealth of Virginia be found out of compliance, for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic menhaden.

The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons.

The implementation of this measure is necessary to achieve the goals and objectives of the FMP, and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resources on a long term basis.

CHAIRMAN MESERVE: Is there a second to the motion? Sarah Peake. John, would you like to speak to the motion first?

MR. McMURRAY: I would, thank you Madam Chair. First of all it's pretty clear that Virginia has failed to adopt the management measures in Amendment 3, and Omega Protein has willingly exceeded the Bay cap. I would argue that the Bay cap is necessary for conservation. While the Board commissioned some work that was unable to conclude there was localized depletion, it was also unable to conclude there wasn't localized depletion. In the absence of science showing that the reduction fishery doesn't cause localized depletion then a five-year average is reasonable. If I understand correctly, menhaden recruitment in the Chesapeake Bay has been low for several years. The science is pretty clear that removing that much menhaden has had an effect on striped bass and other predators, striped bass in particular, which is overfished.

More importantly that Bay cap was about preventing localized depletion from occurring, and we made a policy decision to do that when we capped harvest at a historical average of 51,000 metric tons. It was a decision to protect one of the largest nursery grounds, not only for menhaden but for just about everything else, again referencing striped bass.

I believe we are certainly in our purview to do that. Whether or not the Secretary of Commerce will support the Commission's finding should not be the basis for a decision here. The authority of the Commission is jeopardized either way, but a failure to find Virginia out of compliance is a sure way to reduce the Commission's authority.

I'm also certain there will be a lot of pushback on this one, particularly from the recreational fishing community. This will not be an easy decision for commerce. It will not be like the last decision that it made, and for these reasons I feel like it's the right thing to do, to find them out of compliance.

CHAIRMAN MESERVE: I think I would like to go the route of speaking in favor and speaking against. If I can get a show of hands for people that would like to speak in favor of the motion around the table. Those that would like to speak against it. There will be an opportunity again, but we'll proceed with the five that have raised their hands so far and not go further than that. Unless there are people that want to speak against it, and we can alternate back and forth. With that said, Ritchie White.

MR. G. RITCHIE WHITE: This clearly is a very difficult decision, and I didn't come here for this meeting knowing how I was going to decide on this issue. This motion is very compelling, and I tend to agree that it is time for us to take a stand, and we cannot worry about the outcome. It is to Adam's point, in all due respect.

It is the Commonwealth of Virginia that has not put in the regulations that we have passed. But the company could have been good stewards and followed the lead of the Commission. The Commonwealth of Virginia didn't force them to catch over the Bay cap. That is very disappointing, and it clearly I think, does not make friends around this table when it comes to our amendment process going forward, and reallocation. For those reasons I reluctantly support this motion.

CHAIRMAN MESERVE: Steve Bowman.

MR. STEVEN G. BOWMAN: First and foremost, on behalf of the Commonwealth of Virginia, I would like to apologize for being in this situation. I would also like to thank you for indulging the Commonwealth of Virginia on two previous occasions; where we truly did attempt to implement some type of mechanism that would remove us from the state that we're in today. Let me just start by saying that having the stigma, from the Commonwealth of Virginia's perspective, of being out of compliance on anything is not a good position in which we desire to be in. Governor Northam, Secretary Strickler, their team, and the Commonwealth of Virginia have worked tirelessly in an attempt to improve the environment, improve the work quality, to do good things in the Commonwealth of Virginia.

However, the laws and the setup in the Commonwealth of Virginia are such that there are times where the administration and its team can impose what we believe are the appropriate things to do as it relates to the management of our fisheries. For that again, I thank you for your indulgence over the last 18 months.

To follow up on what has been said about the Commission process. I have been coming up here since 1992. I came up here as a young snot as a Deputy Chief in the law enforcement division, but I've taken great strides to pay attention to what is going on around this Commission table, and learned a lot from the folks that have been here, a great deal.

I respect every minute and every encounter that we've had, and we do have a process. The process is set by law that the Commission is responsible for setting caps on fisheries. Some of us leave here and don't like it; some of us leave here and like it. Any way you look at it we end up leaving.

To Mr. Nowalsky's point, and friends are friends and business is business as I've said before, but to Mr. Nowalsky's point to others point. The Commonwealth of Virginia, as far as the Administration, would love to have not been here in this situation, and it is true that one entity, which has been at times a good partner in the Commonwealth of Virginia, but at times that brings us here today, we're a little concerned with.

If the Commonwealth of Virginia and the Administration had its way, we would not be here today. There is a process in place, and to maintain the integrity of this great Commission, I believe that there is no other option but to move forward after we've exhausted all of our attempts to do what is right, it brings us here to where we are today.

To one other final point, we know that we have science coming down the path, and I'll be quite honest. After hearing today I'm not as enthused about the speed in which the process moves, but that is sometimes I've been told that I'm somewhat that way. I tend to want things faster than later. But the science is coming.

This company had an opportunity to engage as good partners, to ride the boat with us a little bit longer, and look to see what the science could be, in order to come to an appropriate cap. The 51,000 metric tons it's been said that it's an arbitrary number. I've never known this Commission since I've been here to do anything that is completely arbitrary, because there are so many good minds around here that know the science.

This was based on some averages and was based on a precautionary decision. I think the decision, although it can be questioned, the decision was one that was made that was well intended. That being said, again although I do not at all like the idea of the Commonwealth of Virginia being labeled out of compliance with anything, I intend to vote for the motion.

CHAIRMAN MESERVE: Bryan Plumlee.

MR. J. BRYAN PLUMLEE: As the GA for Virginia, I just want to acknowledge the dozens of fishermen through their leadership who have written or called about the lack of oversight of the primary permit holder for this species by our Legislature. Both the recreational and commercial fishermen of our state complain about two primary points.

First, the decline in menhaden relates directly to the decline in the predator species; less food, less fish. This is perhaps a difficult science and a subtle point for our Legislature, but perhaps at this coming session they will recognize it and enact and adopt the recommended allotment. Even if the information is anecdotal, we know our state scientists with VIMs and Marine Agency rely routinely upon the observations of our fishermen to enact regulations.

The second primary point is that there is a perceived double standard, which puts effective enforcement of our laws in jeopardy. When we allow a powerful actor to ignore regulations, all of our regulations are diminished. Our Legislature meets in January, and it's my sincere wish is that this finding of noncompliance today will cause them to act to adopt the cap. But also to divest themselves of their regulatory authority over this single species, and put it in the hands of the Virginia Marine Resource Commission.

CHAIRMAN MESERVE: Tom Fote.

MR. FOTE: I figured I had to say something, because of all the comments that were put on me, because New Jersey was the one that went out of compliance and went to the Secretary of Commerce. But that was in a different situation. We were not asking for more fish, we were not asking to get away from the conservation that was being imposed on us.

All we were asking for is we want to use our own rules and get the same size that we wanted for our state, not what another state had. We took a greater reduction as a matter of fact as it turned out, then all the states that were required to do, because we knew what we were going to do in our state. We weren't going out of compliance to basically get more fish or to basically harvest more fish. We just wanted to have a different size. This is a different situation.

My concern has always been that we have reduction plants up and down the coast; as a matter of fact North Carolina was the last one to have one. My question has always been what makes one company allowed to absorb the reduction harvest of all the other states? We have no other fishery that did that.

When we did away with the flynet fishery, we did away with certain fisheries, the dragging fishery in the weakfish. We didn't get back to one other dragger from another state because they were allowed to do it. We basically just distributed a pool among all the actors in that fishery. Having said that I look at what is going on with menhaden, and I've been sitting around this table, well not as a Commissioner, but since 1990, but as a player since about '87.

This is one of the problems we've always had with the menhaden industry. At least it's not as bad as it used to be, where there used to be five members of the industry in the five states that used to harvest the resource that actually managed the resource. At least now it's the full Commission almost, and it's basically a better place than we are. That is one of the reasons I'm supporting this. We need to do what we have to do, whether in the future it might be voting New Jersey, we'll make our arguments before the Secretary of Commerce and let them do that. But this is for conservation of the other resources too that is involved in this fishery, and not just the stock of the menhaden.

CHAIRMAN MESERVE: Emerson you'll be next. Before you go though, could I get a show of hands from the audience? How many people think they may want to address the Board on this issue, taking consideration the way the discussion is going, I'm just looking to do some time management, just one? Okay two, okay thank you. Emerson, go ahead.

MR. EMERSON C. HASBROUCK: Although I was not supportive of lowering the bay cap when we voted on that, because it didn't in my mind have a lot of solid biological reasons to do so. However, this Board passed that resolution that set that Chesapeake Bay cap. I support this motion. Even though I did not support lowering the cap, I fully support this motion.

The Board made a decision, and I think we have to stand by that decision regardless of what we think the Secretary of Commerce may or may do. We can't worry about that. We need to do what we have to do to maintain the integrity of this Commission, so I fully support this motion. I feel badly for Mr. Bowman and his staff, kind of caught between a rock and a hard place. But hopefully this action may prompt the Legislature to give them regulatory authority.

CHAIRMAN MESERVE: I'm going to turn to the public now, and the first I saw was Ben Landry and Tom Lilly I also saw your hand, you will be next.

MR. BEN LANDRY: Thank you Madam Chair and Commissioners. I appreciate the opportunity to address you guys. My name is Ben Landry; I'm with Omega Protein. You guys clearly know my company and what we do. You guys have been a significant part of our operations for a long time.

I come before you today not with any illusions that what I've seen is going to turn around in the next five minutes or so. But I do think it's important that you guys understand how the 2019 fishing season worked for Omega Protein. If you guys indulge me, it may be a little bit over a couple of minutes.

I guess to start things off; you know I've heard a couple of speakers today talk about the decline of menhaden. That simply is not the case. The stock assessments have proven over and over again, and you're seeing this play itself out as the stock has increased up to Maine, you're seeing record catches. This population is robust and healthy and sustainable.

It's not a declining stock. I think that's important. Take that into account as you guys think about how to view this overage. Our season started in May in the Chesapeake Bay, and we saw a number of schools inside the Bay. We had a little bit of difficult time finding fish outside of the Bay in the very beginning of the year. We had internal discussions about this. That was unusual to us, but we thought that since it was such moderate amounts of harvest at the time that there was going to be ample time for it to regulate itself, where the fish move outside into the ocean. As that kind of continued into June, we caught a break in July. All of our vessels, every single day in July, were outside in the ocean, and we thought that the situation had normalized itself that we were getting back to the norms, where the majority of the fish caught were outside of the ocean, adhering to your stated purpose in 2006 to fish more outside of the Bay.

I think we have a very strong and very present record of that as adhering to your word, and fishing less in the Bay. In July not a single fish was caught in the Chesapeake Bay. Then we had some weather events early August, where we had a difficult time fishing out into the ocean, for weather and for safety.

But we saw really enormous schools inside the Bay, just inside the Bay, inside the Bay Bridge Tunnel, which we said, "all right, well let's fish in the Bay. We know it's going to move our bait number up a little bit, but we've got to keep this operation going. We've got to keep our fishermen receiving paychecks; otherwise we're just going to tie up our vessels."

That happened again a second week in August, and then a third, and then probably around late August it became inevitable that we were going to run up to that 51,000 number. Anyone that thinks that we took this process lightly, or thumbed our nose at the Commission that is just not my view of it, I mean it was a very difficult decision of how do you balance going over the 51,000 number that you guys have set, and we have enormous respect for this body, we have for a long time.

But, how do you kind of battle between telling your fishermen that you're going to tie up boats, not for any biological reason, there are tons of menhaden out there, but we just don't have access to them. I think the first week of September or so we went over the 51,000 number, notified a number of you all in a statement. I take full responsibility. If you guys read that letter to be aggressive or flippant about the cap that was not the intention.

We continue to have internal discussions. That letter made it look like we would go all the way up to the 87,000 number, which was in Virginia code. That was never out intent. We came back and we said, "Where are we going to voluntarily halt this year?" That is how that 67,000 number came about. The 67,000 number combined with last year's harvest would still put the two-year average under the 51,000.

The further you go back the three-year average, the four-year average. That number drops. In terms of this perennial exceeding of the cap, we've only gone over the 51,000 number one time probably in the last four or five years. This is not troubling the stock at all. We get that it's higher than the number that you asked us to stay within, but in terms of deleterious effects of the stock that is not the case.

I can tell you now that our fishing in the Bay has been halted short of the 67,000 number. You know we do that as an offer of good faith that as we move forward, which the real eye on the prize should be the ecological reference points and not the Bay cap, due to a number of reasons. But we think that the ecological reference points will be something that this Commission can hang its hat on for a long time. Let's look forward to that. But we understand that you guys are well within your prerogative to do whatever you guys want to do. We give that update to you all, just to give you guys some color that this was not this company that's been around for 106 years thumbing its nose at you, it was simply a difficult decision that we made to keep our fishermen fishing.

If we would have thought that the population was troubled by this, I think the decision might have been different, but since we've seen such a healthy, robust stock that has kind of been our thought process behind it. I thank you for the opportunity to address you all. I don't know if it's appropriate, but if you guys have questions I'm happy to answer those as well.

CHAIRMAN MESERVE: While you're in the seat I guess we'll, if you're willing, take a couple of questions from Board members, if they have a burning desire. Adam.

MR. NOWALSKY: Can you describe what role in your decision making process the fact that the Virginia Legislature did not enact the updated cap, in combination with this body's failure to pursue, or decision not to pursue a noncompliance finding previously. Can you tell us what role that played in your decision making?

MR. LANDRY: Thank you for the question, Mr. Commissioner. I would say little. We knew that we were not going to be found on the hook criminally, because of the number in Virginia, it was 87. I would say that that factored in. Was it a conscious effort to say, we're going to go over this? Did we decide in April or May that we were going to go over this, because the number was 87, and this Board had given us some leeway? No.

That was not into our calculus. In fact the decision was made because we haven't gone over this number. We've seen enormous schools out in the ocean of late, and the idea of catching over the 51,000 number in the Bay was a bit shocking to us, I would say at least through the middle part of the season. It had very little impact in us saying that we were going to go over this, because we felt comfortable from a regulatory standpoint. Does that answer your question?

MR. NOWALSKY: Thank you.

CHAIRMAN MESERVE: A couple of other hands over here, Ritchie White.

MR. WHITE: Thank you Mr. Landry for taking our questions. It seemed what you were saying, if I understand you correctly, is that your decision to go over the cap was based on your analysis of the stock of menhaden, and because it's robust then you decided that it did no harm to go over that. If Virginia changes their management regime and adopts the 51,000 tons for Chesapeake Bay, will you make the decision based on your sense of the stock, or will you abide by that quota if that becomes the law in Virginia?

MR. LANDRY: If I'm correct, you're saying that if a bill makes its way through the General Assembly and gets adopted at 51,000, and that becomes the new number in the code? We would adhere to that. We're not in the practice of breaking Virginia law. That would be the approach that we would take.

CHAIRMAN MESERVE: Senator Miramant.

SENATOR DAVID MIRAMANT: Mine was a statement in support for the motion that I would like to come back to, not to question the public.

CHAIRMAN MESERVE: Very good. Were there any other questions for Mr. Landry? Tom Fote.

MR. FOTE: You made a statement about having to tie up your boats at the dock and not send them out at that particular time. There are other dates, and you know that the menhaden are out in the ocean right now, so you could have basically gotten the quota you needed just by waiting until the ocean opened up and the storms quieted down. Well that is true with a lot of the fisheries we manage. We make boats tie it up.

I'm thinking, are you ignorant of the fact that we do that to a whole bunch of other fisheries, where groundfish fishermen have to stay at the dock, where fluke fishermen have to stay at the dock, because we decide that certain periods of time. They don't ignore what the Commission puts out there, or the Council's put out there. It's an understanding. Now because you had a loophole in your Virginia law, and it wasn't going to be a criminal act, it seemed to me it was a little cavalier to say, "Well we can get away with this now."

Especially in the fact, and I think you must have realized this. That's the question I'm asking, you would have gotten all the quota you needed to fill the gaps you needed, by just waiting until when the sea settled down, as most of our boats. Because we don't allow them to fish within three miles of the shore for dragging for fluke and things like it, they have to wait until the ocean calms down. I'm really having a hard time dealing with this the way you're putting it forward to me.

MR. LANDRY: Okay, so the only question I heard in there was if I was ignorant of the idea that other fisheries have to deal with weather. Clearly, we're aware of that. Our fear is that it's an awful lot of risk for the company of our magnitude to take. That is not an indictment of other fisheries. But if we leave dozens of thousands of metric tons on the table, and we get weather in October/November, then we're going to be shy of that coastwide quota.

You guys have apparently been comfortable with the coastwide quota numbers that you guys have given us, and we haven't exceeded that. But we've always kept in our mind that we do have a smaller reserve in the Bay, and how do you manage that versus trying to catch a coastwide quota versus trying to stay within the Bay-wide quota? It was just a risk that we thought we could not take.

CHAIRMAN MESERVE: As long as it's a question, Tom. I want comments about the behavior directed to the Board's discussion, and not asked of Mr. Landry.

MR. FOTE: Okay the question has to do with harvesting smaller fish. It was always Omega's point of view, when there were certain other states that were actually harvesting peanuts, and they were harvesting ones because they didn't have good oil content. Wasn't those fish that you were harvesting not the most profitable fish, because they weren't that big, the ones in the Bay that you were harvesting at that time, compared to what you're getting in the ocean right now?

MR. LANDRY: I can't comment on the age classes of fish. National Marine Fisheries Service has not yet provided the age classes to us. But I will tell you it's a mixed bag. I mean sometimes you get the bigger, oiler fish in the Bay; sometimes they're out in the ocean.

That has never really been a huge part of our fishing operations, in terms of where to catch and how fat they may be. I mean the hope is that they have plenty of oil content, sure. But you can catch sometimes those age three, because of the highly migratory nature of them. You can catch those age threes, age fours in the Bay from time to time too.

CHAIRMAN MESERVE: Okay, any other questions for Mr. Landry? Lynn Fegley.

MS. FEGLEY: Thank you, Ben for offering your perspective. I heard you say to keep your eye on the prize that is the ecological reference points. I don't know that this is a question. I feel compelled to make everybody aware that we are on the cusp of being able to manage this with some ecological vision of this fishery.

You had said, "Oh the menhaden stock is okay." But just please remember everybody that there is a value judgment component to ecological reference points. We ran a survey to see what we wanted out of our striped bass fishery, to help us how to manage that. We talked about doing homework, to think about what we want out of our fisheries as we develop these ecological reference points.

I would just ask you, Mr. Landry, to keep that in your mind, because we don't want to hear, I don't personally want to hear that ecological reference point isn't set appropriately, because it will be a value judgment. It's going to have that component, but it's going to be a scientifically backed one. I just felt compelled to say that.

CHAIRMAN MESERVE: I'm looking to Ben, if you have anything to say. If not, I'll turn to Ritchie White.

MR. LANDRY: We very much hope that the ecological reference points carry a significant scientific nature to it, and that whatever happens to the Bay cap hopefully can be rolled into ecological reference points, and have some kind of scientific backing. That is our hope as well.

CHAIRMAN MESERVE: Thank you, my mistake. It was actually Rep. Abbott who had his hand up.

MR. DENNIS ABBOTT: Thank you Mr. Landry for being here, and thank you for taking my question. We know you're always here when there is a menhaden meeting, for sure. In your description of the fishery this year you talked about whatever reasons drove you back to Chesapeake Bay to catch fish, because they were near the Bay tunnels, wherever they were. Would I not be wrong in surmising that Omega Protein will go where the fish are when they need them, regardless of the numbers? That is the impression I think I'm left with. Would you not think it would be a dereliction of our duty as Commissioners not to find the Commonwealth of Virginia out of compliance?

MR. LANDRY: I think that to answer your first question. Omega largely does go where the fish are. You know that is within reason of course. We're not going to travel too far up north, but we have a region, particularly in the Mid-Atlantic that our goal is to catch fish first outside of the Bay, because that is the message that this Commission and many stakeholders have provided with us.

Yes, I would say that we do go where the fish are when that is at all possible. I won't comment on your duty as a Commissioner. You guys certainly are free to make the decision that you guys choose to, nor am I here to urge you on a particular place. I would say that if you look at from 2000 to 2009, Omega Protein caught roughly around 92,000 metric tons in the Chesapeake Bay.

From 2010 through this year with the higher number, we're right at that 51,000 number that you've asked us to stay within. I think while this year is that anomaly, this year is that to use the term perhaps, episodic event, where they are all inside the Bay. The goal of this Commission to keep us at the 51 number has been met over a ten year period. I would just offer that.

CHAIRMAN MESERVE: I'm going to turn to John McMurray for the last question to Mr. Landry, and then look to other public comments.

MR. McMURRAY: I don't actually have a question for Mr. Landry, but I have a question for Kate regarding Mr. Landry's comments.

CHAIRMAN MESERVE: Okay go ahead, please.

MR. McMURRAY: I may have misunderstood, but there seems to have been some inference that ERPs will give us some guidance on how to set a Bay cap, but that's not the case, correct? My understanding is that the development of ERPs was a coastwide process. It is not going to provide us specific information on the Chesapeake Bay. Absent an entirely new stock assessment for the Bay only, we need to set a limit based on other data, which is essentially what we did with the Bay cap. Is that correct?

DR. DREW: That is correct, yes.

CHAIRMAN MESERVE: I'm going to thank you, Ben for coming to the microphone, for your testimony and a bit of a cross examination there, and invite Tom Lilly to be next for the public comment, and at the same time have the Board be thinking about whether or not. I know Senator Miramant had a comment in support of the motion. If anyone else feels the need to make a comment on the motion, we'll come back to the Board shortly. Mr. Lilly, two minutes please.

MR. LILLY: The first thing I would like you to keep in mind is that I mentioned those 2500, 1500 schools rather of menhaden that have been coming down the Atlantic coast. We know that is what's caught. The basic difficulty here is we don't know what is left in the water. We don't have a measure of that. You're allocating to Omega without a measurement of what is left, or what the total is. As a result of that despite what Mr. Landry says, of those 1500 schools, they could be catching 99 percent of them, and none of them are getting to the rockfish. Now there is no question that we have a very good example in the spawning rockfish biomass down by what is it, 40 percent? Now that is hurting the whole Atlantic coast.

Those fish should be in the Bay. We need menhaden to feed those fish. I think the answer possibly to what he had to say is not so much what they did, but what have resulted, and what you could have accomplished if they hadn't done it. If they had not done it, and I haven't heard this mentioned, as of September 1st, what would have happened?

What would have happened as of September 1, if they had not violated the spirit of that regulation? We would have had about 100 or 150 schools of menhaden coming into the Bay per day, to feed our beleaguered Chesapeake Bay fish. That didn't happen, because they violated the spirit of that regulation. That is the thing you were trying to accomplish that got unaccomplished, if that's the word, by what they did.

Right now through all of September and October, menhaden would have been coming into the Bay to feed our beleaguered fish, and that didn't happen. That is what this is all about, what didn't happen that would have for the first time benefited our Chesapeake Bay ecosystem so greatly. It could have made a huge difference, and it's not. I hope that's your answer.

CHAIRMAN MESERVE: Thank you Mr. Lilly. Were there others from the public? I didn't see any hands earlier. If not, we're going to bring the discussion back to the Board. There was one more hand raised from Senator Miramant in favor of the motion.

SENATOR MIRAMANT: I was just reminded, well a few days ago reading the materials and coming across that letter, of what got me interested in preservation, becoming a member of the Marine Resources Committee in Maine, working with the Commissioner in Law Enforcement, and realizing that how we got here with so many of the fisheries was the same attitude that I was reading was that when a fishery doesn't like what somebody is telling them, they just say that it's not based in science, or numerous things.

I expect that of them. Then it became the state that had to try to regulate, and they did a terrible job. That's why this was formed, and why I was so happy to be able to become a member, because as states we get together and it's not subject to the votes coming from your hometown, and some bad rules being passed, as we watch the fisheries dwindle.

I feel like we are on track, but we need to support this Amendment to make sure that the amount of work that goes into this now to protect fisheries, even if we err on the side of overprotecting them for a while. We have more than made up for it in the other direction, but I don't think that is the case here. I just want to make sure everybody knows that. This is an essential Board for doing just the kind of work that this Amendment is stating.

CHAIRMAN MESERVE: We've had a pretty robust discussion in favor of the motion. Does anyone want to speak against the motion? Bob Ballou, is there something that you would like to add to the conversation?

MR. ROBERT BALLOU: Yes thank you, Madame Chair. I strongly support the motion. I'm deeply disappointed in Omega's actions. I would like to ask regarding the exceedance of the cap. As I read Section 4.3.7 of Amendment 3, there is a clear payback provision in there. Will that be implemented necessarily irrespective of this motion? Is that a separate action that is going to be taking place for 2020?

MR. MAX APPELMAN: Yes, the overage will be deducted from next year's cap of 51,000.

CHAIRMAN MESERVE: I think we're ready for a vote on the motion. Is there a need to **caucus? One minute caucus so I can talk to my delegation. The discussion can come back to the Board. I don't believe the motion needs to be reread; it hasn't changed since it was put up on the Board.**

We do have a request for a roll call vote, but I'll try the easy way first and ask if there is any opposition to the motion or abstentions, two abstentions from the Services, from U.S. Fish and Wildlife Service and National Marine Fisheries Service, and no further opposition. The motion carries, and I will assume, Bob that this will come before the Policy Board on Thursday.

EXECUTIVE DIRECTOR BEAL: Yes, there is a placeholder agenda item on the Policy Board schedule for Thursday morning.

ADJOURNMENT

CHAIRMAN MESERVE: Is there any other business to come before the Board this afternoon? Seeing none; motion to adjourn. So moved, we are adjourned, thank you.

(Whereupon the meeting adjourned at 2:25 o'clock a.m. on October 27, 2019)

From: William Bartlett
To: info
Subject: [External] Article on menhaden
Date: Sunday, January 12, 2020 2:29:52 PM

Dear ASMFC,
I would hope that you would share this with members of the Commission.

MENHADEN

I think that most people familiar with the menhaden issue know that the Secretary of Commerce has placed a moratorium on fishing for the menhaden in the Chesapeake Bay to begin effective June 17,2020. Omega Protein (owned by Cooke of Canada) is the only company still in the business of catching menhaden in the Bay.
Much has been discussed and written about how important the menhaden are to the Bay. Menhaden have been called the most important fish in the sea. It is always mentioned that menhaden feed numerous other fishes like striped bass and bluefish, as well as whales and sharks, but there is more to the menhaden story.

We seem to dwell on the oyster as the great water filterer to clean the Bay. Oysters do not move. They lay on the bottom or may be in some manmade floats at the surface. They have to wait for the tide or the current to bring them food or they filter the same water over and over. The opening of an oyster shell to feed is almost imperceptible. Menhaden have large mouths compared to other fish and they leave them wide open as they move through the water collecting anything that floats. They feed mostly on plankton: phytoplankton (tiny plants) and zooplankton (tiny animals), the two things that cloud so much of the water. We need to improve the clarity of the water to a point where the sun can penetrate it. This would allow grasses to grow which in turn would remove more nutrients and help clear the water. You may notice that menhaden swim in schools near the surface of the water. This is because phytoplankton grows there, where they can receive the sunlight they need to grow.

Zooplankton then feeds on the phytoplankton. As part of the food chain, several species of whales eat zooplankton. The largest fish in the sea is the whale shark and it also eats zooplankton. Doesn't it seem a little strange that some of the largest creatures on earth eat the smallest creatures? Shrimp, snails, jelly fish and menhaden also feed on zooplankton. Even most baby fish feed on some plankton. We need to have enough filter feeders in the water to keep it clean or stop putting so many nutrients into the water. The filter feeders, grasses and oysters are all part of cleaning up the Bay.
Let's do one scenario to the nth degree. Let's say an osprey is returning to her nest with a menhaden fish when she encounters an eagle. The eagle is bigger and stronger than the osprey, but the osprey is a better fisher. The eagle steals the fish. The osprey must now start to hunt for another school of menhaden. She can't find a menhaden close by and has to fly far to get one. By the time she returns to her nest she finds that a group of crows has found her nest and eaten the eggs. Could happen.

Many people use omega 3 oil as a supplement. It is touted as being good for your health. Omega 3 oil is extracted from commercially caught menhaden and sold as fish oil. The actual omega 3 oil is not produced by the fish but comes from the plankton they eat. It is a plant oil and no animal can produce it. We could grow phytoplankton to produce omega 3 oil instead of getting it from the menhaden.

Another scenario we must look at is filial cannibalism. This is where fish eat their own young. Many fish do this and also eat each others' young, though studies suggest they would prefer to eat menhaden. If there were enough menhaden around maybe so many young fish would not be eaten by other fish. This same theory could also be applied to fish eating crabs.

We do not want the Bay to look like a swimming pool. We need all the things in the Bay to be in balance. But removing so many menhaden is keeping things out of balance. To get things in balance we need to remove a lot of plankton. Menhaden are filter feeders and are well equipped to do the job. Just consider what Omega Protein is doing by removing up to 51,000 metric tons of menhaden. That is over 10 million pounds of fish. And that is just in the Bay. Most fish have a food conversion rate of 1.5 to 2. That means the menhaden have to eat 1.5 to 2 pounds of plankton to gain 1 pound. The number of menhaden Omega Protein is allowed to catch would eat over 20 million pounds of plankton. And the company recently caught 87,000 metric tons that put them "not in compliance." The numbers of menhaden caught in total by Omega Protein makes the situation almost incomprehensible.

It is interesting to note how bluefish play an important role in the Bay. Bluefish will attack a school of menhaden and keep on attacking even after they are full of menhaden. When they are caught they may even regurgitate some of the menhaden they ate. Other fish that don't have sharp teeth like the bluefish wait below to eat the pieces that float by. In past years I remember large flocks of seagulls sitting on piers waiting for the bluefish to start feeding. They would get up and fly to the school of fish and feed on the scraps that the bluefish tore up. Sea gulls can't catch menhaden on their own. Many of the pieces of menhaden sink to the bottom where bottom feeding fish and crabs find a meal. So the bluefish feed other fish, crabs and birds. Ain't Mother Nature great.

I remember a project in St. Mary's County where there was an attempt to grow oysters in floats. It was on a large tidal pond off the Potomac River. They used only one finger of the creek. The tide came in and raised the level of water in the finger but there was no exchange of water in the finger. Therefore there were no new plankton for the oysters to feed on. Without more food, the project was bound to fail. One day when I was in the finger I used my oar and pushed it down as far as I could. I could still see the end of the oar, another sign that there were no plankton in the water. When I returned to the river I did the same experiment with the oar. The tip disappeared before the oar was halfway down.

It is ludicrous to think you can remove millions of pounds of fish from an area without damaging the ecology of that area. We have been trying to bring back the oysters and grasses only with varying degrees of success. Why is it that one foreign country can take for free what belongs to all of us and then sell it back to us in the form of fish oil and farmed fish. Our last best chance to return the Chesapeake Bay to some semblance of its past, is to abolish the wholesale slaughter of menhaden.

Bill Bartlett Valley Lee, Maryland

Atlantic States Marine Fisheries Commission

South Atlantic State/Federal Fisheries Management Board

February 5, 2020
1:00 – 5:00 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order (*P. Geer*) 1:00 p.m.

2. Board Consent 1:00 p.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2019

3. Public Comment 1:05 p.m.

4. SEDAR 58 Cobia Benchmark Stock Assessment and Peer Review Report **Action** 1:15 p.m.
   - Presentation of Stock Assessment Report (*K. Siegfried*)
   - Presentation of Peer Review Report (*J. Buckel*)
   - Consider Acceptance of Benchmark Stock Assessment, Reference Points, and Peer Review Report for Management Use (*P. Geer*)

5. Consider Management Response to SEDAR 58 Cobia Assessment Results **Action** 2:15 p.m.
   - Presentation of Recommended Harvest Quota Options from the Cobia Technical Committee (*A. Giuliano*)
   - Set Harvest Specifications (*P. Geer*)

6. Consider Atlantic Croaker Addendum III and Spot Addendum III for Final Approval (*M. Schmidtke*) **Final Action** 3:00 p.m.
   - Review Options and Public Comment Summary
   - Review Committee Reports
   - Consider Final Approval of Atlantic Croaker Addendum III and Spot Addendum III

7. Consider Management Action to Align State and Federal Management of Spanish Mackerel (*P. Geer*) **Action** 4:15 p.m.

The meeting will be held at the Westin Crystal City, 1800 S Eads Street, Arlington, Virginia 22202; 703.486.1111

8. Review Red Drum Stock Assessment Road Map and Consider Recommendations for Changes to the Assessment Timeline (*J. Kipp*) **Possible Action** — 4:40 p.m.

9. Elect Vice Chair **Action** — 4:55 p.m.

10. Other Business/Adjourn — 5:00 p.m.

The meeting will be held at the Westin Crystal City, 1800 S Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW

South Atlantic State/Federal Fisheries Management Board Meeting
Wednesday, February 5, 2020
1:00 – 5:00 p.m.
Arlington, Virginia

Chair: Pat Geer (VA) Assumed Chairmanship: 02/18	Technical Committee (TC) Chairs: Black Drum: Harry Rickabaugh (MD) Cobia: Angela Giuliano (MD) Atlantic Croaker: Dawn Franco (GA) Red Drum: Vacant	Law Enforcement Committee Representative: Capt. Chris Hodge (GA)
Vice Chair: Robert H. Boyles, Jr. (SC)	Advisory Panel Chair: Craig Freeman (VA)	Previous Board Meeting: October 31, 2019
Voting Members: NJ, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS, SAFMC (12 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 31, 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. SEDAR 58 Cobia Benchmark Stock Assessment (1:15 – 2:15 p.m.) Action
Background • A benchmark stock assessment was recently completed for Atlantic cobia and peer reviewed through the Southeast Data, Assessment, and Review (SEDAR) process (**Briefing Materials**). • The assessment uses the Beaufort Assessment Model (BAM), an age-structured projection model, to estimate annual abundances as fish progress in age. This assessment also recommends biological reference points that may be used to determine stock status. • The SEDAR 58 Peer Review Panel endorses use of the BAM and recommended reference points to describe the Atlantic cobia stock.
Presentations • SEDAR 58 Atlantic Cobia Stock Assessment Report by K. Siegfried. • SEDAR 58 Atlantic Cobia Stock Assessment Peer Review Panel Report by J. Buckel.
Board actions for consideration at this meeting

- Consider approval of the Stock Assessment and Peer Review Reports for management use.

5. Management Response to SEDAR 58 Cobia Benchmark Stock Assessment (2:15 – 3:00 p.m.) Action

Background

- The Cobia Technical Committee (Cobia TC) reviewed population projections of the BAM model provided in the SEDAR 58 Assessment Report (**Briefing Materials**) as well as additional projections provided by the SEDAR 58 Analytical Team (**Supplemental Materials**). Based on these projections, the Cobia TC developed options for total harvest quotas for the Board's consideration in specifying harvest quotas (**Supplemental Materials**).
- Under Amendment 1 to the Cobia Fishery Management Plan (FMP), the Board may set harvest specifications following a peer-reviewed stock assessment for up to three years.

Presentations

- Cobia TC Harvest Quota Recommendations by A. Giuliano

Board actions for consideration at this meeting

- Set harvest specifications.
- Set timeline for state implementation plan submission and Board review.

6. Atlantic Croaker Addendum III and Spot Addendum III for Final Approval (3:00 – 4:15 p.m.) Action

Background

- In October 2019, the Board approved Draft Addendum III to Amendment 1 to the Interstate Fishery Management Plan (FMP) for Atlantic Croaker (Croaker Draft Addendum III) and Draft Addendum III to the Omnibus Amendment to the Interstate FMPs for Spanish Mackerel, Spot, and Spotted Seatrout (Spot Draft Addendum III) for Public Comment. These addenda incorporate Technical Committee recommendations for the Traffic Light Approaches (TLA) applied to Atlantic croaker and spot (**Briefing Materials**).
- Public hearings were held in Maryland, Virginia, North Carolina, and via webinar. Written public comments were accepted through January 10, 2020 (**Supplemental Materials**).
- The Advisory Panel (AP), Atlantic Croaker Technical Committee (TC), and Spot Plan Review Team (PRT) met via webinar and will provide recommendations for Board consideration (**Supplemental Materials**).

Presentations

- Public Comment Summary for Croaker Draft Addendum III and Spot Draft Addendum III by M. Schmidtke.
- Advisory Panel and Technical Committee/Plan Review Team Reports by M. Schmidtke.

Board actions for consideration at this meeting

- Review public comment and committee reports and consider final approval for Croaker Draft Addendum III and Spot Draft Addendum III.

7. Consider Management Action to Align State and Federal Management of Spanish Mackerel (4:15 – 4:40 p.m.) Action

Background

- At the October 2019 Board meeting, the Board was mad aware of inconsistencies between Commission and federal management of Spanish mackerel. Action at that time was postponed due to potential changes in federal management being considered by the South Atlantic Fishery Management Council (SAFMC) at their December 2019 meeting.
- The SAFMC postponed consideration of most of the potential changes at their December 2019 meeting.

Board actions for consideration at this meeting

- Consider initiating management action to the Omnibus Amendment so it may better align with or complement federal management of Spanish mackerel.

8. Review Red Drum Stock Assessment Road Map and Consider Recommendations for Changes to the Assessment Timeline (4:40 – 5:00 p.m.) Possible Action

Background

- In 2019, the Assessment Science Committee (ASC) and Red Drum Stock Assessment Subcommittee (SAS) were tasked with providing a road map for future red drum stock assessments. The ASC and SAS met and developed a strategy for the next stock assessment, outlined in a memo developed by the SAS (**Supplemental Materials**).

Presentations

- Red Drum Stock Assessment Road Map by J. Kipp.

Board actions for consideration at this meeting

- Consider initiating a simulation modeling process by which the SAS may determine the most appropriate assessment strategy for red drum, including recommendation to the ISFMP Policy Board for an external peer review of the simulation modeling process.
- Consider changing the stock assessment timeline to accommodate the simulation modeling process and peer review.

9. Elect Vice Chair

10. Other Business/Adjourn

South Atlantic Board

Activity level: High

Committee Overlap Score: Moderate (American Eel TC, Bluefish TC, Menhaden TC, Weakfish TC)

Committee Task List
• Atlantic Croaker and Spot PDT – Draft Addendum III (croaker) and Draft Addendum III (spot) to incorporate updated Traffic Light Analyses; Board Review for Final Action in Winter 2020 • Red Drum SAS – Pending Board direction, conduct simulation modeling and assessment model comparison ahead of next stock assessment • Atlantic Croaker TC – July 1: Compliance Reports Due • Red Drum TC – July 1: Compliance Reports Due • Cobia TC – July 1: Compliance Reports Due • Atlantic Croaker TC – August 1: Update Traffic Light Analysis • Spot PRT – August 1: Update Traffic Light Analysis • Black Drum TC – August 1: Compliance Reports Due • Spotted Seatrout PRT – September 1: Compliance Reports Due • Spanish Mackerel PRT – October 1: Compliance Reports Due • Spot PRT – November 1: Compliance Reports Due

TC Members:
Atlantic Croaker: Dawn Franco (GA, Chair), Kristen Anstead (ASMFC), Michael Schmidtke (ASMFC), Michael Greco (DE), Harry Rickabaugh (MD), Somers Smott (VA), Jason Rock (NC), Dan Zapf (NC), Chris McDonough (SC), Joseph Munyandorero (FL)
Black Drum: Harry Rickabaugh (MD, Chair), Jeff Kipp (ASMFC), Michael Schmidtke (ASMFC), Craig Tomlin (NJ), Jordan Zimmerman (DE), Ethan Simpson (VA), Chris Stewart (NC), Chris McDonough (SC), Ryan Harrell (GA), Liz Herdter Smith (FL)
Cobia: Angela Giuliano (MD, Chair), Michael Schmidtke (ASMFC), Alex Aspinwall (VA), Anne Markwith (NC), Mike Denson (SC, Vice Chair), Chris Kalinowsky (GA), Christina Wiegand (SAMFC), Michael Larkin (SERO)
Red Drum: Jeff Kipp (ASMFC), Michael Schmidtke (ASMFC), Michael Greco (DE), Robert Bourdon (MD), Ethan Simpson (VA), Lee Paramore (NC), Joey Ballenger (SC), Chris Kalinowsky (GA), Roger Pugliese (SAFMC)

Spanish Mackerel (PRT): Michael Schmidtke (ASMFC), Randy Gregory (NC), BJ Hilton (GA), Dustin Addis (FL), Christina Wiegand (SAFMC), John Hadley (SAFMC)
Spot (PRT): Michael Schmidtke (ASMFC), Harry Rickabaugh (MD), Ethan Simpson (VA), Dan Zapf (NC), Chris McDonough (SC), Dawn Franco (GA)
Spotted Seatrout (PRT): Michael Schmidtke (ASMFC), Douglas Lipton (MD), Tracey Bauer (NC), Joey Ballenger (SC), Chris Kalinowsky (GA)

SAS Members:
Red Drum: Jeff Kipp (ASMFC), Michael Schmidtke (ASMFC), Angela Giuliano (MD), Lee Paramore (NC), Joey Ballenger (SC), Jared Flowers (GA), Liz Herdter Smith (FL)

PDT Members:
Atlantic Croaker and Spot: Michael Schmidtke (ASMFC), Harry Rickabaugh (MD), Ethan Simpson (VA), Dan Zapf (NC), Chris McDonough (SC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

SOUTH ATLANTIC STATE/FEDERAL FISHERIES MANAGEMENT BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 31, 2019

These minutes are draft and subject to approval by the South Atlantic State/Federal Fisheries Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of Proceedings** of August 2019 by consent (Page 1).

3. **Move to approve Draft Addendum III to Amendment 1 to the Interstate FMP for Atlantic Croaker and Draft Addendum III for spot to the Omnibus Amendment with the additions discussed for public comment** (Page 10). Motion by Malcolm Rhodes; second by Doug Haymans. Motion carried (Page 11).

4. **Move to approve the 2019 Spotted Seatrout, Black Drum, and Red Drum FMP Reviews, state compliance reports, and *de minimis* requests for New Jersey and Delaware for red drum and spotted seatrout** (Page 18). Motion by Lynn Fegley; second by Jim Estes. Motion carried (Page 18).

5. **Motion to adjourn** by consent (Page 18).

ATTENDANCE

Board Members

Joe Cimino, NJ (AA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Lynn Fegley, MD, proxy for B. Anderson (AA)
Phil Langley, MD, proxy for Del. Stein (LA)
Pat Geer, VA, proxy for S. Bowman (AA), Chair
Chris Batsavage, NC, proxy for S. Murphey (AA)
Mike Blanton, NC, proxy for Sen. Steinburg (LA)
Mel Bell, SC, proxy for R. Boyles (AA)
Malcolm Rhodes, SC (GA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Marty Gary, PRFC
Roy Crabtree, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Chris McDonough, Technical Committee Chair

Staff

Robert Beal
Toni Kerns
Mike Schmidtke
Maya Drzewicki
Jeff Kipp

Guests

Jack McDonough, Eliot, ME
John Satterly, VSSA
Jack Travelstead, CCA

The South Atlantic State/Federal Fisheries Management Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Thursday, October 31, 2019, and was called to order at 10:40 o'clock a.m. by Chairman Pat Geer.

CALL TO ORDER

CHAIRMAN PAT GEER: All right, let's get started, I know everybody has got places to go. We probably could have this meeting in the bar with as few people that are left. My name is Pat Geer; and I am the Chairman of the South Atlantic State and Federal Fisheries Management Board. I welcome you all here today and we'll try to get out of here as quickly as possible, because I know everybody has flights.

APPROVAL OF AGENDA

CHAIRMAN GEER: The first order of business is Approval of the Agenda. Are there any changes to the agenda? Hearing none, the agenda is approved by consent.

APPROVAL OF PROCEEDINGS

CHAIRMAN GEER: Secondly is approval of the proceedings from the August, 2019 meeting. Are there any changes or modifications to the proceedings? Hearing none, the proceedings are approved by consent.

PUBLIC COMMENT

CHAIRMAN GEER: Is there any public comment? I haven't seen anybody sign up. I don't have a signup sheet yet. Does anybody want to speak to anything that is not on the agenda, hearing none, moving on? Mike is trying to get up his computer as quickly as he can. I know I'm rushing him.

CONSIDER APPROVAL OF ATLANTIC CROAKER DRAFT ADDENDUM III AND SPOT DRAFT ADDENDUM III FOR PUBLIC COMMENT

CHAIRMAN GEER: The fourth item is to Consider Approval of Atlantic Croaker Draft Addendum III and Spot Draft Addendum III for Public Comment. If Mike is ready we'll move into that.

DR. MIKE SCHMIDTKE: The Atlantic croaker and spot decided to go out and get tattoos last night after the Nationals won. As I'm going through the presentation today, if you looked at the documents in your briefing materials there is a lot of overlap between the croaker and spot addenda. I'm going to try to not be redundant in the information that's being conveyed.

The first few slides are going to be things that apply to both of these, as they're both running on a similar timeline and have similar background information. Then I'll get into the specifics of croaker first, followed by spot. I guess after croaker, if the Chair thinks it's appropriate, then we can pause for questions specific to that species before moving into spot.

First looking at the timeline, both of these documents are operating along the same timeframe. They were both initiated in May, and have been developed over the summer, and are now being reviewed and considered for public comment. If approved today, then those documents would go out for public comment through January, and the Board would be able to consider them for final approval in February of 2020. Both of these documents are Addendum III for each of their respective FMPs, so there may be some combining of that Addendum III terminology and the Addendum II terminology that applies to the previous TLA, traffic light approach talked about for each species. But traffic light approaches were established for both Atlantic croaker and spot via Addendum II for each of the respective management plans.

The traffic light is a data poor approach that uses the colors of a traffic light, red, yellow, and green to characterize population indicators. The ones that are used in this instance are harvest and abundance. The basic principal behind this is if there is too much red, which is indicative of low harvest or low abundance. If there is too much red for too long then management action is required.

Recently there have been significant declines in harvest as well as reports of poor fishing for both Atlantic croaker and spot that have not been reflected in the fishery independent survey indices used in the traffic light approach for both species. In 2018 the Croaker TC and the Spot Plan Review Team were tasked with looking at the TLA again, and seeing if there were potential revisions that could be made.

They recommended several updates in follow up to that task, also the Joint Croaker and Spot Plan Development Team was tasked with looking at potential management responses that would occur after triggers. There were some recommendations concerning that as well. All of those recommendations are contained in the background of the documents.

Concerning the traffic light approaches themselves. There is a separate TLA; it's not a joint TLA. There is a croaker TLA and a spot TLA, they are run separately. Both of them contain similar characteristics though. Both of them contain a harvest characteristic that includes commercial and recreational harvest, and an abundance characteristic that right now is based off of the Northeast Fisheries Science Center Multispecies Bottom Trawl Survey, as well as the Southeast Area Monitoring Assessment Program Survey, or SEAMAP.

The management trigger is set such that if proportions of red for both the abundance and the harvest characteristics meet or exceed a threshold level for each of the three most recent years for croaker, or the two most recent years for spot, then management action is triggered. The threshold levels that we're currently working with are at 30 percent red and 60 percent red; 30 percent indicating a moderate concern and management response and 60 percent, indicating a more significant concern and response.

That is the end of the information that is applying to both of these species. Now I'm moving specifically into croaker. The statement of the problem for each of these addenda is pretty similar. The Draft Addendum III for Atlantic croaker incorporates the Technical Committee's recommended updates, and considers revisions to the management triggers and responses.

I'm not going to read through all of these, but these have been provided in the document. But the recommended updates include additional abundance surveys, use of age information, evaluating characteristics on a regional scale, changing the reference time period with the primary motivation being to accommodate the new surveys that are put in, and changing the management trigger mechanism. I'm going to go through the TLA figures that give a comparison of what the Addendum II TLA is versus what the Draft Addendum III TLA result would be if all of this information is approved. Looking at Addendum II, this was viewed earlier this year. What you see on the screen here is the harvest characteristic, and you'll note at the end all three of the terminal years exceed the 30 percent threshold, with one of those years exceeding the 60 percent threshold for this characteristic.

Going through looking at the regional metrics that are being proposed through the Technical Committee's updates and Addendum III, the Mid-Atlantic harvest characteristic shows an exceedance of the 30 percent red threshold in all four of the terminal years, with one year being above 60 percent.

For the South Atlantic, this characteristic exceeds 60 percent red in three of the last four years. If this were applied this year there would be that 60 percent level in play, potentially due to the harvest metric. Now moving into the abundance characteristic, and just as a reminder of the harvest characteristics that are tied to each of these, you'll see those kind of down in the bottom right hand corner of the slide.

Coastwide abundance according to the Addendum II traffic light approach, none of the three terminal years exceed 30 percent red, therefore management action is not triggered for Atlantic croaker, and it would not be triggered in 2020 either, if this were continued into next year. Looking at the Mid-Atlantic Region, all of the last four years exceed 30 percent red for the abundance characteristic, and as a reminder all of the four terminal years exceeded 30 percent red for the harvest characteristic as well. Management action would have been triggered this year if this was in place, and it will be triggered next year if this document is approved for management use.

Finally looking at the South Atlantic abundance metric, the abundance does not exceed the 30 percent red threshold in any of the terminal years. Therefore, although harvest is down abundance does not trigger management action due to this region. However, because the Mid-Atlantic Region triggered that would trigger management action on a coastwide basis.

Even though we use regional metrics, this is one continuous stock. Therefore, any action that is triggered due to one region gets applied from a management response on a coastwide basis. Next I'm going to be going through the specific issues and the options that are spelled out within the Draft Addendum.

First of all looking at Issue 1, this is to incorporate one of the recommendations from the Croaker Technical Committee. Option A is as close as we can get to a status quo, while allowing some incorporation of the scientific recommendation to use a regional metric. It's not strictly status quo, but it is close as it evaluates a trigger based on the three terminal years.

Option B would change that trigger to any three of the four terminal years. The thresholds for both of these options would remain the same as those of Addendum II. Looking next at Issue 2, the recreational management trigger response, Option A is that the TC would recommend state percent reduction that is proportional to the percent red that is over the threshold. That is something that the TC was asked to look at going back to when they made the recommendations. That is something that they were asked to look at, as far as what potential measures would be. What they came up with was, oh excuse me. This was the Plan Development Team that was asked to look at this.

Basically their response to this was due to the environmental variables that are strongly tied to the Atlantic croaker fishery, a reduction in harvest by a certain percentage of red from a traffic light analysis would not necessarily be projected to achieve a response in the abundance of the population, which is ultimately what the goal would be from any reduction in harvest.

In response to that, the Board gave the directive to the Plan Development Team to investigate measures that would have kind of a smaller effect on the fishery, but put something in place that management could then work off of as there are no coastwide measures required by this Plan right now.

There are three alternative options to the TC recommending based off of the proportion of both the threshold level, and these for the recreational sector are Option B, which would be a 50 fish bag limit at the 30 percent threshold level. For all of the 30 percent responses, the *de minimis* states would not be required to implement these regulations; it would only be the non *de minimis* states at that stage, so for the 30 percent response, options of 50 fish, 40 fish, or 30 fish.

The upper end of that level was kind of expert opinion among the Plan Development Team of what are some of the upper levels of harvest that go on with this fishery, and where is a good line to cut it off? We also took into consideration some of the state regulations that are in place. I believe the highest state regulation bag limit is 50 fish at this stage. That is something else that went into the consideration and the formation of these specific numbers.

At the 60 percent threshold response all states would be included in any form of management response here, due to it being indicative of a more serious decline in the stock, as well as in the fishery. The bag limits would essentially be reduced by 10 fish per person. Throughout this, states that already have more restrictive measures in place would be encouraged to maintain those. One difficult factor that we ran into in the development of this was trying to accommodate the use of live croaker, and this will apply for spot as well, live spot for use as bait within the recreational sector.

Basically if you put a possession limit on these fish, and somebody is holding that species of fish in a live well, then it could be interpreted that they would be subject to that bag limit based on what they're holding for bait. That is not something that the Plan Development Team was trying to necessarily reduce with this plan.

The language in the document states that for-hire vessels may possess live croaker for use as bait, possessing up to the sum of the bag limits for the number of paying customers allowed onboard. During a trip the bag limits would apply to the harvested fish, according to the number of paying customers that are actually onboard. For example, if a 50 fish bag limit were in place and a vessel were licensed for six customers, that vessel could hold 300 croaker total onboard. But if four customers show up for this trip, only up to 200 of the 300 croaker allowed onboard may be harvested. Anything beyond that 200 number would have to be shown to be held in a live well, and they would have to be alive, not dead.

I spoke with the Law Enforcement Committee about this language earlier this week, and they provided some comments. One of the comments concerning the live lining use was that it would be difficult to essentially enforce a boat limit that includes up to hundreds of live fish, because in going through the live well they would be counting out hundreds of fish, and they would have to take fish out of the live well to do that potentially causing harm to the fish and the Captain or anglers' bait.

One of the ideas that they offered that could be applicable to croaker is implementing a maximum size. What we've heard from talking to our AP is that typically smaller croaker is used as bait. A maximum size on the order of potentially 4 inches could be applicable, and this would be checked by law enforcement by looking at simply a sample of fish, rather than going through the entire live well.

There was also a note in those discussions that the numbers of croaker that are kept alive and are used for bait are essentially limited by the size of the live well and the size of the vessel. There is a mechanism in place that even if there is no rule on how many croaker can be held there, it's not like an angler can go out on the water and fill up a live well, and expect to keep those fish alive to kind of skirt the rules, so to speak.

They recommended a bag limit on the harvested fish only, and no restriction on the number of live fish. If there is any restriction on the number of live fish they would put that as a size restriction, but thinking that that may not even be necessary either.

Just kind of for informational purposes, and the amounts used within all of this, the bait disposition in 2018 was 6 percent of the commercial landings for Atlantic croaker. There is limited data for the recreational disposition, but that is something for consideration that it may not be a huge deal to allow keeping of fish within live wells, and having those fish not count towards any type of vessel or bag limit.

Issue Number 3 deals with the commercial sector and its response to any management trigger. Option A is status quo that the TC would make a recommendation, quite similar to the recreational sector. Option B at the 30 percent would be a response from all non *de minimis* states that do not already have measures in place for something like minimum size or a possession limit for the commercial fishery.

Any state that doesn't have such measures in place and is non *de minimis* would be required to put in some form of measure. The PDT was specific, as this measure would need to be quantifiable, able to be reduced, or essentially able to be reduced if necessary at a higher level of response, something like a season or a trip limit or a size limit, with the projection that it would achieve a 1 percent commercial harvest reduction. This is within the direction of the Board to basically put some form of regulation on the books that's not necessarily going to severely impact harvest, but just so there is a baseline from which management can then move in one direction or another, based on the results that come from it. The suboptions for Option B have to do with the 60 percent threshold response, which would be a more significant concern. The suboptions would include a 5 percent, 10 percent, or 20 percent reduction.

All of these reductions being from the previous ten-year average for Atlantic croaker. Seasons should be brought in, that last statement at the bottom, measures, any measures that are put in, in response to management triggers would need to be reviewed by the TC, and approved by the Board, similar to an implementation plan.

The PDT did want to allow the Board to have some additional flexibility if you all deem it necessary to act beyond the terms that are spelled out in the Addendum. Basically, if the Board deems that more restrictive actions are necessary, then the Board can task the TC to analyze the potential response of the fishery, and come up with an alternative reduction and the measures to achieve it.

But the options that are put in place in this Addendum have some initial reaction measures that can be put in place, and if more time needs to be taken to evaluate further, then the Board can task the TC to do that. Issue Number 4, and the final issue for the document has to do with the evaluation of the fisheries response to any triggering measures.

Status quo is that management measures would remain in place for three years, and after management action has been taken the thresholds would not be applied to the harvest characteristics in assessing the fishery during that three-year period. But there is not really clear direction for what happens after three years.

There was some confusion among members of the Plan Development Team. Option B spells out what would happen in that case in a little bit more detail. Triggering measures would be put in place for at least three years. While they are in place, harvest characteristics would not be used to enact any type of management trigger, but the abundance characteristic can trigger at a higher level by itself.

If we're under measures that are in response to a 30 percent threshold, and the abundance continues to decline such that it triggers at the 60 percent by itself, that could initiate more significant action. After at least three years, if there are no more triggers for harvest, then the triggered measures may be removed and the harvest characteristic would be incorporated into the approach again.

This would not kind of cause the trigger to happen right away again. Obviously the harvest would be low, but the abundance in this case would have exceeded the levels that it needed to be so that measures will not be triggered, and we're still in the case where both abundance and harvest are necessary to trigger management action.

Finally, if triggering measures are in place for a minimum of four years, then the TC will evaluate the trends in abundance and recommend whether more restrictive measures are necessary. The basic idea behind that is if four years have passed and abundance is trending up from the measures that are in place, but it just isn't to the level where the measures would be removed quite yet, then those can remain in place and nothing needs to be done. But if there is still a downward trend in abundance, even though the management measures are in place, then there can be kind of that further evaluation of what to do. That is all for the croaker document, and if it is okay with the Chair we can take questions on croaker specific questions.

CHAIRMAN GEER: Yes I think we'll do that because I think it's going to be about the same, so we'll ask questions while it's fresh in everybody's mind. I want to thank Mike and the TC. We asked them to come up with measures, because when we went through this before we didn't know what those measures would be. At least we have some now that they put forth. A lot of those, when our states met some of these measures were things that we talked about. I'll take any questions that people might have for Mike at this time. I'll go Chris and Lynn.

MR. CHRIS BATSAVAGE: My questions would apply to both spot and croaker. Is it okay to just ask those now, while as you said it's fresh on our minds? Okay, first one in both draft addenda it says Draft Addendum III also retains the TCs ability to alter the TLA as needed to best represent trends in spot harvest and abundance.

Am I correct in interpreting that so a new addendum would not be needed for any changes to the TLA. For instance, if the Plan Review Team or TC I guess in this case, thought it was appropriate to add new independent surveys, or something like that or change any reference years, we wouldn't have to go through an addendum to do that?

DR. SCHMIDTKE: Yes that's correct. Really of the recommendations that have been made by the Technical Committee, the one that necessitates an addendum is the last one that has to do with the management trigger going from, in the case of croaker three years to three out of four. But the other four are scientific decisions that are made by the TC, and they have the full ability to make those scientific decisions to make sure the analysis is as good as it can be.

MR. BATSAVAGE: Thank you for that and I like the flexibility, because it makes for a more efficient process. The second question, is it possible for the Plan Development Team to calculate, I guess coastwide percent reductions expected for the bag limit options for spot and croaker? The reason I ask that is I think at least in our state, where stakeholders are very concerned about equity to see how those compare to the percent reduction options for the commercial fishery.

DR. SCHMIDTKE: Looking specifically at the recreational sector, I did pull some MRIP trips coastwide, and kind of calculate how those would affect the trips for that sector. This is something that can be done more in depth by the Plan Development Team with a little bit more time. This is looking on a coastwide scale, and not thinking of the scaling factors that would happen with actual MRIP estimates based on location or wave and things like that.

Basically running down the list from smallest to largest bag limit, if a 20 fish bag limit were put in place that would impact 8 percent of the trips that harvested croaker, it would impact 4 percent of the trips that harvested croaker at 30 fish, at 40 fish 1.6 percent, and 50 fish about a half percent of the trips. Those percentages go up a bit if you think in terms of harvest and numbers; 28, 20, 10, 4. But that gives a rough scale, very rough scale. I emphasize that because there would definitely be regional impacts on how the actual MRIP estimates would be scaled up on a full analysis. But this is just kind of a quick and dirty look at it.

MR. BATSAVAGE: Thanks, I would expect that question to come up, and I think just giving a ballpark rough estimate would be helpful, or at least have that information available at the public hearings. I'm not recommending that is something that necessarily goes in the draft addenda.

CHAIRAMN GEER: Mike that was coastwide, correct?

DR. SCHMIDTKE: Correct.

CHAIMRAN GEER: Okay, and Lynn you had a question?

MS. LYNN FEGLEY: Yes thanks, Mr. Chair, and thanks Mike for putting this together. You guys put a lot of thought into this, and I particularly appreciate your care about the live lining issue. Just two questions, actually one question and a comment. The first is, I was running under the assumption that states that had regulations in place would be exempt, and it seems like that occurred on the commercial side but not the recreational side.

For example in Maryland, we already have a possession limit and a size limit on croaker. I think it says it in the document that if you have something in place that is more conservative, then you would be encouraged to maintain that. But for example, I don't think that I would want to try to mess with putting a maximum size, switching a minimum size for croaker to a maximum size croaker in Maryland. I just want to make sure that that flexibility is in there.

DR. SCHMIDTKE: Just to clarify. There is a minimum size for croaker and a bag limit in place. Yes, Maryland would be able to maintain their minimum size, and maintain their current bag limit, because I think yours is 25 fish or something like that. That is more restrictive than what would be required by the triggered measures.

One thing to note is that all of these measures would only be in place when management action is triggered by the TLA. If everything were fine, which croaker we know from looking at the numbers that if this Addendum is passed action will be triggered next year. But that is not necessarily the case for spot, so in the case where everything is fine then these requirements would not be in place, it would only be during times when action is triggered.

MS. FEGLEY: That's a good segue, because my other comment you articulated it very well in this presentation, but it struck me that in the draft addenda there was not a lot of language letting the public know about this idea that we can't really project the impact of these actions on the stock.

I think it would be worth adding some language to be very clear, you know sort of the nature of this type of management, and you know the assessment that didn't pass peer review. It's not online because it didn't pass peer review, so that background information is a little harder to find. Then also, I thought given the very strong comment in this regard from our stakeholders that it would also be worth mentioning something about the magnitude of the harvest of the recreational and commercial fisheries relative to what's happening in the bycatch fisheries. Because there was a lot of discussion, even here at the Board, about how we really in making these actions are kind of nibbling at the edges.

Relative to the bycatch, I think if we lived in a perfect world, if we triggered we would want to tell all the bycatch to go down too, but we can't. I think for transparency it would just be a couple sentences in there to reflect sort of where we are, relative to those other pieces of mortality.

CHAIRMAN GEER: Are there any other questions for Mike? John.

MR. JOHN CLARK: More just kind of a comment about the TLA diagrams. I mean even though they're very simple, every time I look at them it still takes me a while. I don't know if I'm distracted by the pretty colors, but I'm just thinking for the public that has never seen that type of diagram before, maybe it would help to have a little example, you know with arrows pointing to what you mean by the scale of the 30 percent to 60 percent. That is something different from most of what we present when we're looking at these things. Like I said if you haven't seen them before they can be a little confusing, rather than just simple to see.

DR. SCHMIDTKE: That was a comment that got brought up with the Technical Committee when this was reviewed by them as well, and that's why we added the appendix, which includes like the landings in more of a linear format with a long-term mean relative to that. You think that we would need to do something beyond that or incorporate it into more of the main portion of the document?

MR. CLARK: Yes, I think Mike. I thought like before you get into all the, because it looks like it just goes right into those TLA ones. Maybe just like a small, you know like an example. Just say, this is how to interpret a traffic light graph.

CHAIRMAN GEER: John, I see what you mean. I was presenting these graphs to crab committees for years, and when they finally had an epiphany and they understood it, it was like oh glory, glory. It was about four or five years before they finally understood it, but when they did it they realized this is pretty simple, but it takes a little bit of understanding. Are there any other questions or comments? Hearing none, I guess we'll move on for spot now.

DR. SCHMIDTKE: Okay so next going through the information for spot. The information that is overlapping I'll go through a little bit more quickly than I did for croaker, as it's been explained a bit more already. Statement of the problem very similar, Draft Addendum III for spot

Draft Addendum III to the Omnibus Amendment incorporates the PRT recommended updates. These were done in coordination with the Croaker TC, and it also considers revisions to the management triggers and responses. Here we show the recommendations that were made, very similar. The couple things to note for spot specifically are that instead of the South Carolina DNR Trammel Net Survey being added to account for the southern region, the North Carolina Pamlico Sound Survey kind of replaces that in the case of spot. The age of adults for croaker is two plus, where spot one plus in point number 2.

Both use the regional metrics and are going to be using the same reference time period. Finally, the trigger mechanism that was recommended was for two of the three terminal years for spot, accounting for their shorter lifespan. Now looking at the traffic light figures specifically for spot, this first one is the one that is currently in place.

The harvest metric it exceeds 30 percent in one of the two terminal years, and starts to approach that 60 percent level. Looking at the proposed Mid-Atlantic harvest metric that exceeds 30 percent in two of the three terminal years, and with one of those years being above 60 percent. Next the South Atlantic harvest, all three of the terminal years are above the 30 percent threshold, with one year above 60 percent.

Now going into the abundance metrics, the Addendum II TLA, the abundance metric exceeds the 30 percent red threshold in the terminal year. With the current TLA for spot, there would be potential, depending on how 2019 performed in terms of abundance and harvest for it to be triggered with the current mechanism.

Looking at the regional metrics again, for the Mid-Atlantic all three of the terminal years are above 30 percent, with one year above 60 percent. Bringing in the information from the harvest, the terminal year for harvest was above 30 percent, but the 2017 red level was below the threshold. We're in a situation for the Mid-Atlantic region where there could be management triggered, or if both of the metrics are reducing the amount of red then management action may not be triggered for spot, due to the Mid-Atlantic analysis.

Next looking at the South Atlantic abundance metric, it exceeds 30 percent in only one of three terminal years, but taking into account harvest this also is kind of in a similar situation, where it depends on how the fishery performs in 2019. It may trigger in 2020, it's yet to be seen. Spot is in a little bit different place than croaker, whereas croaker will trigger if all of this goes through, croaker will trigger in 2020. Spot may trigger.

The management triggers very similar, Option A the close to status quo option is that the threshold needs to be exceeded in both of the most recent two years. Option B the threshold would need to be exceeded in two of three terminal years to trigger management action, and the thresholds of course would remain the same.

Looking at Issue 2, the bag limits are the same as croaker, and same type of principle in the sense that non *de minimis* states would be the ones that would have to take action, in terms of the 30 percent threshold response, and all states would be included in the response at the 60 percent threshold.

Considering the live lining use for spot, there were similar comments that were given. The one difference, and there were similar provisions in the original document. Looking next at the LEC comments, the one difference between spot and croaker is that spot were noted by our Advisory Panel that large spot are used and are preferred in fishing for a species like striped bass, cobia, large red drum, and so an upper size limit for spot would not be as applicable as it could potentially be for croaker.

Again, the LEC notes the limitations that are put in place, kind of essentially through the live well size of the vessel, and I wasn't able to fill in this percentage. I apologize. I had a place holder there for how much of the commercial landings are of bait disposition, but I do have the information for the recreational trip information for spot, kind of similar to croaker.

If a 20 fish bag limit were put in place then that would impact 13 percent of the trips that harvested spot, 30 fish bag limit would impact 10 percent of trips, 40 fish bag limit would impact 5 percent, and 60 fish bag limit would impact 4 percent. That kind of gives a bit of the scale of what the recreational bag limits how they would potentially impact those trips.

Next looking at the commercial trigger response, similar status quo as croaker, except right now spot does not have a technical committee, so the Plan Review Team is the body that would be recommending percent reductions, and this applies for both the commercial and the recreational status quo options.

Looking at Option B the 30 percent threshold response is similar to croaker, quantifiable measures that would achieve a 1 percent commercial harvest reduction from the previous ten year average. This would apply for non *de minimis* states that do not already have measures in place. At the 60 percent level all states would be included, and again it would be the commercial quantifiable measures that would achieve 5 percent, 10 percent, or 20 percent reductions, based on the suboption chosen.

In order to evaluate any implementation plans submitted to put in triggered response measures, a Spot Technical Committee would be formed with the passing of this Addendum. The Omnibus Amendment includes information on the composition of the Technical Committee for spot; it just simply did not form one. But it doesn't preclude the formation of one.

This notes that a technical committee would be a bit more able to evaluate these implementation plans as it tends to have more technical expertise than a Plan Review Team, also there is representation from all states on a technical committee, whereas a Plan Review Team is typically a smaller body that doesn't necessarily have representation from all states.

That would be able to incorporate some of the state expertise and explanation of the implementation plans in that evaluation process. Next looking at the alternative management response, and that is the same as croaker that if the Board wants to be more restrictive they can direct what would be the newly formed Spot TC to come up with these alternative measures.

Finally, looking at the evaluation of the fisheries response to the triggered measures, this is very similar to the issue that occurred with croaker, where there wasn't much direction, and there was some confusion among the PDT as to what happens after two years of triggered measures. Option B tweaks it a little bit to say that measures would be put in place for at least two years, and there is the potential that they could be continued further. But during triggered measures harvest wouldn't be used for management. Abundance can trigger at a higher level, similar to what was described for croaker, just altering the timeframe a little bit. After at least two years if there aren't any more triggers for abundance, then no more triggered measures would be required, and the harvest characteristic can be incorporated into the evaluation again.

If triggered measures remain in place for a minimum of three years, then the TC can evaluate the abundance trends, and recommend if more restrictive action is necessary. With that I can take questions on spot.

CHAIRMAN GEER: Are there any specific questions on spot, Malcolm, no?

DR. SCHMIDTKE: Just letting you know that the questions and the points that were raised on potential additions for croaker, I'm taking those that they are applicable to spot as well. I'm planning to put them into both documents.

CHAIRMAN GEER: Malcolm.

DR. MALCOLM RHODES: All right if it pleases the Chairman, I would move to approve the Atlantic croaker Draft Amendment III, and Spot Draft Amendment IIII, with the additions discussed for public comment. Addendum III, I'm sorry.

CHAIRMAN GEER: Mike has a question before we take a second on that.

DR. SCHMIDTKE: I guess does the Board have any additional direction on the live lining language that is currently in the documents, with respect to the comments that were provided by the LEC, because right now what's in the document talks about restricting what is in the live well. Is that something that the Board wants to move forward with, or would you like that removed now that the LEC has provided their comments related to enforcement?

CHAIRMAN GEER: What is the pleasure of the Board on that? Lynn.

MS. FEGLEY: Recognizing the issues with the LECs comment. I really think I would like to leave it stand in there, just because I would like to get some public comment on that. That would be my opinion.

CHAIRMAN GEER: Anyone else? I see people nodding your head no, so shaking your head no. We have a motion on the floor; do we have a second by anyone? Second by Mel Bell, say it again? Doug, do you have a question? I think we already have a couple seconds, Doug. Excuse me, you're right. Excuse me, Mr. Bell. You can't take it; it's the same state, so I will take a second from Mr. Haymans from the great state of Georgia.

Make sure we have the motion right before, we had some question about which addendum this was, because in the Omnibus there were two concurrent addenda going on. We want to make sure we have this right. Is there any other discussion on this? **I'll read the motion. Move to approve Draft Addendum III to Amendment 1 to the Interstate FMP for Atlantic croaker and Draft Addendum III for spot to the Omnibus Amendment with the additions discussed for public comment. Motion by Dr. Rhodes, and seconded by Mr. Haymans. Let's see a show of hands of who is in favor. Opposed, the motion carries unanimously.** Thank you very much, Mike. I appreciate that.

DISCUSS DIFFERENCES BETWEEN FEDERAL AND COMMISSION MANAGEMENT OF SPANISH MACKEREL

CHAIRMAN GEER: The next item on the agenda is we have a memo that Mike wrote concerning Spanish mackerel, and some inconsistencies we have between the Federal Plan. What do we do?

There is no mention of what happens in state waters when the federal waters close. The zones are slightly different. They are defined slightly differently between the South Atlantic Fisheries Management Council and the Commission. There is also the Southern Zone Commercial Management Measures are somewhat different as well. Mike has three things. He can pull these up and show you.

DR. SCHMIDTKE: Just providing some additional discussion points for the Board, and summarizing what's in that memo. This was all looked at in response to the northern zone closure that occurred in August 2019, for federal waters. Basically we had inquiries from several states as to what the response of states needs to be when there is a federal closure.

The short answer is that the Omnibus Amendment doesn't require states to do anything in response to a federal closure with the current language. But kind of in that look into the Omnibus, we also noticed that there were some management differences, some pretty key management differences between Commission and Federal management documents.

First of these being the differences in the regional management zones, the zones were updated through Amendment 20B to the Coastal Migratory Pelagics FMP, and that just for whatever reason did not get carried over to the Omnibus Amendment. There are differences in the zones right now, and secondly in the southern zone commercial measures, both the Omnibus and the Coastal Migratory Pelagics describe a step down process that reduces the southern zone trip limit as it approaches an adjusted quota.

The difference there is that from the Coastal Migratory Pelagics FMP, when 100 percent of the full commercial ACL is caught, then the fishery is closed. There is no mention of any type of closures within the Omnibus Amendment. The Omnibus Amendment really only comments on the ACL being reduced in the following year if the stock is overfished, which it's not right now, so that is not something that would be immediately applicable.

It does mention within it that there would be a closure for the remainder of the year if a quota is met, but quota is distinct from an ACL within that document. That quota refers to any quota that is set by the Commission, and there is nothing in the document that sets a Commission quota or connects the Commission quota to the Federal ACL.

That is why there is technically no language that would tie any federal closure to states needing to close. Kind of further moving the target for kind of aligning management, there is some action that is currently being considered by the South Atlantic Fishery Management Council. It will be reviewed at their December meeting. They're planning to take final action on it in January that proposes modifications to the accountability measures that would allow a 500 pound trip limit after the commercial zones have met their respective quotas, until the total ACL, which includes both sectors, has been met. At which point the entire fishery, both sectors would be closed. That is kind of something that has been proposed and is being talked about by the Council. These issues were raised so that the Board can consider whether and how to complement the Council's management for Spanish mackerel.

CHAIRMAN GEER: Jim, go ahead.

MR. JIM ESTES: I think that was a pretty good summary, Mike. Thank you. This is a mess. In fact I think we took action after the federal waters closed, and I had to call Toni to say, "Are we out of compliance?" Because I did not understand, because the plans are so different and they're confusing, and they need to be fixed, we need to do something with this.

But I think it's a little bit early now, I think to go do something about this, until we know what the Council is going to do, because that is quite a big change from what they're doing right now. We may not all agree on what we should do until we know what they're doing. That's my two cents.

CHAIRMAN GEER: Are there any other comments? Chris.

MR. BATSAVAGE: Just a comment and then a question. Kind of as it stands now, where there is no required closure in states waters, it makes me a little nervous, even though the stocks seem to be fine right now. Most of the fish are landed in state waters. There appears to be an under harvest in the recreational fishery.

However, when the revised MRIP estimates are incorporated in the next stock assessment, we may find out that they were harvesting more fish and closer to their ACL than originally thought, if scup and black sea bass north of Cape Hatteras are any indication. Looking at some way to put some measures in to address that either through complementing the South Atlantic Plan or not, it's probably a good idea.

A question I have, and it kind of goes to Jim Estes comments that we try to complement what's going on with the Federal Plan, but we're always going to be kind of chasing whatever changes occur on that. Could we look into an addendum to this FMP that allows for responding to changes for federal Spanish mackerel management, and adjust the management through Board action, rather than an addendum, ensuring greater consistency between the state and federal regulations?

I'm thinking about something similar to what we put in place under Addendum V to the Coastal Sharks FMP, to where we wouldn't have to take action every time there were changes to federal coastal shark measures. I don't know if that is a question for Toni or not, or just the Board in general as far as thoughts on that.

CHAIRMAN GEER: Okay I'll go to Toni and then Roy.

MS. TONI KERNS: Chris, yes. That is something that we could consider in an addendum. In order to do that we would just have to outline what type of measures that you would want to be able to make changes to through Board action. While I have the microphone, I will ask a question of the Board is several of you obviously sit on the South Atlantic Council, but not everybody on this Board does. Are there any issues or concerns or thoughts of support for certain things that you would want the Commission to bring forward to the South Atlantic Council as they are considering changes to their framework? Is there any message, you know information that you think would be helpful to bring over to the South Atlantic Council?

CHAIRMAN GEER: Roy, did you still have something?

DR. ROY CRABTREE: Well I just wanted to agree with Jim and Chris that this is a bit of a mess right now. I think we do need to update the plan and reconcile it with the Federal Plan, and I agree with Chris that leaving state waters open after the quotas are caught, the ACLs are caught is not a good idea.

My worry is that we're going to have to when we start looking at when to close the commercial fishery, we're going to have to start closing early to account for what is going to be caught in state waters. Otherwise, we're going to continuously go over the ACL, which the statute doesn't allow us to do without some accountability.

I think what the South Atlantic Council is looking at that is on the board now kind of came up at the last minute at the last Council meeting. I think that is probably not a good idea, and I hope we don't go down that path. There are a lot of problems with it, not the least of which are the new recreational catch estimates.

But there is also the lack of timeliness in the recreational catch estimates, and our ability to tell when the recreational fisheries caught what. It's going to entail a great deal of projections and uncertainty, and so I hope we don't go down that path. But I think we do need to update this plan. I think it's been quite a while since the plan was updated, at least the Spanish mackerel part of it. I think we do need to do that.

CHAIRMAN GEER: Roy, should we take action now or wait until the December Council meeting, and decide what the Council is going to move forward with?

DR. CRABTREE: Well I guess I would leave that up to you, and I don't know that the Council is going to be able to take any final action at the December meeting, because I'm not sure that all of the documents will be pulled together. You may not know even at that point where they're going to be. But I'll defer to my colleagues.

MR. A. G. "SPUD" WOODWARD: That is our predicament is that we're going to discuss options and alternatives in December, and then we hope to have some sort of final decisive action on a call in a meeting in January. But I'm not sure that is going to happen. We've got a timing issue.

There is a sense of urgency, but I don't know that we can mitigate this, because we don't know what to do. If we started initiating an addendum right now, we don't know what to put in the addendum, other than maybe the zones and some things like that that are probably going to stay the same in the federal plan. But as far as actual, how do you do quota management, and so forth and so on. It's undetermined at this point. I think it's almost one of those things where we know we need to do something, but we don't have the information we need to initiate anything at this point.

CHAIRMAN GEER: Mel.

MR. MEL BELL: I think just following up on Roy and what Spud said. Yes it is a bit of a mess at the moment, and the Council did, this just sort of came up at the last meeting in particular. We're really not in a position to know where we're going to land. If we're trying to synchronize these plans and all, it's a moving target at this point. You might want to wait until we work through the federal side of this to see what we've got, and then try to match up from there perhaps.

CHAIRMAN GEER: Are there any other comments? Spud.

MR. WOODWARD: Well I think the issue that was raised and caused concern, obviously the northern zone commercial quota was met, and there was a closure in August, which is the earliest that it has been. That prompted discussion about clarity as regards to the current version of the Omnibus Amendment.

I think just so it's said on the record; as it sits right now there is nothing in the Omnibus Plan that would compel the state of North Carolina to stop fishing in its state waters for Spanish mackerel at this point. That is a correct interpretation of the Plan as it is written right now, correct?

DR. SCHMIDTKE: Yes.

CHAIRMAN GEER: Well maybe what we can do is start populating our Plan Development Team, and then come back in February with a motion to start; I would assume it would be an addendum, or an amendment? Toni.

MS. KERNS: I think most likely an addendum. If there is something in there that we can't modify through an addendum then it would have to be an amendment. We could have that Plan Development Team at least pull together a list, which Mike has basically done already.

But as the Council moves forward with their framework, we could bring back to the Board a list of information; maybe have a little bit more background information in there. If the Board does initiate an addendum it will be a little easier and faster to pull together, if that is the intent of the Board for issues such as the difference in the zone boundaries.

CHAIRMAN GEER: Does that sound like a way to move forward with the Board now? I see everyone saying yes. Is there any other discussion on this topic? We're going to try to do these compliance reports. I'm told Mike everyone is cold in this room. I know if I'm cold everyone is cold.

CONSIDER 2019 FISHERY MANAGEMENT PLAN REVIEWS AND STATE COMPLIANCE FOR RED DRUM, BLACK DRUM, AND SPOTTED SEATROUT

CHAIRMAN GEER: Everyone wants to get out of here, so Mike are we going to do the compliance reports for red drum, black drum, and spotted sea trout?

DR. SCHMIDTKE: I will try to move through these quickly; not really huge compliance issues with any of these species, but just gives an update on each of them. First looking at red drum, total coastwide red drums in 2018 were 8.3 million pounds. This is roughly a 1.4 million pound decrease from 2017, but it is above the previous ten year average.

The commercial and recreational fisheries harvested 2 percent and 98 percent of the total respectively. Coastwide commercial landings have varied without much trend from approximately 55,000 to 423,000 pounds since 1981. In 2018, coastwide commercial harvest decreased from 194,000 pounds in 2017 to 145,000 pounds, with 99 percent of the commercial harvest coming from North Carolina.

Red drum are assessed as two stocks, one in the Mid-Atlantic from North Carolina north, and the other in the South Atlantic from South Carolina south. In 2018, 80 percent of the total landings came from the South Atlantic region, where the fishery is exclusively recreational, and the other 20 percent came from the Mid-Atlantic.

This really continues a trend that's been going on for the last 30 years, in which the majority of harvest comes from the South Atlantic recreational fishery. Recreational data as a note, these are all updated FES numbers. Recreational harvest of red drum peaked in 1984 at 2.9 million fish, which comes to 10.1 million pounds.

Following this peak and a subsequent decline, the recreational fishery has shown an increasing trend from the late 1980s through the present, in terms of both harvest and catch. In 2018 the recreational harvest decreased from 2.6 million fish to 2.3 million fish, and as far as poundage that goes 9.5 million pounds in 2017, 8.2 million pounds in 2018. The 2018 harvest is higher than the previous 10-year average in numbers and in pounds.

Florida anglers landed the largest share of recreational harvest in numbers at 47 percent, followed by Georgia and North Carolina. Anglers release more red drum than they keep. The percentage of the catch that is released has hovered around 80 percent since the 1990s, and recreational releases show an increasing trend over the time series, due to an increasing trend in the catch, 9.8 million fish were released in 2018, which is 81 percent of the recreational catch.

Eight percent of the released fish are estimated to die as a result of being caught using this mortality rate. An estimated 782,000 discarded fish died in 2018. Recreational removals from the fishery in 2018 are thus estimated to be 3 million fish. This increasing trend seen in total removals since the late 1980s is reflective of increases in catch and harvest.

The most recent coastwide assessment was completed in 2017. It indicated that the abundance of young fish from both the northern and southern stocks has remained fairly stable since 1991, and static spawning potential ratio has been above the overfishing threshold since 1995. Therefore, neither stock is likely experiencing overfishing, although the SASS and the Plan Review Team both noted a great amount of uncertainty in the static SPR for the southern stock in particular.

In 2017, South Carolina also completed a state-specific assessment that did indicate that overfishing was occurring for that population of red drum. This resulted in a management change that went into effect in 2018. Here is a brief reminder of the Commission's management history for red drum. The FMP was established in 1984. There have been two amendments, and one addendum to the most recent amendment. We currently manage under Amendment 2, with optimal yield set and reference points based on static SPR.

There is a requirement also from Amendment 2, requiring the 27 inch maximum size. This is Table 1 from the FMP Review Document, and it shows the 2018 management that was in place. The only change from previous years was in South Carolina. They reported a change in regulations that went into effect reducing their bag limit from 3 fish to 2 fish, and establishing a 6 fish boat limit. But there were no other state regulatory changes for 2018.

A state may be granted *de minimis* if the Board determines that action by the state in terms of a particular management measure would not contribute significantly to the overall management program. It doesn't really specify a time period, percent, or a fishery in terms of de minimis, so the PRT has been evaluating states contributions to the fishery by comparing each state's two-year average of combined commercial and recreational landings to the management unit.

New Jersey and Delaware have both applied for *de minimis* status, and the PRT has determined that they qualify. The PRT would recommend that all states have implemented the requirements of Amendment 2, and that the Board would approve the 2019 FMP Review, state compliance reports, and *de minimis* status for New Jersey and Delaware. There are also additional research and monitoring recommendations that can be found in the FMP review document. I can take questions on red drum.

CHAIRMAN GEER: Any questions on red drum? We're not going to hear any, moving on.

DR. SCHMIDTKE: Next looking at black drum. First going to black drum harvest, total landings throughout the time series are heavily recreational, ranging up to 11 million pounds in 2008, 2018 landings were 5.3 million pounds, which is a 20 percent decrease from 2017. Commercial landings have been low and fairly consistent throughout the time series. They comprise 5 percent of the total in 2018, at 239,000 pounds.

This was a 17 percent increase from 2017, and North Carolina harvested the majority of commercial landings, followed by Virginia. Recreational harvest has fluctuated pretty widely, but doesn't show any long term trends since 2000. Harvest in 2018 was about 5.1 million pounds, or 1.4 million fish.

This was a 20 percent decrease by weight and a 19 percent decrease by numbers from 2017. Looking specifically at the recreational sector for catch and releases, Florida harvested the majority of recreational landings in numbers at 65 percent, followed by South Carolina. The percentage of releases has increased throughout the time series.

Over the last four years over 70 percent of the recreational catch has been released. In 2018 there was an increase in the percentage of catch that was released, with about 6 million fish that were released. Recreational discard mortality is estimated at 8 percent. This amounts to about 486,000 recreational dead discards. The 2015 benchmark stock assessment was conducted, and showed that median biomass is still well above what is needed to produce maximum sustainable yield. The median overfishing limit is 4.12 million pounds, and the stock is not overfished or experiencing overfishing. There was a five year trigger for the next assessment in 2020. The Black Drum TC met earlier this year to discuss that and the PRT when we get to the recommendations has a recommendation concerning the TCs conclusion.

The black drum FMP was established in 2013, and required all states with a declared interest to implement a maximum possession limit by 2014, with a minimum size limit of 14 inches or more by 2016. Addendum I was approved in 2018, which allows Maryland to reopen its commercial fishery in the Chesapeake Bay.

Looking at 2018 management measures that were in place, all the management was the same except one note going into 2019 is that Maryland will be reopening their commercial fishery in the Chesapeake Bay, well they have. They have opened their commercial fishery in the Chesapeake Bay as of February of this year.

The PRT finds that all states have implemented the FMP requirements. No states requested *de minimis* through the reporting process. Therefore, the PRT recommends that the Board approve the 2019 black drum FMP Review and state compliance reports. There are other management research and monitoring recommendations included in the FMP Review Report concerning the assessment scheduling.
The PRT recommends that the assessment scheduling be postponed for three years and then reconsidered, and whenever the next assessment is conducted that it be a benchmark that attempts to modify the DBSRA model, and incorporate new information. This is basically

the Plan Review Team supporting the Technical Committee's recommendation to the Assessment Science Committee.

They would ask that the Board also take up that recommendation as well. This does not need any specific motion to it, it is simply informing the Board of the timing, and if the Board has any disagreement then that can be expressed. But otherwise I can take any comments or questions on black drum.

CHAIRMAN GEER: Are there any questions for Mike? I believe the stock assessment; we approved the new stock assessments schedule which includes that change in the Policy Board meeting. No questions of Mike, moving on?

DR. SCHMIDTKE: Okay last one is spotted sea trout. Here we see the spotted sea trout coastwide landings, the vast majority of which come from within the management unit, comprised of Maryland through Florida. Total landings in 2018 were 4.7 million pounds; this was a 36 percent decrease from 2017.

Commercial landings were 169,000 pounds, a 55 percent decrease from 2017, and North Carolina harvested the majority of the commercial landings. Commercial landings have shown a gradual decline since the 1980s through the present. The majority of harvest comes through the recreational sector throughout the time series though, when that data has been available. Recreational landings in 2018 were, excuse me I'll skip to the next one. Recreational landings in 2018 were 2.8 million fish. This was a 31 percent decrease from 2017. Georgia had the largest recreational harvest in numbers at about 39 percent. Recreational releases have increased throughout the time series. In 2018, 91 percent of the catch was released.

That amounts to 28.1 million fish. This is the highest in both percent and number released in the time series, and this was likely impacted by the closure of North Carolina's fishery for about half of the year, also South Carolina took up a campaign to encourage catch and release fishing, in response to a winter cold stun event that occurred in 2018.

Catch largely follows the trend of releases due to that highly disproportionate number of releases, so 31 million fish were caught in 2018. This is 36 percent higher than 2017, and the highest catch in the time series for the recreational fishery. No coastwide stock assessment has been conducted for spotted sea trout, and the PRT maintains its recommendation that a coastwide assessment would not be recommended, due to the largely non-migratory life history, and the low data availability to that effect.

There have been local assessments performed by several states, the most recent of which we've been made aware of occurred for Florida. It indicated that northeastern Florida and southeastern Florida were above the biomass threshold, but below the target biomass and not overfishing.

Spotted sea trout are included in the Omnibus Amendment. The only management requirement is a minimum length limit of at least 12 inches for both sectors. All states were in compliance with this minimum length limit. There were two management changes noted for 2018. Virginia defined total length within their documentation, and North Carolina as I mentioned before, they closed the commercial and recreational fisheries from January 5 through June 15.

This is not a regulation change, but South Carolina as I mentioned before, also was trying to encourage catch and release fishing from January through September through their "Let "em spawn let 'em live" campaign.

The Omnibus defines a *de minimis* status for spotted sea trout, in which states qualify if average total landings from the last three years are less than 1 percent of the total coastwide landings during that time period. New Jersey and Delaware requested continuation of their *de minimis* status, and the PRT notes that they meet the requirements. Therefore, the PRT find that all states have implemented the requirements of the FMP, and recommends that the Board approve the 2019 FMP Review, state compliance reports, and *de minimis* status for New Jersey and Delaware. There are other recommendations found in the FMP Review as well, and I can take questions on spotted sea trout.

DR. SCMIDTKE: Any questions for Mike? Lynn.

MS. FEGLEY: I'll try not to let my teeth chatter, and thank you, Mike. I would like to make a motion to accept the FMP Reviews and state compliance reports for red drum, black drum and spotted sea trout, with *de minimis* status approved for New Jersey and Delaware for red drum and spotted sea trout.

CHAIRMAN GEER: Everybody's hand going up, I'll take Mr. Estes. I don't know if you're standing up because you're cold or you're ready to go, or both.

MR. ESTES: Yes.

CHAIRMAN GEER: Can we combine them or do you want them separately? Thank you for indulging us on that. I guess they had it already written separately, and I was trying to do it together as one. I apologize. **Move to approve the 2019 Spotted Seatrout, Black Drum, and Red Drum FMP Reviews, state status reports and *de minimis* requests for New Jersey and Delaware for red drum and spotted sea trout, motion by Ms. Fegley, seconded by Mr. Estes.**

Is there any opposition to this? Hearing none, I'll say it's approved unanimously or by consent.

ADJOURNMENT

CHAIRMAN GEER: Is there anything else to come before this Board, besides trying to stay warm? All right the meeting is adjourned and everyone have safe travels back home.

(Whereupon the meeting adjourned at 12:05 o'clock p.m. on October 31, 2019)

Southeast Data, Assessment, and Review

SEDAR 58
Atlantic Cobia

Stock Assessment Report

January 6, 2020

SEDAR
4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

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Atlantic Cobia

SECTION I: Introduction

SEDAR
4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

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I. Introduction

SEDAR 58 addressed the stock assessment for Atlantic Cobia. A Stock ID Workshop was held June 5-7, 2018 in Charleston, SC. The Data Workshop was held April 1-5, 2019 in Charleston, SC. The SEDAR 58 Assessment Process was conducted through a series of webinars held from April to October 2019. The Review Workshop (RW) took place November 19-21, 2019 in Beaufort, NC.

The Stock Assessment Report is organized into six sections. Section I is the Introduction which contains a brief description of the SEDAR Process, Assessment, and Management Histories for the species of interest, and the management specifications requested by the Cooperator. Section II is the Data Workshop Report. It documents the discussions and data recommendations from the Data Workshop Panel. Section III is the Assessment Report. This section details the assessment model, as well as documents any changes to the data recommendations that may have occurred after the Data Workshop. Section IV is the Addenda and Post-Review Workshop Documentation which consists of any analyses conducted during or after the RW to address reviewer concerns or requests. It may also contain documentation of the final RW-recommended base model, should it differ from the model put forward in the Assessment Report for review. Consolidated Research Recommendations from all three stages of the process (data, assessment, and review) can be found in Section V for easy reference. Finally, Section VI documents the discussions and findings of the Review Workshop.

The final Stock Assessment Report (SAR) for Atlantic Cobia was disseminated to the public in January 2020. The Atlantic States Marine Fisheries Commission's (ASMFC) Cobia Technical Committee (TC) will review the SAR to develop options for harvest quotas within the management unit. The TC may request additional projection model runs to define options that they will provide to the ASMFC's South Atlantic State/Federal Fisheries Management Board (Board). Documentation on TC recommendations is not part of the SEDAR process and is handled through ASMFC. The Board will review the SAR, consider use of the recommended reference points, and consider harvest quota options at their February 2020 meeting.

1. SEDAR Process Description

SouthEast Data, Assessment, and Review (SEDAR) is a cooperative Fishery Management Council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. The improved stock assessments from the SEDAR process provide higher quality information to address fishery management issues. SEDAR emphasizes constituent and stakeholder participation in assessment development, transparency in the assessment process, and a rigorous and independent scientific review of completed stock assessments.

SEDAR is managed by the Caribbean, Gulf of Mexico, and South Atlantic Regional Fishery Management Councils in coordination with NOAA Fisheries and the Atlantic and Gulf States Marine Fisheries Commissions. Oversight is provided by a Steering Committee composed of NOAA Fisheries representatives: Southeast Fisheries Science Center Director and the Southeast Regional Administrator; Regional Council representatives: Executive Directors and Chairs of the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils; a representative from the Highly Migratory Species Division of NOAA Fisheries; and Interstate Commission representatives: Executive Directors of the Atlantic States and Gulf States Marine Fisheries Commissions.

SEDAR is typically organized around three stages. First is the Data Stage, where a workshop is held during which fisheries, monitoring, and life history data are reviewed and compiled. Second is the

Assessment Stage, which is conducted via a workshop and/or series of webinars, during which assessment models are developed and population parameters are estimated using the information provided from the Data Workshop. The final stage is the Review Workshop, during which independent experts review the input data, assessment methods, and assessment products. The completed assessment, including the reports of all 3 workshops and all supporting documentation, is then forwarded to the Council SSC for certification as 'appropriate for management' and development of specific management recommendations.

SEDAR workshops are public meetings organized by SEDAR staff and the lead Council. Workshop participants are drawn from state and federal agencies, non-government organizations, Council members, Council advisors, and the fishing industry with a goal of including a broad range of disciplines and perspectives. All participants are expected to contribute to the process by preparing working papers, contributing, providing assessment analyses, and completing the workshop report.

SEDAR Review Workshop Panels consist of a chair, three reviewers appointed by the Center for Independent Experts (CIE), and one or more SSC representatives appointed by each council having jurisdiction over the stocks assessed. The Review Workshop Chair is appointed by the council having jurisdiction over the stocks assessed and is a member of that council's SSC. Participating councils may appoint representatives of their SSC, Advisory, and other panels as observers.

2. Cobia Management Overview

2.1 South Atlantic Fishery Management Plan and Amendments

The following summary describes only those management actions that likely affect Atlantic and Florida East Coast Zone cobia fisheries and harvest.

SAFMC FMP Amendments affecting Atlantic and Florida East Coast Zone Cobia

Description of Action	FMP/Amendment	Effective Date
• Cobia added to fishery management unit. • *Management Objective*: Institute management measures necessary to increase yield per recruit and average size and to prevent overfishing. • Maximum Sustainable Yield (MSY) is estimated at 1,057,000 pounds, Estimated Domestic Annual Harvest (EDAH) is estimated at 1,000,000 pounds (in 1981), and Total Allowable Level of Foreign Fishing (TALFF) is zero. • Optimum Yield (OY) is defined as all cobia equal to or larger than 33 inches in length from the tip of the head to the center of the tail (fork length) which can be harvested by U.S. fishermen given prevailing economic conditions and fishing techniques. • Minimum size limit for recreational and commercial is 33 inches FL.	Original FMP LINK	02/04/1983
• Establish fishing year as January 1-December 31. • Clarify minimum size limit is 33 inches FL *or* 37 inches TL. • *Identified problem*: Cobia are presently harvested at a size below that necessary for maximum yield and may be overfished in some areas beyond the management area. Most southeastern states have not yet adopted the recommended minimum size limit. Also, no management action has been taken by states which have jurisdiction over cobia populations in Chesapeake Bay, which appear to have been overfished. Federal enforcement capability is limited and not believed to be very effective in this case.	Amendment 1 LINK	09/22/1985

• Annual permits are required for charter boats fishing for coastal migratory pelagics for hire. Charter boats normally fish under bag limits but may also be eligible to obtain commercial permits to fish under the commercial quota when not under charter. • Permits are issued for an April through March permit year, are available at any time, and are valid through the following March. Permits for the following permit year become available in February.	Amendment 2 LINK	*CH vessel permit requirement*: 08/24/1978 *All else*: 06/30/1987
• Prohibited drift gill nets for coastal pelagic species.	Amendment 3 LINK	08/14/1989
• *Identified problem*: The condition of the cobia stock is not known and increased landings over the last ten years have prompted concern about overfishing. • *Definition of overfishing*: o A mackerel or cobia stock shall be considered overfished if the spawning stock biomass per recruit (SSBR) is less than the target level percentage recommended by the assessment group, approved by the Scientific and Statistical Committee (SSC), and adopted by the Councils. The target level percentage shall not be less than 20 percent. o When a stock is overfished (as defined in (a)), the act of overfishing is defined as harvesting at a rate that is not consistent with a program to rebuild the stock to the target level percentage, and the assessment group will develop ABC ranges for recovery periods consistent with a program to rebuild an overfished stock. o When a stock is not overfished (as defined in (a)), the act of overfishing is defined as a harvest rate that if continued would lead to a state of the stock that would not at least allow a harvest of OY on a continuing basis, and the assessment group will develop ABC ranges based upon OY (currently MSY). • Added cobia to the Annual Stock Assessment procedures. • Bag limit 2-fish/person/day with 1-day possession limit.	Amendment 5 LINK	08/20/1990
• Specify the minimum size limit is 33”FL (removed 37” TL) • Changed MSY=2.2 million pounds based on results from 1992 Report of the Mackerel Stock Assessment Panel.	Amendment 6 LINK	12/03/1992

• *Identified problem*: Localized reduction of fish abundance due to high fishing pressure. • Extended management of cobia through NY (i.e. through the jurisdiction of the MAFMC); extended 2-fish bag limit and 33" FL minimum size limit through the MAFMC's area. • Required additional information on each species, including cobia, from the Assessment Panel. • *Overfishing Definition*: For species like cobia, when there is insufficient information to determine whether the stock or migratory group is overfished (transitional SPR), overfishing is defined as a fishing mortality rate in excess of the fishing mortality rate corresponding to a default threshold static SPR of 30 percent. If overfishing is occurring, a program to reduce fishing mortality rates to at least the level corresponding to management target levels will be implemented. • Modified the Stock Assessment Panel process. • Optimum Yield (OY) for cobia is set at MSY, currently 2.2 million pounds, in accord with the recommendation of the SPRMSC that, because of limited data, SPR not be used for cobia.	Amendment 8 LINK	04/03/1998
• Addressed Sustainable Fishery Act definitions. o Optimum Yield (OY) for the coastal migratory pelagic fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the Spawning Potential Ration (SPR) at or above 40% Static SPR. o Overfishing for all species in the coastal migratory pelagics management unit is defined as a fishing mortality rate (F) in excess of the fishing mortality rate at 30% Static SPR (F30% Static SPR). The "threshold level" for all species in the coastal migratory pelagic management unit is defined as 10% Static SPR.	Amendment 11 LINK	12/02/1999
• Established Essential Fish Habitat (EFH) in the South Atlantic.	Amendment 10 LINK	07/14/2000
• Updated existing EFH information for the Coastal Migratory Pelagics FMP (not regulatory).	Amendment 19 LINK	07/22/2010

• Established separate Gulf and Atlantic migratory stocks at the SAFMC/GMFMC boundary.
• Set the MSY, Minimum Stock Size Threshold (MSST), and Maximum Fishing Mortality Threshold (MFMT) for Atlantic migratory group cobia.
  o MSY is the value from the most recent stock assessment. Currently MSY is unknown.
    ▪ ABC for Atlantic migratory group Cobia will be used as a proxy for MSY pending results from the SEDAR assessment.
  o The value for MSST is the value from the most recent stock assessment based on MSST = [(1-M) or 0.5 whichever is greater]*BMSY. Currently MSST is unknown.
  o The value for MFMT is the value of FMSY or proxy of F30%SPR from the most recent stock assessment. Currently MFMT is unknown.
• The total ACL for Atlantic migratory group cobia will be used to determine whether overfishing is occurring. Currently OFL is unknown.
• Adopt the Gulf Council's ABC Control Rule as an interim control rule.
  o ABC equals the mean plus 1.5 times the standard deviation of the most recent 10 years of landings data (1,571,399 lb whole weight).
• Define allocations for Atlantic migratory group cobia based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on the following formula for each sector:
  o Sector apportionment = (50% * average of long catch range (lbs) 2000-2008 + (50% * average of recent catch trend (lbs) 2006-2008).
    ▪ 8% commercial
    ▪ 92% recreational.
• Annual Catch Limit (ACL) for Atlantic migratory group cobia: ACL = OY = ABC (currently 1,571,399 lb based on the SSC Interim Control Rule)
  o Recreational Sector ACL = 92% = 1,445,687 lbs.
  o Commercial Sector ACL = 8% = 125,712 lbs.
• The recreational sector ACT equals sector ACL[(1-PSE) or 0.5, whichever is greater] (currently 1,184,688 lb). No commercial sector ACTs for Atlantic migratory group cobia.
	Amendment 18
	LINK
		01/30/2012

• *Commercial AM for Atlantic migratory group cobia*: prohibit harvest, possession, and retention when the commercial quota (total ACL x commercial allocation) is met or projected to be met. All purchase and sale is prohibited when the commercial quota is met or projected to be met. o Commercial payback of overage: payback only if overfished - If the commercial sector ACL is exceeded, the Assistant Administrator for Fisheries shall file a notification with the Office of the Federal Register to reduce the commercial sector ACL in the following year by the amount of the overage. ▪ Only deduct overages if the Total ACL is exceeded. • *Recreational AM for Atlantic migratory group cobia*: if the recreational sector quota (total ACL x recreational allocation) is exceeded, the RA shall publish a notice to reduce the length of the following fishing year by the amount necessary to ensure landings do not exceed the recreational sector quota for the following fishing year. o Compare the recreational ACL with recreational landings over a range of years. For 2011, use only 2011 landings. For 2012, use the average landings of 2011 and 2012. For 2013 and beyond, use the most recent three-year (fishing years) running average. If in any year the ACL is changed, the sequence of future ACLs will begin again starting with a single year of landings compared to the ACL for that year, followed by two-year average landings compared to the ACL in the next year, followed by a three-year average of landings ACL for the third year and thereafter. ▪ Only adjust the recreational season length if the Total ACL is exceeded. o Recreational payback of any overage from one year to the next: payback only if overfished - If the recreational ACL is exceeded, the Assistant Administrator for Fisheries shall file a notification with the Office of the Federal Register to reduce the recreational ACL in the following year by the amount of the overage. The ACT would also be adjusted according to the ACT formula. ▪ Only deduct overages if the Total ACL is exceeded.	Amendment 18 continued	01/30/2012
• Limit harvest and possession of coastal migratory pelagic species (with the use of all non-prohibited fishing gear) in the Special Management Zones (SMZs) off South Carolina.	Amendment 21 LINK	01/30/2012

• Requires weekly electronic reporting for headboats in South Atlantic	Amendment 22 LINK	01/27/2014

• Modified the boundary between Gulf migratory group cobia and Atlantic migratory group cobia to the GA/FL line.
• The Atlantic migratory group ACL would be equal to the ABC for the Atlantic migratory group cobia (as determined by the SSCs).
  o Atlantic cobia ABC=ACL= 690,000lbs for 2015; 670,000lbs for 2016+
• The Gulf migratory group cobia ABC (as determined by the SSCs) would be divided into a Gulf Zone ACL and a Florida East Coast Zone ACL (Florida/Georgia border to the Gulf and South Atlantic Councils jurisdictional boundary) based on 1998-2012 (15 years) landings to establish the percentage split for the Gulf ABC.
  o Allocated 36% of the Gulf ACL to the Florida east coast zone cobia (FLEC ACL= 900,000lbs 2015; 930,000lbs 2016+)
	Amendment 20B LINK	03/1/2015

• SAFMC considering removing Atlantic migratory cobia from the CMP Fishery Management Plan	Amendment 31	Under development; anticipate taking final action later in 2018

SAFMC Regulatory Amendments affecting Atlantic and Florida East Coast Zone Cobia

<table>
<tr><th>Description of Action</th><th>FMP/Amendment</th><th>Effective Date</th></tr>
<tr><td>*For Atlantic cobia only*
• Recreational minimum size limit of 36” FL.
• Recreational bag limit of 1 fish per person per day or 6 per vessel per day (whichever is more restrictive).
• Commercial trip limit of 2 fish per person per day or 6 fish per vessel per day (whichever is more restrictive).
• Recreational AM: next year’s landings are monitored for persistent increase in landings.
  o If necessary, the length of the following fishing season will be reduced to ensure that recreational landings meet the recreational ACT but do not exceed the recreational ACL (based on recreational landings in the previous year).
    ▪ only if the STOCK ACL is exceeded.
  o If necessary, reduce the recreational vessel limit for the following fishing year to ensure that recreational landings meet the recreational ACT but do not exceed the recreational ACL (based on the recreational landings in the previous year).
    ▪ Only if the STOCK ACL is exceeded.
• Cobia removed from limited harvest species list.</td><td>Framework Amendment 4
LINK</td><td>09/05/2017</td></tr>
</table>

2.2 Emergency and Interim Rules - None for cobia.

2.3 Secretarial Amendments - None for cobia.

2.4 Control Date Notices - None for cobia.

2.5 Management Program Specifications

2.5.1 Table General Management Information South Atlantic

Species	Cobia (*Rachycentron canadum*)
Management Unit	Atlantic cobia: Mid-Atlantic and Southeastern US to GA/FL border Florida East Coast zone cobia: From the GA/FL border to the jurisdictional boundary between the Gulf and South Atlantic Councils.
Management Unit Definition	Atlantic cobia: All waters from the intersection of New York, Connecticut, and Rhode Island to a line extending due east of the Florida/Georgia border. Florida East Coast zone cobia: the EEZ south and east of the line of demarcation between the Atlantic Ocean and Gulf of Mexico, and south of a line extending due east of the Florida/Georgia border.
Management Entity	South Atlantic Fishery Management Council (Note: Mid-Atlantic Council participates as voting member on South Atlantic Council's Mackerel Cobia Committee.)
Management Contacts **SERO / Council**	SAFMC: Christina Wiegand SERO: Karla Gore
Current stock exploitation status	Not undergoing overfishing
Current stock biomass status	Not overfished

2.5.2 Table Management Parameters Atlantic Cobia

Criteria	South Atlantic – Current (SEDAR 28)			
	Definition	**Base Run Values**	**Units**	**Median of Base Run MCBs**
M	Average of Lorenzen M (if used)	0.26	Instantaneous natural mortality; per year	-
$F_{CURRENT}$	Geometric mean of apical fishing mortality rates for 2009-2011 ($F_{2009-2011}$)	0.276	Per year	-
F_{TARGET}	-	-	-	-
Yield at F_{TARGET} (equilibrium)	-	-	-	-
F_{MSY}	F_{MSY}	0.461	Per year	-
B_{MSY}	Biomass at MSY	1991.6	Metric tons	-
R_{MSY}	-	-	-	-
SSB_{2011}	Spawning stock biomass in 2011	693	Metric tons	
SSB_{MSY}	Spawning stock biomass at MSY	536.8	Metric tons	
MSST	MSST = [(1-M) or 0.5 whichever is greater]*B_{MSY}	397.2	Metric tons	-
MFMT	F_{MSY}	0.461	Per year	-
MSY	Yield at F_{MSY}	808	1000 lb	-
OY	Yield at F_{OY}	-	-	-
F_{OY}	F_{OY} = 65%,75%, 85% F_{MSY}	65% FMSY = 0.299 75% FMSY=0.345 85% FMSY=0.391	-	-
Exploitation Status	$F_{2009-2011}/F_{MSY}$	0.599	-	-
	F_{2011}/F_{MSY}	0.423	-	
Biomass Status[1]	SSB_{2011}/MSST	1.75	-	-
	SSB_{2011}/SSB_{MSY}	1.29	-	
Terminal F (2011)	F_{2011}	0.195	-	-
Terminal Biomass (2011) [1]	SSB	693	mature female weight, metric tons	-
Generation Time	-	-	-	-
$T_{REBUILD}$ (if appropriate)	-	-	-	-

Criteria	South Atlantic – Proposed (SEDAR 58)			
	Definition	**Base Run Values**	**Units**	**Median of Base Run MCBs**
M	Average of Lorenzen M (if used)			
$F_{CURRENT}$	Geometric mean of apical fishing mortality rates (F)			
F_{TARGET}	-			
Yield at F_{TARGET} (equilibrium)	-			
F_{MSY}	F_{MSY}			
B_{MSY}	Biomass at MSY			
R_{MSY}	-			
SSB	Spawning stock biomass			
SSB_{MSY}	Spawning stock biomass at MSY			
MSST[1]	MSST = [(1-M) or 0.5 whichever is greater]*B_{MSY}			
MFMT	F_{MSY}			
MSY	Yield at F_{MSY}			
OY	Yield at F_{OY}			
F_{OY}	FOY = 65%,75%, 85% F_{MSY}			
Exploitation Status	F/F_{MSY}			
	F/F_{MSY}			
Biomass Status[1]	SSB/MSST			
	SSB/SSB_{MSY}			
$F_{CURRENT}$	-			
Terminal Biomass [1]	-			
Generation Time	-			
$T_{REBUILD}$ (if appropriate)	-			

- [1]Biomass values reported for management parameters and status determinations should be based on the biomass metric recommended through the Assessment process and SSC. This may be total, spawning stock or some measure thereof, and should be applied consistently in this table.
- NOTE: "Proposed" columns are for indicating any definitions that may exist in FMPs or amendments that are currently under development and should therefore be evaluated in the current assessment. Please clarify whether landings parameters are 'landings' or 'catch' (Landings + Discard). If 'landings', please indicate how discards are addressed.

2.5.3 **Table 2.5.3. Stock Rebuilding Information**

2.5.4 **Stock not overfished, so no rebuilding plan in place. Table 2.5.4. General Projection Specifications *South Atlantic***

First Year of Management	Late-2021 or mid-2022
Interim basis	Ask SEDAR 58 Panel to provide guidance on appropriate assumptions to address harvest and mortality levels in interim years; recent SEDAR assessments have asked for ACL, if ACL is met Average exploitation, if ACL is not met.
Projection Outputs	
Landings	Pounds and numbers
Discards	Pounds and numbers
Exploitation	F & Probability F>MFMT
Biomass (total or SSB, as appropriate)	B & Probability B>MSST (and Prob. B>B_{MSY} if under rebuilding plan)
Recruits	Number

2.5.5 **. Table Base Run Projections Specifications. Long Term and Equilibrium conditions.**

Criteria	Definition	If overfished	If overfishing	Neither overfished nor overfishing
Projection Span	Years	$T_{REBUILD}$	10	10
Projection Values	$F_{CURRENT}$	X	X	X
	F_{MSY}	X	X	X
	75% F_{MSY}	X	X	X
	$F_{REBUILD}$	X		
	F=0	X		

- NOTE: Exploitation rates for projections may be based upon point estimates from the base run (current process) or upon the median of such values from the MCBs evaluation of uncertainty. The critical point is that the projections be based on the same criteria as the management specifications.

2.5.6 Table P-star projections. Short term specifications for OFL and ABC recommendations. Additional P-star projections may be requested by the SSC once the ABC control rule is applied.

Basis	Value	Years to Project	P* applies to
P*	50%	Interim + 5	Probability of overfishing
P*	40%	Interim + 5	Probability of overfishing
Exploitation	F_{MSY}	Interim + 5	NA
Exploitation	75% of F_{MSY}	Interim + 5	NA

2.5.7 Table Quota Calculation Details

- If the stock is managed by quota, please provide the following information

	Atlantic Cobia	FLEC Cobia
Current Acceptable Biological Catch (ABC) and Total Annual Catch Level (ACL) Value for Cobia	ACL = ABC = OY ACL = 670,000 lbs	ACL = 36% ABC ACL = 930,000 lbs
Commercial ACL for Cobia	8% ACL = 50,000 lbs	8% ACL = 70,000 lbs
Recreational ACL for Cobia	92% ACL = 620,000 lbs	92% ACL = 860,000
Next Scheduled Quota Change	None	None
Annual or averaged quota?	Annual	Annual
If averaged, number of years to average	-	-
Does the quota include bycatch/discard?	No	No

How is the quota calculated - conditioned upon exploitation or average landings?

- Gulf Council's ABC Control Rule: ABC equals the mean plus 1.5 times the standard deviation of the most recent 10 years of landings data.
  - *NOTE*: The Gulf's ABC Control Rule was adopted for Atlantic cobia as an interim control rule until results from SEDAR 28 became available (ABC value derived by the Gulf Council's ABC Control was adopted by the South Atlantic Council's SSC as their ABC recommendation for Atlantic cobia).
- Atlantic and Florida East Coast Cobia Sector Allocation: (50% * average of long catch range (lbs) 2000-2008 + (50% * average of recent catch trend (lbs) 2006-2008). The allocation would be 8% commercial and 92% recreational. The commercial and recreational allocations specified would remain in effect until modified
- FL East Coast Zone Allocation of Gulf Cobia ACL: 1998-2012 (15 years) landings to establish the percentage split (36% to FLEC zone) for the Gulf ACL.

Does the quota include bycatch/discard estimates? If so, what is the source of the bycatch/discard values? What are the bycatch/discard allowances?

- No.

Are there additional details of which the analysts should be aware to properly determine quotas for this stock?

2.6 Management and Regulatory Timeline

- See tables 2.6.1 and 2.6.2

2.6.1 . Closures Due to Meeting Commercial Quota or Commercial/Recreational ACL

- See tables 2.6.1 and 2.6.2

2.7 . State Regulatory History

- Please see section 2.8

References

None provided.

Table 2.6.1 Atlantic Migratory Group Cobia Recreational Federal Regulatory History prepared by: Christina Wiegand, SAFMC staff

Year	Migratory Group	Quota (lbs ww)	ACL (lbs ww)	Days Open	Fishing Season	Reason for Closure	Season Start Date (first day implemented)	Season end Date (last day effective)	Size Limit	Size Limit Start Date	Size Limit End Date	Retention Limit (# fish)	Retention Limit Start Date	Retention Limit End Date
1983 [A]	NA	NA	NA	33	OPEN	NA	1-Jan	3-Feb	NONE	NA	NA	NONE	NA	NA
	NA	NA	NA	330	OPEN	NA	4-Feb	31-Dec	33in FL [A]	4-Feb	31-Dec	NONE	NA	NA
1984	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	NONE	NA	NA
1985	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL [B]	1-Jan	31-Dec	NONE	NA	NA
1986	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1987	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1988	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1989	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1990	NA	NA	NA	230	OPEN	NA	1-Jan	19-Aug	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
	NA	NA	NA	133	OPEN	NA	20-Aug	31-Dec	33in FL or 37in TL	20-Aug	31-Dec	2 per person per day [C]	20-Aug	31-Dec
1991	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1992	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL [B]	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1993	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1994	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1995	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1996	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1997	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1998	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1999	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2000	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2001	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2002	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2003	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2004	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2005	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2006	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2007	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2008	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2009	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2010	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2011	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2012	NA	NA	NA	28	OPEN	NA	1-Jan	29-Jan	33in FL	1-Jan	29-Jan	2 per person per day	1-Jan	29-Jan
	Atlantic[D]	SEE ACL	1,445,687	336	OPEN	NA	30-Jan	31-Dec	33in FL	30-Jan	31-Dec	2 per person per day	30-Jan	31-Dec
2013	Atlantic[D]	SEE ACL	1,445,687	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2014	Atlantic[D]	SEE ACL	1,445,687	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2015	Atlantic[D]	SEE ACL	1,445,687	58	OPEN	NA	1-Jan	28-Feb	33in FL	1-Jan	28-Feb	2 per person per day	1-Jan	28-Feb
	Atlantic[E]	SEE ACL[F]	630,000	305	OPEN	NA	1-Mar	31-Dec	33in FL	1-Mar	31-Dec	2 per person per day	1-Mar	31-Dec
	Florida East Coast[E]	SEE ACL[F]	830,000	305	OPEN	NA	1-Mar	31-Dec	33in FL	1-Mar	31-Dec	2 per person per day	1-Mar	31-Dec
2016	Atlantic[E]	SEE ACL	620,000	170	CLOSED	2015 ACL EXCEEDED	1-Jan	19-Jun	33in FL	1-Jan	19-Jun	2 per person per day	1-Jan	19-Jun
	Florida East Coast[E]	SEE ACL	860,000	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2017	Atlantic[E]	SEE ACL	620,000	23	CLOSED	2016 ACL EXCEEDED	1-Jan	23-Jan	33in FL	1-Jan	23-Jan	2 per person per day	1-Jan	23-Jan
	Atlantic[E]	-	-	-	-	-	-	-	36in FL[G]	5-Sep	31-Dec	1 per person per day OR 6 per vessel per day whichever more restrictive [D]	5-Sep	31-Dec
	Florida East Coast[E]	SEE ACL	860,000	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec

Notes:

A = Original FMP (effective 2/4/1983) implemented 33 inch FL size limit

B = Amendment 1 (effective 9/22/1985) included clarification of minimum size limit is 33 in FL or 37 in TL; Amendment 6 (effective 12/3/1992) removed clarification of 37in TL as minimum size limit C = Amendment 5 (effective 8/20/1990) included implementation of 2 fish/person/day bag limit with one day possession limit

D = CMP Amendment 18 (effective 1/30/2012) included establishment of separate Gulf and Atlantic migratory stocks with a boundary at the SAFMC/GMFMC line; implemented ACLs

E = Amendment 20B (effective 3/1/2015) included setting boundary between Gulf and Atlantic migratory groups at the FL/GA line, a portion of the Gulf migratory group ACL allocated to the FLEC Zone F = Amendment 20 B also included adjustment to Atlantic cobia ACL based on SEDAR 28

G = CMP Framework Amendment 4 (effective 9/5/2017) included adjustments to recreational harvest limits, size limits, and accountability measures

Table 2.6.2 Atlantic Migratory Group Cobia Commercial Federal Regulatory History prepared by: Christina Wiegand, SAFMC staff

Year	Migratory Group	Quota (lbs ww)	ACL (lbs ww)	Days Open	Fishing Season	Reason for Closure	Season Start Date (first day implemented)	Season end Date (last day effective)	Size Limit	Size Limit Start Date	Size Limit End Date	Retention Limit (# fish)	Retention Limit Start Date	Retention Limit End Date
1983 [A]	NA	NA	NA	33	OPEN	NA	1-Jan	3-Feb	NONE	NA	NA	NONE	NA	NA
	NA	NA	NA	330	OPEN	NA	4-Feb	31-Dec	33in FL [A]	4-Feb	31-Dec	NONE	NA	NA
1984	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	NONE	NA	NA
1985	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL [B]	1-Jan	31-Dec	NONE	NA	NA
1986	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1987	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1988	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1989	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	NONE	NA	NA
1990	NA	NA	NA	230	OPEN	NA	1-Jan	19-Aug	33in FL or 37in TL	1-Jan	19-Aug	NONE	NA	NA
	NA	NA	NA	133	OPEN	NA	20-Aug	31-Dec	33in FL or 37in TL	20-Aug	31-Dec	2 per person per day [C]	20-Aug	31-Dec
1991	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1992	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL or 37in TL [B]	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1993	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1994	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1995	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1996	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1997	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1998	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
1999	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2000	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2001	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2002	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2003	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2004	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2005	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2006	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2007	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2008	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2009	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2010	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2011	NA	NA	NA	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2012	NA	NA	NA	28	OPEN	NA	1-Jan	29-Jan	33in FL	1-Jan	29-Jan	2 per person per day	1-Jan	29-Jan
	Atlantic [D]	SEE ACL	125,712	336	OPEN	NA	30-Jan	31-Dec	33in FL	30-Jan	31-Dec	2 per person per day	30-Jan	31-Dec
2013	Atlantic [D]	SEE ACL	125,712	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2014	Atlantic [D]	SEE ACL	125,712	343	OPEN	NA	1-Jan	10-Dec	33in FL	1-Jan	10-Dec	2 per person per day	1-Jan	10-Dec
				20	CLOSED	ACL MET	11-Dec	31-Dec						
2015	Atlantic [D]	SEE ACL	125,712	58	OPEN	NA	1-Jan	28-Feb	33in FL	1-Jan	28-Feb	2 per person per day	1-Jan	28-Feb
	Atlantic [E]	SEE ACL [F]	60,000	305	OPEN	NA	1-Mar	31-Dec	33in FL	1-Mar	31-Dec	2 per person per day	1-Mar	31-Dec
	Florida East Coast [E]	SEE ACL [F]	70,000	305	OPEN	NA	1-Mar	31-Dec	33in FL	1-Mar	31-Dec	2 per person per day	1-Mar	31-Dec
2016	Atlantic [E]	SEE ACL	50,000	339	OPEN	NA	1-Jan	5-Dec	33in FL	1-Jan	5-Dec	2 per person per day	1-Jan	5-Dec
				25	CLOSED	ACL MET	6-Dec	31-Dec						
	Florida East Coast [E]	SEE ACL	70,000	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec
2017	Atlantic [E]	SEE ACL	50,000	246	OPEN	ACL MET	1-Jan	4-Sep	33in FL	1-Jan	4-Sep	2 per person per day	1-Jan	4-Sep
	Atlantic [E]	-	-	117	CLOSED	ACL MET	5-Sep	31-Dec	-	-	-	2 per person per day OR 6 per vessel per day whichever more restrictive [G]	5-Sep	31-Dec
	Florida East Coast [E]	SEE ACL	70,000	365	OPEN	NA	1-Jan	31-Dec	33in FL	1-Jan	31-Dec	2 per person per day	1-Jan	31-Dec

Notes:

A = Original FMP (effective 2/4/1983) implemented 33 inch FL size limit

B = Amendment 1 (effective 9/22/1985) included clarification of minimum size limit is 33 in FL or 37 in TL; Amendment 6 (effective 12/3/1992) removed clarification of 37in TL as minimum size limit C = Amendment 5 (effective 8/20/1990) included implementation of 2 fish/person/day retention limit with one day possession limit

D = CMP Amendment 18 (effective 1/30/2012) included establishment of separate Gulf and Atlantic migratory stocks with a boundary at the SAFMC/GMFMC line; implemented ACLs

E = Amendment 20B (effective 3/1/2015) included setting boundary between Gulf and Atlantic migratory groups at the FL/GA line, a portion of the Gulf migratory group ACL allocated to the FLEC Zone F = Amendment 20 B (effective 3/1/2015)also included adjustment to Atlantic cobia ACL based on SEDAR 28

G = Framework Amendment 4 (effective 9/5/2017) included removing Atlantic cobia removed from the limited harvest species list and changed retention limits

2.8 . State Regulatory History

State Regulatory Histories for Cobia
Updated: April 3, 2018

2.8.1 New York

Year	Recreational	Commercial
~1997 - 2017	*Minimum Size*: 37" TL *Bag Limit*: 2 pp/d	*Minimum Size*: 37" TL *Possession Limit*: 2 pv

Confirming start year for NY regulations

2.8.2 New Jersey **

Year	Recreational	Commercial
~1997 - 2017	*Minimum Size*: 37" TL *Bag Limit*: 2 pp/d	*Minimum Size*: 37" TL

Confirming start year for NJ regulations

2.8.3 Delaware **

Year	Recreational	Commercial
2017	None	None

2.8.4 Maryland **

Year	Recreational	Commercial
2017	None	None

2.8.5 Virginia **

History of commercial cobia regulations in Virginia state waters

Year	Minimum size limit	Possession limit	Vessel limit	Season	Other
1990	37 inches TL	2/person	-	Year-round	-
1991	37 inches TL	2/person	-	Year-round	-
1992	37 inches TL	2/person	-	Year-round	-
1993	37 inches TL	2/person	-	Year-round	-
1994	37 inches TL	2/person	-	Year-round	-
1995	37 inches TL	2/person	-	Year-round	-
1996	37 inches TL	2/person	-	Year-round	-
1997	37 inches TL	2/person	-	Year-round	-
1998	37 inches TL	2/person	-	Year-round	-
1999	37 inches TL	2/person	-	Year-round	-
2000	37 inches TL	2/person	-	Year-round	-
2001	37 inches TL	2/person	-	Year-round	-
2002	37 inches TL	2/person	-	Year-round	-
2003	37 inches TL	2/person	-	Year-round	-
2004	37 inches TL	2/person	-	Year-round	-
2005	37 inches TL	2/person	-	Year-round	-
2006	37 inches TL	2/person	-	Year-round	-
2007	37 inches TL	2/person	-	Year-round	-
2008	37 inches TL	2/person	-	Year-round	-
2009	37 inches TL	2/person	-	Year-round	-
2010	37 inches TL	2/person	-	Year-round	-
2011	37 inches TL	2/person	-	Year-round	-
2012	37 inches TL	2/person	-	Year-round	-
2013	37 inches TL	2/person	-	Year-round	-
2014	37 inches TL	2/person	-	Year-round	Commercial hook-and-line licensees may possess 6 per day
2015	37 inches TL	2/person	-	Year-round	Commercial hook-and-line licensees may possess 6 per day
2016	37 inches TL	2/person	-	Year-round	Commercial hook-and-line licensees may possess 6 per day
2017	37 inches TL	2/person	-	Jan. 1-Sep. 30	Commercial hook-and-line licensees may possess 6 per day

History of recreational cobia regulations in Virginia state waters

Year	Minimum size limit	Possession limit	Vessel limit	Season	Other
1990	37 inches TL	2/person	-	Year-round	-
1991	37 inches TL	2/person	-	Year-round	-
1992	37 inches TL	2/person	-	Year-round	-
1993	37 inches TL	2/person	-	Year-round	-
1994	37 inches TL	2/person	-	Year-round	-
1995	37 inches TL	2/person	-	Year-round	-
1996	37 inches TL	2/person	-	Year-round	-
1997	37 inches TL	2/person	-	Year-round	-
1998	37 inches TL	2/person	-	Year-round	-
1999	37 inches TL	2/person	-	Year-round	-
2000	37 inches TL	2/person	-	Year-round	-
2001	37 inches TL	1/person	-	Year-round	-
2002	37 inches TL	1/person	-	Year-round	-
2003	37 inches TL	1/person	-	Year-round	-
2004	37 inches TL	1/person	-	Year-round	-
2005	37 inches TL	1/person	-	Year-round	-
2006	37 inches TL	1/person	-	Year-round	-
2007	37 inches TL	1/person	-	Year-round	-
2008	37 inches TL	1/person	-	Year-round	-
2009	37 inches TL	1/person	-	Year-round	-
2010	37 inches TL	1/person	-	Year-round	-
2011	37 inches TL	1/person	-	Year-round	-
2012	37 inches TL	1/person	-	Year-round	-
2013	37 inches TL	1/person	-	Year-round	-
2014	37 inches TL	1/person	-	Year-round	-
2015	37 inches TL	1/person	-	Year-round	-
2016	40 inches TL	1/person	2/vessel	Jan. 1-Aug. 30	Only 1>50 inches TL allowed per vessel per day; gaffing prohibited
2017	40 inches TL	1/person	3/vessel	Jun. 1-Sep. 15	Only 1>50 inches TL allowed per vessel per day; gaffing prohibited; mandatory recreational reporting

2.8.6 **North Carolina ****

History of Rules

The first appearance of cobia in the N.C. Fisheries Rules for Coastal Waters rulebook is in 1991. Rule 15A NCAC 03M .0507 (Hook-and-Line Fishing Restricted) provided the Fisheries Director proclamation authority to impose size and harvest limit restrictions for cobia, as well as other federally-managed species:

> **15A NCAC 03M .0507 HOOK-AND-LINE FISHING RESTRICTED**
>
> The Fisheries Director may, by proclamation, establish size and harvest limit restrictions for the following species taken by hook-and-line:
>
> (1) Blue marlin;
> (2) White marlin;
> (3) Sailfish
> (4) Cobia;
> (5) Dolphin;
> (6) Bluefish;
> (7) Spotted seatrout; and
> (8) Weakfish.
>
> *History Note: Statutory Authority G.S. 113-134; 113-182; 113-221; 143B-289.4; Eff. January 1, 1991.*

Rule 15A NCAC 03M .0507 was amended in 1991 and 1992 to remove weakfish from the rule and to add tunas and flounder. It was further amended in 1994 to remove bluefish.

In 1996, rule 15A NCAC 03M .0507 was retitled and reconstructed to remove the director's proclamation authority and to incorporate federal regulations at that time into state rules as follows:

> **15A NCAC 03M .0507 RECREATIONAL FISHING RESTRICTIONS**
>
> (a) Blue marlin:
> (1) It is unlawful to possess blue marlin less than 86 inches in length from the lower jaw to the fork in the tail.
> (2) It is unlawful to possess more than one blue marlin per person per day.
>
> (b) ….
> (c) ….
> (d) ….
> (e) Cobia:
> (1) It is unlawful to possess cobia less than 33 inches fork length taken by hook-and-line.
> (2) It is unlawful to possess more than two cobia per person per day taken by hook-and-line.
>
> (f) …

(g) …
History Note: Statutory Authority G.S. 113-134; 113-182; 113-221; 143B-289.4; Eff. January 1, 1991. Amended Eff. March 1, 1996; March 1, 1994; February 1, 1992; September 1, 1991.

Also in 1996, the proclamation authority originally granted to the Fisheries Director in rule 15A 03M .0507 above was moved into a new rule, 15A NCAC 03M .0512 (Compliance with Fishery Management Plans). This new rule provided broader authority to the Fisheries Director to complement federal regulations and interstate fishery management plan requirements as per below:

15A NCAC 03M .0512 COMPLIANCE WITH FISHERY MANAGEMENT PLANS

In order to comply with management requirements incorporated in Federal Fishery Management Council Management Plans or Atlantic States Marine Fisheries Commission Management Plan, the Fisheries Director may, by proclamation, suspend the minimum size and harvest limits established by the Marine Fisheries Commission, and implement different minimum size and harvest limits. Proclamations issued under this Section shall be subject to approval, cancellation, or modification by the Marine Fisheries Commission at its next regularly scheduled meeting or an emergency meeting held pursuant to G.S. 113-221(e1).

History Note: Authority G.S. 113-134; 113-182; 113-221; 143B-289.4; Eff. March 1, 1996.

In 1999, rule 15A NCAC 03M .0507 was again amended and retitled to apply only to billfish. Cobia was removed and placed into a new, stand-alone rule 15A NCAC 03M .0516 that was first adopted as a temporary rule in 1999, with permanent adoption in 2000. This rule has remained in place and unchanged through March 2018:

15A NCAC 03M .0516 COBIA

(a) It is unlawful to possess cobia less than 33 inches fork length.
(b) It is unlawful to possess more than two cobia per person per day.
History Note: Authority G.S. 113-134; 113-182; 143B-289.52; Temporary Adoption Eff. July 1, 1999;

Eff. August 1, 2000.

One final rule change relevant to cobia is the modification of rule 15A NCAC 03M .0512 (Compliance with Fishery Management Plans) described above. In 2002, North Carolina adopted its Inter-Jurisdictional Fishery Management Plan (IJ FMP), which incorporates all ASMFC and council-managed finfish species by reference, and adopts all federal regulations as minimum standards for management. In completing the 2008 update to the IJ FMP, the proclamation authority contained in rule 15A NCAC 03M .0512 to implement changes in management was broadened to include additional items beyond size and harvest limits (see below). An information update to the IJ FMP was completed and approved in November 2015 and contained no additional regulatory changes.

15A NCAC 03M .0512 COMPLIANCE WITH FISHERY MANAGEMENT PLANS

(a) In order to comply with management requirements incorporated in Federal Fishery Management Council Management Plans or Atlantic States Marine Fisheries Commission Management Plans or to implement state management measures, the Fisheries Director may, by proclamation, take any or all of the following actions for species listed in the Interjurisdictional Fisheries Management Plan:

(1) Specify size;
(2) Specify seasons;
(3) Specify areas;
(4) Specify quantity;
(5) Specify means and methods; and
(6) Require submission of statistical and biological data.

(b) Proclamations issued under this Rule shall be subject to approval, cancellation, or modification by the Marine Fisheries Commission at its next regularly scheduled meeting or an emergency meeting held pursuant to G.S. 113-221.1.

History Note: Authority G.S. 113-134; 113-182; 113-221; 113-221.1; 143B-289.4; Eff. March 1, 1996;

Amended Eff. October 1, 2008.

<u>*History of Management Measures*</u>

Cobia regulations remained mostly consistent from February 1992 until February 2016. The earliest cobia proclamation FF-5-92 was issued on February 11, 1992 accordance with 15A NCAC 03M .0507 with the following measures:

- No person may possess cobia less than 33 inches fork length or 37 inches total length.
- No person may possess more than two fish per person per day for recreational fisheries.

While FF-5-92 clearly established a minimum size limit for both commercial and recreational fisheries, it appeared to only establish a possession limit for recreational fisheries. Proclamation FF-4-94, effective February 15, 1994 revised the possession limit as follows:

- No person may possess cobia less than 33 inches fork length or 37 inches total length.
- No person may possess more than two fish per person per day taken by hook and line.

The above change applies a possession limit to cobia harvested by hook and line, regardless of the intent to sell. Proclamation FF-19-94, effective July 1, 1994, removed reference to the 37-inch total length minimum size limit alternative. In 1996, amendments to rule 15A NCAC 03M .0507 in 1999 (noted in the previous section) codified the minimum size limit and two-fish per person daily possession limit for hook and line that were previously in proclamation. In 1999, when cobia measures were moved into current rule 15A NCAC 03M .0516, the two-fish per person daily possession limit was modified to remove any reference to gear type, hence applying equally to all commercial and recreational fisheries.

In February 2016, the N.C. Marine Fisheries Commission received information regarding the significant overharvest of the recreational annual catch limit and the contribution of North Carolina's recreational harvest to that overage. The commission voted to modify the possession limits for both commercial and recreational harvest via proclamation FF-9-2016 (http://portal.ncdenr.org/web/mf/proclamation-ff-09-2016) as detailed below (note that not all members of a commercial fishing operation, i.e. crew, are required to have a Standard Commercial Fishing License to participate in the operation):

- Recreational: possession limit of one fish per person per day.
- Commercial: possession limit of two fish per license holder per day.

The above action was taken in an attempt to extend the recreational season for cobia, as NOAA Fisheries indicated that federal recreational accountability measures required a shortened season in 2016 to constrain harvest. A NOAA Fishery Bulletin was issued on March 10, 2016 closing federal waters to harvest on June 20, 2016.

In May 2016, the N.C. Marine Fisheries Commission voted to not complement the recreational federal waters closure, but to keep state waters open to recreational harvest of cobia by implementation of the following management measures via proclamation FF-25-2016, effective May 23, 2016. (http://portal.ncdenr.org/web/mf/proclamation-ff-25-2016):

- Recreational (all modes): Season open through September 30, 2016; minimum size limit of 37 inches fork length;
  - Private vessel: Harvest allowed Monday, Wednesday, Saturday; possession limit of one fish per person per day, or no more than two fish per vessel per day when more than one person is onboard the vessel.
  - Shore based: Harvest allowed seven days/week; possession limit of one fish per person per day.
  - For-hire: Harvest allowed seven days/week; possession limit of one fish per person per day, or four fish per vessel per day when four or more people are onboard the vessel.
- Commercial: minimum size limit of 33 inches fork length; possession limit of two fish per Standard Commercial Fishing License holder per day in a commercial operation; season to close when commercial annual catch limit is met.

On May 27, 2016 proclamation FF-28-2016 was issued (http://portal.ncdenr.org/web/mf/proclamation-ff-28-2016), revising the commercial possession limits, based on stakeholder input. The revised measures allowed for possession of two fish per person per day, not to exceed four fish per vessel per day in a commercial fishing operation, thus removing the per license holder requirement.

Closure of the commercial cobia fishery in federal waters on December 6, 2016 was complemented via proclamation FF-55-2016 (http://portal.ncdenr.org/web/mf/proclamation-ff-55-2016). This proclamation also maintained the recreational season closure through December 31, 2016, and reopened both commercial and recreational harvest in state waters in accordance with rule 15A NCAC 03M .0516 effective January 1, 2017.

At its February 2017 meeting, the N.C. Marine Fisheries Commission voted to implement the recreational and commercial management measures for 2017 detailed below via proclamation FF-13-2017 issued April 10, 2017 (http://portal.ncdenr.org/web/mf/proclamation-ff-13-2017). The commission also voted to require recreational anglers to tag and report length and weight of all fish at a N.C. Saltwater Fishing Tournament Citation Weigh Station. Due to lack of statutory authority to require citation weigh stations to engage in this activity, anglers were requested to provide this information on a voluntary basis (via catch cards distributed to weigh stations or an online reporting form).

- Recreational (all modes): Season of May 1 through August 31, 2017; minimum size limit of 36 inches fork length; possession limit of one fish per person per day, no more than four fish per vessel per day when four or more people were on the vessel (includes captain and mate on for-hire vessels).
- Commercial: Season closes when federal annual catch limit is met; minimum size limit of 33 inches fork length; possession limit of two fish per person per day.

On August 25, 2017 proclamation FF-31-2017 (http://portal.ncdenr.org/web/mf/proclamation-ff-31-2017) was issued effective September 5, 2017 to complement the commercial provisions of Framework Amendment 4 to the Coastal Migratory Pelagics FMP (minimum size limit of 33 inches fork length; possession limit of two fish per person per day or six fish per vessel per day, whichever is more restrictive), and to maintain the recreational season closure through April 30, 2018 as per direction from the N.C. Marine Fisheries Commission. Subsequently, on August 31, 2017 proclamation FF-32-2017 (http://portal.ncdenr.org/web/mf/proclamation-ff-32-2017) was issued effective September 5, 2017 to complement the commercial federal waters closure due to the annual catch limit being met (still maintaining the recreational closure through April 30, 2018). The result was that the commercial fishery was closed the same day that Framework Amendment 4 regulations became effective. Proclamation FF-32-2017 also established the reopening of the commercial fishery on January 1, 2018 under the Framework Amendment 4 management measures noted above.

In January 2018, the N.C. Division of Marine Fisheries (NCDMF) submitted its Cobia Implementation Plan to the Atlantic States Marine Fisheries Commission (ASMFC) for technical review, as required by the recently approved (October 2017) ASMFC Interstate FMP for Atlantic Cobia. NCDMF submitted two recreational management options, only one of which was recommended by the ASMFC Cobia Technical Committee for approval by the ASMFC South Atlantic State/Federal Management Board at its February 2018 meeting. A third option was submitted for technical review in late February, and was approved by the Board in early March. The following commercial and recreational management measures were issued via proclamation FF-10-2018 (http://portal.ncdenr.org/web/mf/proclamation-ff-10-2018) on March 20, 2018 and will be effective May 1, 2018. Recreational measures are designed to constrain harvest to North Carolina's recreational harvest target of 236,313 pounds, while commercial measures will remain consistent with the coastwide measures established in Framework Amendment 4 of the Coastal Migratory Pelagics FMP and subsequently incorporated into the ASMFC Interstate FMP.

- Recreational (all modes): Season of May 1 through December 31; minimum size limit of 36 inches fork length
    - Private vessel/shore: May 1 through May 31 -- possession limit of one fish per person per day, not to exceed two fish per vessel per day if more than one person is onboard; June 1 through December 31 – possession limit of one fish per vessel per day.

  - For-hire: Possession limit of one fish per person per day, not to exceed four fish per vessel per day if four or more people are onboard.
- Commercial: Minimum size limit of 33 inches fork length; possession limit of two fish per person per day up to six fish per vessel per day, whichever is more restrictive; season closes when commercial annual catch limit is met.

A summary of all commercial and recreational cobia regulations in North Carolina state waters is contained in Tables 1 (recreational) and 2 (commercial).

Table 1. North Carolina recreational regulations in state waters, 1992-2018. Minimum size limits are inches fork length (FL).

Year	Season	Min. Size (FL)	Daily Possession Limit	Regulation
1992	Year-round	33	2 fish/person	15A NCAC 03M .0507/FF-5-92
1993	Year-round	33	2 fish/person	15A NCAC 03M .0507/FF-5-92
1994	Year-round	33	2 fish/person	15A NCAC 03M .0507/FF-4-94, FF-19-94
1995	Year-round	33	2 fish/person	15A NCAC 03M .0507/FF-19-94
1996	Year-round	33	2 fish/person	15A NCAC 03M .0507/FF-19-94
1997	Year-round	33	2 fish/person	15A NCAC 03M .0507FF-19-94
1998	Year-round	33	2 fish/person	15A NCAC 03M .0507/FF-19-94
1999	Year-round	33	2 fish/person	15A NCAC 03M .0507/.0516
2000	Year-round	33	2 fish/person	15A NCAC 03M .0516
2001	Year-round	33	2 fish/person	15A NCAC 03M .0516
2002	Year-round	33	2 fish/person	15A NCAC 03M .0516
2003	Year-round	33	2 fish/person	15A NCAC 03M .0516
2004	Year-round	33	2 fish/person	15A NCAC 03M .0516
2005	Year-round	33	2 fish/person	15A NCAC 03M .0516
2006	Year-round	33	2 fish/person	15A NCAC 03M .0516
2007	Year-round	33	2 fish/person	15A NCAC 03M .0516
2008	Year-round	33	2 fish/person	15A NCAC 03M .0516
2009	Year-round	33	2 fish/person	15A NCAC 03M .0516
2010	Year-round	33	2 fish/person	15A NCAC 03M .0516
2011	Year-round	33	2 fish/person	15A NCAC 03M .0516
2012	Year-round	33	2 fish/person	15A NCAC 03M .0516
2013	Year-round	33	2 fish/person	15A NCAC 03M .0516
2014	Year-round	33	2 fish/person	15A NCAC 03M .0516
2015	Year-round	33	2 fish/person	15A NCAC 03M .0516
2016	1/1 - 2/26	33	2 fish/person	15A NCAC 03M .0516
	2/27 - 5/22	33	1 fish/person	15A NCAC 03M .0512/FF-9-2016
	5/23 - 9/30	37	**Private:** M/W/Sat, 1 fish/person up to 2 fish/vessel when more than 1 person onboard **Shore**: 1 fish/person **For-hire**: 1 fish/person up to 4 fish/vessel when 4 or more people onboard	15A NCAC 03M .0512/FF-25-2016, FF-55-2016
2017	1/1 - 4/30	33	2 fish/person	15A NCAC 03M .0512/FF-55-2016
	5/1 – 8/31	36	**All modes**: 1 fish/person up to 4 fish/vessel when 4 or more people onboard	15A NCAC 03M .0512/FF-13-2017, FF-31-2017, FF-32-2017
2018	5/1 – 12/31	36	**Private/shore:** 5/1-5/31, 1 fish/person up to 2 fish/vessel when more than 1 person onboard; 6/1 – 12/31, 1 fish/vessel. **For-hire:** 1 fish/person up to 4 fish/vessel when 4 or more people onboard	15A NCAC 03M .0512/FF-10-2018

Table 2. North Carolina commercial cobia regulations in state waters, 1992-2018.

Year	Season	Min. Size (FL)	Daily Possession Limit	Regulation
1992	Year-round	33	none	15A NCAC 03M .0507/FF-5-92
1993	Year-round	33	none	15A NCAC 03M .0507/FF-5-92
1994	Year-round	33	2 fish/person (by hook-and-line)	15A NCAC 03M .0507/FF-4-94/FF-19-94
1995	Year-round	33	2 fish/person (by hook-and-line)	15A NCAC 03M .0507/FF-19-94
1996	Year-round	33	2 fish/person (by hook-and-line)	15A NCAC 03M .0507/FF-19-94
1997	Year-round	33	2 fish/person (by hook-and-line)	15A NCAC 03M .0507/FF-19-94
1998	Year-round	33	2 fish/person (by hook-and-line)	15A NCAC 03M .0507/FF-19-94
1999	Year-round	33	2 fish/person	15A NCAC 03M .0507/.0516
2000	Year-round	33	2 fish/person	15A NCAC 03M .0516
2001	Year-round	33	2 fish/person	15A NCAC 03M .0516
2002	Year-round	33	2 fish/person	15A NCAC 03M .0516
2003	Year-round	33	2 fish/person	15A NCAC 03M .0516
2004	Year-round	33	2 fish/person	15A NCAC 03M .0516
2005	Year-round	33	2 fish/person	15A NCAC 03M .0516
2006	Year-round	33	2 fish/person	15A NCAC 03M .0516
2007	Year-round	33	2 fish/person	15A NCAC 03M .0516
2008	Year-round	33	2 fish/person	15A NCAC 03M .0516
2009	Year-round	33	2 fish/person	15A NCAC 03M .0516
2010	Year-round	33	2 fish/person	15A NCAC 03M .0516
2011	Year-round	33	2 fish/person	15A NCAC 03M .0516
2012	Year-round	33	2 fish/person	15A NCAC 03M .0516
2013	Year-round	33	2 fish/person	15A NCAC 03M .0516
2014	Year-round	33	2 fish/person	15A NCAC 03M .0516
2015	Year-round	33	2 fish/person	15A NCAC 03M .0516
2016	1/1 - 2/26	33	2 fish/person	15A NCAC 03M .0516
	2/27 - 5/22	33	2 fish/license holder	15A NCAC 03M .0512/FF-9-2016
	5/23 – 5/29	33	2 fish/license holder	15A NCAC 03M .0512/FF-25-2016
	5/30 – 12/6	33	2 fish/person, not to exceed 4 fish/vessel	15A NCAC 03M .0512/FF-28-2016, FF-55-2016
2017	1/1 - 4/30	33	2 fish/person	15A NCAC 03M .0512/FF-55-2016
	5/1-9/5	33	2 fish/person*	15A NCAC 03M .0512/FF-13-2017, FF-31-2017, FF-32-2017
2018	1/1 – 12/31	33	2 fish/person or 6 fish/vessel, whichever is more restrictive	15A NCAC 03M .0512/FF-32-2017, FF-10-2018

*The effective date of Framework Amendment 4 regulations (9/5/2017; complemented via FF-31-2017) coincided with the effective date of the federal waters closure of the commercial fishery (complemented via FF-32-2017).

2.8.7 South Carolina**

1989: SC Code of Laws Section 50-17-510(3) adopted minimum size limits for certain species where size limits were established under the Fishery Conservation and Management Act (PL94-265); a 33 inch fork length minimum was specifically listed for cobia.

1992: SC Code of Laws Section 50-17-510(C) adopted the federal minimum size limits automatically for all species managed under the Fishery Conservation and Management Act (PL94-265); and Section 50-17-510(F) adopted the federal catch and possession limits for a number of listed species managed under the Fishery Conservation and Management Act (PL94-265) as the Law of the State of SC, with cobia specifically listed.

2000: SC Marine-related Laws reorganized under SC Code of Laws Title 50 Chapter 5.

SC Code of Laws Section 50-5-2730 reads – "Unless otherwise provided by law, any regulations promulgated by the federal government under the Fishery Conservation and Management Act (PL94-265) or the Atlantic Tuna Conservation Act (PL 94-70) which establishes seasons, fishing periods, gear restrictions, sales restrictions, or bag, catch, size, or possession limits on fish are declared to be the law of this State and apply statewide including in state waters." As such, SC cobia–related regulation was pulled directly from the federal regulations as promulgated under Magnuson.

2012: SC designated cobia as a gamefish under SC Code Section 50-5-1700(D) and (E) and made it "unlawful to sell, purchase, trade, or barter or attempt to sell, purchase, trade, or barter cobia taken from state waters."

2016: Through SC Code Section 50-5-15(67) SC created a "Southern Cobia Management Zone" in "all waters of the State south of 032° 31.0' N latitude, the approximate latitude of Jeremy Inlet, Edisto Island." This was done to create special state management of fish participating in a well-documented spawning aggregation each year in the southern sounds of the state. Regulation within this area is described in SC Code Section 50-5-2730(B)(2), which states that "cobia (Rachycentron canadum) located in the Southern Cobia Management Zone. Subject to the size limit established by federal regulation, possession of cobia caught in the Southern Cobia Management Zone is limited to one per person per day, and no more than three per boat per day, from June 1 to April 30. It is unlawful to take and possess cobia in the Southern Cobia Management Zone from May 1 to May 31, and at any time federal regulations provide for the closure of the recreational cobia season in the waters of the South Atlantic Ocean."

2.8.8 **Georgia****

The Georgia Legislature, the Board of Natural Resources and the Department of Natural Resources, an executive agency, share regulatory responsibilities for wildlife in the state of Georgia with the Board and Department as subordinates. Title 27 (Game and Fish Code) Chapter 4 of the Georgia Statutes contain the laws directly related to the management of wildlife including marine fishes (O.C.G.A. 27-4-10). In 2012, the legislature amended the Game and Fish Code extensively and in doing so granted the Board and Department additional powers to promulgate regulations affecting marine fisheries. Previously the legislature maintained management authority over a select group of marine fishes while allowing the Board and Department authority over others. With the 2012 amendment, the legislature set parameters within which the Board and Department regulate marine fishes. Board of Natural Resources Rule 391-2-4-.04, Saltwater Finfishing, contains regulations for these fishes, including cobia.

Current Cobia Regulations in Georgia (March 2018)

The size and creel limit for both recreational and commercial cobia harvest are the same, 36 inch fork length minimum size, and one fish per person or six fish per vessel whenever six or more licensed fishermen are onboard. The recreational season is March 1 through October 31 (Board Rule 391-2-4-.04(3)(h). The GADNR Commissioner has the authority to reduce the season length, annually, if necessary (O.C.G.A. 27-4-130(a). For commercial harvest, the season is open in conjunction with the federal season and will close once the commercial Annual Catch Limit (ACL) is met (Board Rule 391-2-4-.04 (4)(c)).

License Requirements

In Georgia, a license is required to fish recreationally (O.C.G.A. 27-2-1) or commercially (O.C.G.A. 27-4-110). Recreational fishing licenses are required of residents and non-residents fishing in state territorial waters as well as the EEZ. All persons under the age of 16, regardless of residency, and residents born before July 1, 1952 are not required to purchase recreational licenses. Other exemptions exist for active military and individuals with disabilities, check with the GADNR for details. Commercial fishing licenses are required to sell seafood landed in Georgia from Georgia waters or from the EEZ.

Penalties for Violations

Penalties for violations of Georgia laws and regulations are established in Georgia Statutes. Most violations of game and fish laws are misdemeanors though some may be elevated to misdemeanors of high and aggravated nature, Title 27, Chapter 4.

Gear Restrictions

There are few restrictions on recreational gear for the harvest of cobia; only gig and gillnet are prohibited. Commercially, cobia may be harvested using trawl nets, cast nets, seines, and pole-and line, though only pole-and-line are practical. (Board Rule 391-2-4-.12)

Commercial Landings and Data Reporting Requirements

Georgia requires commercial harvesters (O.C.G.A. 27-4-118) and seafood dealers (O.C.G.A. 27-4-136) to submit landings data. Information to be supplied for each trip includes trip date; vessel identification; trip number; species; quantity; units of measure; disposition; value; county or port landed; state landed; dealer identification; unloading date; market; grade; gear; quantity of gear; days at sea; number of crew; fishing time; and number of sets.

Commercial finfish harvest limits are equivalent to recreational limits unless otherwise noted. This means that commercial harvesters may land and sell no more than one fish per person per day not to exceed 6 fish per boat and minimum size and landing restrictions are the same as recreational. (Board Rule 391-2-4-.04) The season is open in conjunction with the federal season and will close once the commercial Annual Catch Limit (ACL) is met (Board Rule 391-2-4-.04 (4)(c)).

Other Restrictions

Cobia, as with all marine species except sharks, must be landed with head and fins intact. Transfer between vessels at sea is prohibited. (Board Rule 391-2-4-.04 (5)(a) and (b))

Management Chronology

1957: Gill nets prohibited in state waters.

1989: The Georgia Legislature established O.C.G.A. 27-4-130.1, Open seasons, creel limits, and minimum size limits for certain finfish species. For cobia a closed season of December 1 through March 15 was established ((a)(3)). Furthermore, the legislature authorized the Board to manage cobia seasons beyond this closed season as well as to set size limits between 20 and 40 inches and to establish a maximum daily creel not to exceed 10 fish ((b)(3)).

1989: The Board of Natural Resources adopted Rule 391-2-4-.04, Saltwater Finfishing. Specifically for cobia, it established a March 16 to November 30th open season ((3)(c)), a two cobia per person daily creel and possession limit ((4)(c)), and a 33-inch fork length minimum size ((5)(c)).

2012: The Georgia Legislature repealed O.C.G.A. 27-4-130.1 and moved those species therein to O.C.G.A. 27-4-10. Cobia ((a)(28)) parameters were set at 0 to 40 inches and five fish. Further, the board was authorized to set size limits, open seasons, creel and possession limits and possession and landing specifications on a state-wide, regional and local basis. Finally, the Commissioner of the Department was empowered to close waters to recreational and commercial fishing by species for a period of up to six months within a calendar year.

2012: The Board of Natural Resources implemented the necessary requirements of the Legislative repeal while keeping cobia management intact, with the exception of resorting species; cobia became letter (h).

2014: The Board of Natural Resources amended 391-2-4-.04, Saltwater Finfishing, for Cobia ((3)(h)) to allow fishing all year, but kept the two cobia per person creel and possession limit and the 33-inch fork length minimum size limit as well as the landing restrictions of head and fins intact and prohibition on transfer at sea.

2018: The Board of Natural Resources amended 391-2-4-.04, Saltwater Finfishing, for Cobia ((3)(h)) to 36 inch fork length minimum size, and one fish per person or six fish per vessel whenever six or more licensed fishermen are onboard, with the size and creel limit for both recreational and commercial cobia harvest are the same. The recreational season is March 1 through October 31 (Board Rule 391-2-4-.04(3)(h). The GADNR Commissioner has the authority to reduce the season length, annually, if necessary (O.C.G.A. 27-4-130(a). For commercial harvest, the season is open in conjunction with the federal season and will close once the commercial Annual Catch Limit (ACL) is met (Board Rule 391-2-4-.04 (4)(c)).

2.8.9 **Florida**

Cobia Regulation History

Year	Minimum Size Limit	Recreational Daily Harvest Limits	Commercial Daily Harvest Limits	Regulation Changes	Rule Change Effective Date
1980	None	None	None		
1981	None	None	None		
1982	None	None	None		
1983	None	None	None		
1984	None	None	None		
1985	37 inches TL (equivalent to 33 inches FL)	None	None	Established a minimum size limit of 37 inches TL (equivalent to 33 inches FL).	June 13, 1985
1986	37 inches TL (equivalent to 33 inches FL)	None	None		
1987	37 inches TL (equivalent to 33 inches FL)	2 fish or 250 pounds per person, whichever is greater	None		
1988	37 inches TL (equivalent to 33 inches FL)	2 fish or 250 pounds per person, whichever is greater	None		
1989	37 inches TL (equivalent to 33 inches FL)	2 fish or 100 pounds per person, whichever is greater	None		
1990	33 inches FL	2 fish per person	2 fish per person	Set the minimum size limit at 33 inches FL. Established a 2-fish daily bag limit for all fishermen, commercial and recreational. Fish must be landed in whole condition.	Jan. 1, 1990

1991	33 inches FL	2 fish per person	2 fish per person		
1992	33 inches FL	2 fish per person	2 fish per person		
1993	33 inches FL	2 fish per person	2 fish per person		
1994	33 inches FL	2 fish per person	2 fish per person		
1995	33 inches FL	2 fish per person	2 fish per person		
1996	33 inches FL	2 fish per person	2 fish per person		
1997	33 inches FL	2 fish per person	2 fish per person		
1998	33 inches FL	2 fish per person	2 fish per person		Aug. 31, 1998
1999	33 inches FL	2 fish per person	2 fish per person		
2000	33 inches FL	2 fish per person	2 fish per person		
2001	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel	Designated cobia as a "restricted species." Established a daily recreational limit of 1-fish per person and 6-fish per vessel, whichever is less. Established a daily commercial limit of 2-fish per person and 6-fish per vessel, whichever is less.	March 22, 2001
2002	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2003	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		

2004	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2005	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2006	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2007	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2008	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2009	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2010	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2011	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2012	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2013	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2014	33 inches FL	1 fish per person and 6	2 fish per person and 6		

		fish per vessel	fish per vessel		
2015	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2016	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2017	33 inches FL	1 fish per person and 6 fish per vessel	2 fish per person and 6 fish per vessel		
2018	33 inches FL	Atlantic Region: 1 fish per person and 6 fish per vessel Gulf Region: 1 fish per person and 2 fish per vessel	Atlantic Region: 2 fish per person and 6 fish per vessel Gulf Region: 1 fish per person and 2 fish per vessel	Defined the Gulf Region for cobia management in Florida to be all Florida waters lying north of the Monroe-Collier county line (25°48.216’ N. lat.). Defined the Atlantic Region for cobia management in Florida to be all Florida waters lying outside of the Gulf Region. Established a commercial vessel limit of 1 fish per person for the Gulf Region. Established a recreational and commercial vessel limit of 2 fish for the Gulf Region. This shall not be construed to exceed the 1-fish per person bag limit.	Feb. 11, 2018

**These states have proposed regulatory changes for Atlantic cobia under ASMFC’s IFMP, which will be implemented April 2018.

2.9 Gulf of Mexico

The following tables summarize the Gulf of Mexico Blueline Tilefish management history.

2.9.1 Gulf of Mexico Harvest Restrictions (Trip Limits)

Harvest Restrictions (Trip Limits*)								
*Trip limits do not apply during closures (if season is closed, then trip limit is 0)								
Species Affected	**First Yr In Effect**	**Effective Date**	**End Date**	**Fishery**	**Possession Limit (per person)**	**Region Affected**	**FR Reference**	**Amendment Number or Rule Type**
Cobia	1990	1/1/1990	-	All	2	Gulf of Mexico Federal Waters		CMP Amendment 5
	2018	2/11/2018	-	All	1	Florida State Waters ONLY	68B-19.004	https://www.flrules.org/gateway/RuleNo.asp?title=COBIA&ID=68B-19.004
"Gulf of Mexico" refers to the Gulf migratory group of cobia occuring within the Gulf Council's jurisdiction, which is from the Texas/Mexico border east to the Dade/Monroe County line in Florida								

2.9.2 Gulf Of Mexcio Harvest Restrictions (size Limits)

Harvest Restrictions (Size Limits*)									
*Size limits do not apply during closures									
Species Affected	**First Yr In Effect**	**Effective Date**	**End Date**	**Fishery**	**Size Limit**	**Length Type**	**Region Affected**	**FR Reference**	**Amendment Number or Rule Type**
Cobia	1985	1/1/1985	-	All	33"	FL	Gulf of Mexico Federal Waters		Original CMP FMP

2.9.3 Gulf Of Mexico Harvest Restrictions Fishery Closures

Harvest Restrictions (Fishery Closures*)									
*Area specific regulations are documented under spatial restictions									
Species Affected	**First Yr In Effect**	**Effective Date**	**End Date**	**Fishery**	**Closure Type**	**First Day Closed**	**Last Day Closed**	**Region Affected**	**FR Reference**
Cobia	None								

2.9.4 Gulf of Mexico Harvest Restrictions (Spatial Restrictions)

Harvest Restrictions (Spatial Restrictions)									
Area	**First Yr In Effect**	**Effective Date**	**End Date**	**Fishery**	**First Day Closed**	**Last Day Closed**	**Restriction in Area**	**FR Reference**	**Amendment Number or Rule Type**
Gulf of Mexico Stressed Areas	1984	11/8/1984	Ongoing	Both	Year round		Prohibited powerheads for Reef FMP	49 FR 39548	Original Reef Fish FMP
	1984	11/8/1984	Ongoing	Both	Year round		Prohibited pots and traps for Reef FMP	49 FR 39548	Original Reef Fish FMP
Alabama Special Management Zones	1994	2/7/1994	Ongoing	Both	Year round		Allow only hook-and line gear with three or less hooks per line and spearfishing gear for fish in Reef FMP	59 FR 966	Reef Fish Amendment 5
EEZ, inside 50 fathoms west of Cape San Blas, FL	1990	2/21/1990	Ongoing	Both	Year round		Prohibited longline and buoy gear for Reef FMP	55 FR 2078	Reef Fish Amendment 1
EEZ, inside 20 fathoms east of Cape San Blas, FL	1990	2/21/1990	4/17/2009	Both	Year round		Prohibited longline and buoy gear for Reef FMP	55 FR 2078	Reef Fish Amendment 1
EEZ, inside 50 fathoms east of Cape San Blas, FL	2009	4/18/2009	10/15/2009	Both	18-Apr	28-Oct	Prohibited bottom longline for Reef FMP	74 FR 20229	Emergency Rule
EEZ, inside 35 fathoms east of Cape San Blas, FL	2009	10/16/2009	4/25/2010	Both	Year round		Prohibited bottom longline for Reef FMP	74 FR 53889	Sea Turtle ESA Rule
	2010	4/26/2010	Ongoing	Rec	Year round		Prohibited bottom longline for Reef FMP	75 FR 21512	Reef Fish Amendment 31
	2010	4/26/2010	Ongoing	Com	1-Jun	31-Aug	Prohibited bottom longline for Reef FMP	75 FR 21512	Reef Fish Amendment 31
Madison-Swanson	2000	4/19/2000	6/2/2004	Both	Year round		Fishing prohibited except HMS[1]	65 FR 31827	Reef Fish Regulatory Amendment
	2004	6/3/2004	Ongoing	Both	1-May	31-Oct	Fishing prohibited except surface trolling	70 FR 24532 74 FR 17603	Reef Fish Amendment 21 Reef Fish Amendment 30B
	2004	6/3/2004	Ongoing	Both	1-Nov	30-Apr	Fishing prohibited	70 FR 24532 74 FR 17603	Reef Fish Amendment 21 Reef Fish Amendment 30B
Steamboat Lumps	2000	4/19/2000	6/2/2004	Both	Year round		Fishing prohibited except HMS[1]	65 FR 31827	Reef Fish Regulatory Amendment
	2004	6/3/2004	Ongoing	Both	1-May	31-Oct	Fishing prohibited except surface trolling	70 FR 24532 74 FR 17603	Reef Fish Amendment 21 Reef Fish Amendment 30B
	2004	6/3/2004	Ongoing	Both	1-Nov	30-Apr	Fishing prohibited	70 FR 24532 74 FR 17603	Reef Fish Amendment 21 Reef Fish Amendment 30B
The Edges	2010	7/24/2009	Ongoing	Both	1-Jan	30-Apr	Fishing prohibited	74 FR 30001	Reef Fish Amendment 30B Supplement
20 Fathom Break	2014	7/5/2013	Ongoing	Rec	1-Feb	31-Mar	Fishing for SWG prohibited[2]	78 FR 33259	Reef Fish Framework Action
Flower Garden	1992	1/17/1992	Ongoing	Both	Year round		Fishing with bottom gears prohibited[3]	56 FR 63634	Sanctuary Designation
Riley's Hump	1994	2/7/1994	8/18/2002	Both	1-May	30-Jun	Fishing prohibited	59 FR 966	Reef Fish Amendment 5
Tortugas Reserves	2002	8/19/2002	Ongoing	Both	Year round		Fishing prohibited	67 FR 47467	Tortugas Amendment
Pulley Ridge	2006	1/23/2006	Ongoing	Both	Year round		Fishing with bottom gears prohibited[3]	70 FR 76216	Essential Fish Habitat (EFH) Amendment 3

[1]HMS: highly migratory species (tuna species, marlin, oceanic sharks, sailfishes, and swordfish)
[2]SWG: shallow-water grouper (black, gag, red, red hind, rock hind, scamp, yellowfin, and yellowmouth)
[3]Bottom gears: Bottom longline, bottom trawl, buoy gear, pot, or trap

2.9.5 Gulf of Mexico Harvest Restrictions (Gear Restrictions*)

Harvest Restrictions (Gear Restrictions*)						
*Area specific gear regulations are documented under spatial restictions						
Gear Type	**First Yr In Effect**	**Effective Date**	**End Date**	**Gear/Harvesting Restrictions**	**Region Affected**	**FR Reference**
Cobia				None		
[1]Except when, purchased from a fish processor, filleted carcasses may be used as bait crab and lobster traps.						

2.9.6 Gulf of Mexico Quota ACL closure

Year	Fixed Closed Months	Recreational Landings	Commercial Landings	Total Landings	ACT	ACL	ACT %	ACL %	Quota Closure
2000	None	1,508,489	129,890	1,638,379	None	None	N/A	N/A	None
2001		1,555,656	92,365	1,648,021					
2002		1,227,708	105,320	1,333,028					
2003		2,060,423	111,636	2,172,059					
2004		2,090,425	101,181	2,191,606					
2005		1,461,039	87,582	1,548,621					
2006		1,572,637	81,948	1,654,585					
2007		1,685,402	73,208	1,758,610					
2008		1,312,126	68,723	1,380,849					
2009		996,105	62,239	1,058,344					
2010		1,317,728	82,361	1,400,089					
2011		1,683,588	69,168	1,752,756					
2012		924,697	51,911	976,608	1,310,000	1,460,000	74.6%	66.9%	
2013		1,211,101	82,531	1,293,632	1,310,000	1,460,000	98.8%	88.6%	
2014		923,426	78,481	1,001,907	1,310,000	1,460,000	76.5%	68.6%	
2015		811,564	70,314	881,878	1,450,000	1,610,000	60.8%	54.8%	
2016		888,898	74,608	963,506	1,500,000	1,660,000	64.2%	58.0%	
2017*		427,561	56,321	483,882	1,500,000	1,660,000	32.3%	29.1%	

Data were pulled from the SERO ACL monitoring website on March 20, 2018. *2017 data are preliminary.

Landings are in pounds landed weight (whole and gutted combined)

All landings are for the Gulf migratory group as defined in each year. Beginning in 2017, landings are for the Gulf's jurisdictional area for cobia, from the Texas/Mexico border to the Dade/Monroe County line.

CMP Amendment 18 (effective date: 1/30/2012) separated Gulf and Atlantic Migratory stocks with a boundary at the SAFMC/GMFMC jurisdicitonal line. Amendment 20B (effective date: 3/1/2015) set the boundary for the Gulf and Atlantic migratory groups at the FL/GA line, a portion of the Gulf migratory group ACL is allocated to the FL East Coast zone. FL East Coast zone includes east coast of FL through the SAFMC/GMFMC jurisdicational line. ACL's and landings? in this table do not include FL East Coast Zone. Information on FL East Coast Zone is included in the SAFMC management history documents.

2.10 ASMFC MANAGEMENT HISTORY

Interstate Fishery Management Plan (ISFMP) for Atlantic Migratory Group (AMG) Cobia

The ISFMP established a management regime for state territorial seas (0-3 nautical miles from shore) and internal waters for the range of AMG cobia (New Jersey-Georgia), under the authority of the Atlantic States Marine Fisheries Commission's (ASMFC) South Atlantic State/Federal Fisheries Management Board (Board). The ISFMP was developed and approved as a complement to the SAFMC Coastal Migratory Pelagics (CMP) FMP. As such, the ASMFC works with the SAFMC to develop management measures. ASMFC implements management measures from the ISFMP in state waters and provides the SAFMC with a recommendation that similar measures be implemented in federal waters.

The ISFMP established the following coastwide measures for state waters to complement SAFMC CMP FMP Framework Amendment 4:

Commercial

1. Minimum size limit: 33 inches fork length or total length equivalent (37 inches).
2. Maximum possession/vessel limit: 2 fish per person, not to exceed 6 fish per vessel.
3. Adherence to the federal commercial Annual Catch Limit (ACL) (currently, 50,000 pounds); if federal waters are closed to commercial fishing due to the commercial ACL being met, state waters will be closed to commercial fishing as well.

Recreational

1. Minimum size limit: 36 inches fork length or total length equivalent (40 inches).
2. Maximum bag limit: 1 fish per person.
3. Maximum vessel limit: 6 fish per vessel per day.

A recreational harvest limit (RHL) was also established and set equivalent to 99% of the federal recreational ACL (current ACL: 620,000 pounds; current RHL: 613,800 pounds). This RHL is allocated to states within the management range that do not have *de minimis* status. Allocated amounts for each state are soft harvest targets, and are evaluated in 3-year time periods. Individual states may set season and vessel limits in addition to the coastwide size and bag limits listed above to achieve their harvest target. Current state allocation percentages and harvest targets are shown in Table 1.

Table 1. Allocated state recreational harvest targets for Atlantic Migratory Group cobia by weight and percentage of the Recreational Harvest Limit (613,800 pounds).

State	**Pounds Percentage of RHL**
Georgia	58,311 9.5%
South Carolina	74,885 12.2%
North Carolina	236,313 38.5%
Virginia	244,292 39.8%

After 3 years, if a state's average annual landings over the 3-year time period are greater than their annual soft harvest target, that state must adjust their season length or vessel limits for the following 3 years, as necessary, to prevent exceeding their target in the future. States reporting an under-harvest over a 3-year period may present a plan to extend seasons or increase vessel limits to allow increased harvests that will not exceed the harvest target. State harvests will next be evaluated against targets in 2021 for 2018-2020 harvests. Current state season and vessel limits are shown in Table 2.

Table 2. State recreational season and vessel limits.

State	Recreational Season and Daily Vessel Limits
Georgia	Season: March 1-October 31; Vessel Limit: 6 fish
South Carolina	Season: None, but will close when federal waters close; Vessel Limit: 3 fish in Southern Cobia Management Zone and 6 fish in all other state waters
North Carolina	Private Vessels – Season: May 1-May 31, Vessel Limit: 2 fish; Season: June 1-December 31, Vessel Limit: 1 fish For-Hire Vessels – Season: May 1-December 31, Vessel Limit: 4 fish
Virginia	Season: June 1-September 30; Vessel Limit: 3 fish, only 1 of which may be over 50 inches total length

States with less than 1% of coastwide recreational landings over the previous 3 years may apply for *de minimis* status under the ISFMP. *De minimis* status is intended to allow some harvest for states with historically minimal levels of harvest. *De minimis* states do not receive recreational harvest target allocations. These states may match the season and daily vessel limits of an adjacent or the nearest non-*de minimis* state or implement a 1 fish daily vessel limit with no season. *De minimis* states are subject to coastwide recreational size and bag limits as well as all commercial coastwide measures. All jurisdictions from Maryland through New Jersey have been granted *de minimis* status.

Effective Date: April 1, 2018

2.11 Assessment History & Review

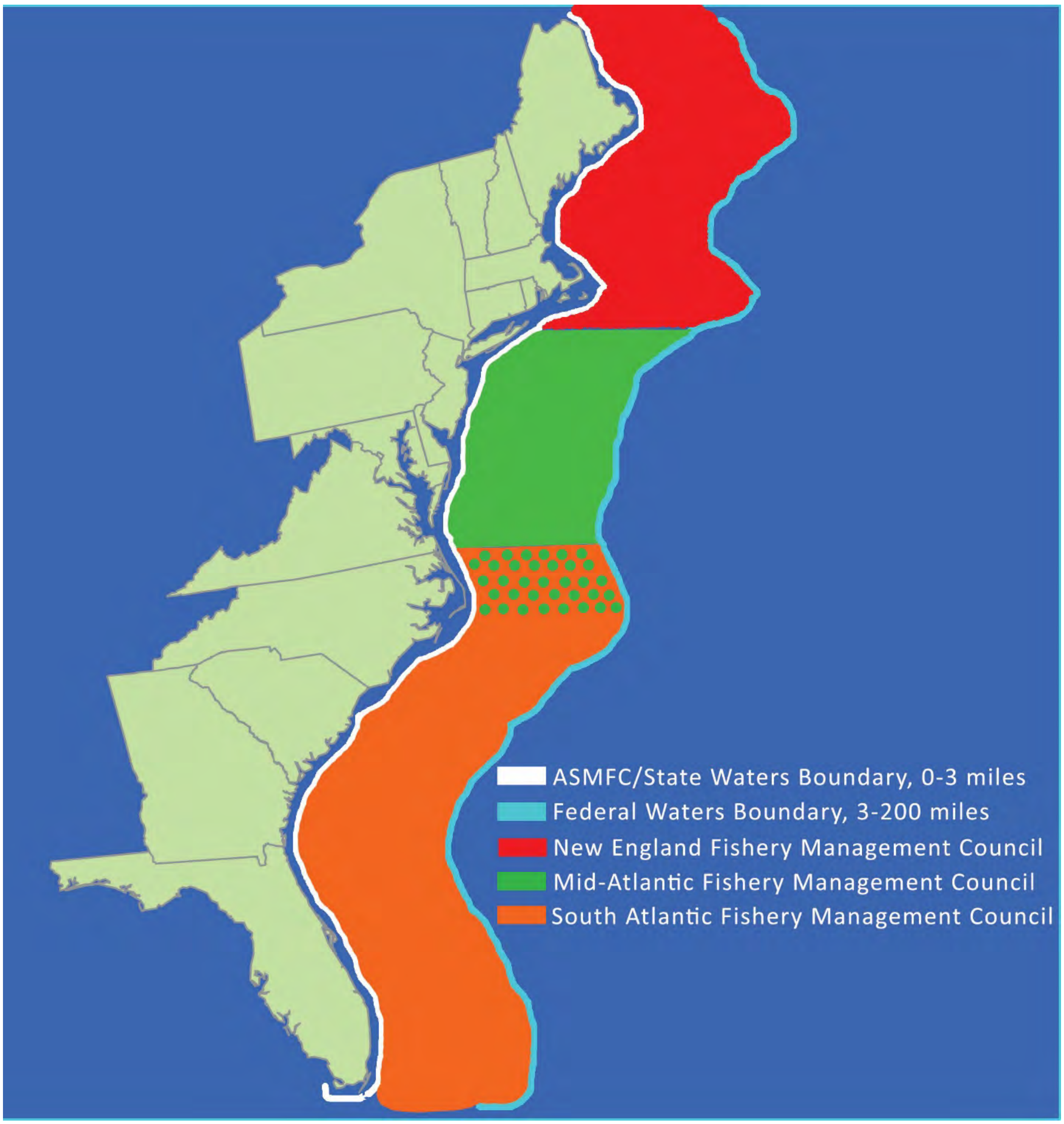
Historically, cobia has been overseen by the Mackerel Stock Assessment Panel (MSAP) under the purview of the Coastal Migratory Pelagics Fishery Management Plan. The most recent assessments of South Atlantic cobia were done in 1995 (Thompson 1995), and 2013 (SEDAR 2013). The 1995 assessment assumed the South Atlantic stock extended north from the Florida Keys. A VPA with a recreational fishery-dependent index (MRFSS) for tuning was used. The results of the VPA suggested that total mortality (Z) was equal to natural mortality (assumed M=0.4), suggesting a very low fishing mortality rate (F). A similar assessment in 1994 also indicated stable catches and low F in the South Atlantic with no indication of overfishing (Thompson 1994). The 2013 benchmark assessment was the first time the South Atlantic stock of cobia were assessed using the SEDAR process. For that assessment, the southern stock boundary was the Florida/Georgia border. The 2013 assessment was carried out using a catch-age statistical model and included life history parameters estimated externally, landings, discards, multiple indices, and length and age compositions.

References Cited:

- SEDAR. 2013. SEDAR 28 – South Atlantic Cobia Stock Assessment Report. SEDAR, North Charleston SC. 420 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=28
- Thompson, N.B. 1994. An assessment of cobia in southeast U.S. waters. Miami Laboratory Contribution No. MIA-94/95-31.
- Thompson, N.B. 1994. An assessment of cobia in southeast U.S. waters. Miami Laboratory Contribution No. MIA-93/94-38.

3. Regional Maps

Figure 4.1: ASMFC jurisdictional boundaries. SEDAR 58 developed models for one region: North of the GA/FL state border line to New York.



4. SEDAR Abbreviations (South East Data Assessment and Review)

APAIS	Access Point Angler Intercept Survey
ABC	Allowable Biological Catch
ACCSP	Atlantic Coastal Cooperative Statistics Program
ADMB	AD Model Builder software program
ALS	Accumulated Landings System; SEFSC fisheries data collection program
AMRD	Alabama Marine Resources Division
ASMFC	Atlantic States Marine Fisheries Commission
ASPIC	a stock production model incorporating covariates
ASPM	age-structured production model
B	stock biomass level
BAM	Beaufort Assessment Model
BMSY	value of B capable of producing MSY on a continuing basis
CFMC	Caribbean Fishery Management Council
CIE	Center for Independent Experts
CPUE	catch per unit of effort
EEZ	exclusive economic zone
F	fishing mortality (instantaneous)
FMSY	fishing mortality to produce MSY under equilibrium conditions
FOY	fishing mortality rate to produce Optimum Yield under equilibrium
FXX%	SPR fishing mortality rate that will result in retaining XX% of the maximum spawning production under equilibrium conditions
FMAX	fishing mortality that maximizes the average weight yield per fish recruited to the fishery
F0	a fishing mortality close to, but slightly less than, Fmax
FL FWCC	Florida Fish and Wildlife Conservation Commission
FWRI	(State of) Florida Fish and Wildlife Research Institute
GA DNR	Georgia Department of Natural Resources
GLM	general linear model
GMFMC	Gulf of Mexico Fishery Management Council
GSMFC	Gulf States Marine Fisheries Commission

GULF FIN	GSMFC Fisheries Information Network
HMS	Highly Migratory Species
LDWF	Louisiana Department of Wildlife and Fisheries
M	natural mortality (instantaneous)
MAFMC	Mid-Atlantic Fishery Management Council
MARMAP	Marine Resources Monitoring, Assessment, and Prediction
MDMR	Mississippi Department of Marine Resources
MFMT	maximum fishing mortality threshold, a value of F above which overfishing is deemed to be occurring
MRFSS	Marine Recreational Fisheries Statistics Survey; combines a telephone survey of households to estimate number of trips with creel surveys to estimate catch and effort per trip
MRIP	Marine Recreational Information Program
MSST	minimum stock size threshold, a value of B below which the stock is deemed to be overfished
MSY	maximum sustainable yield
NC DMF	North Carolina Division of Marine Fisheries
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
OY	optimum yield
SAFMC	South Atlantic Fishery Management Council
SAS	Statistical Analysis Software, SAS Corporation
SC DNR	South Carolina Department of Natural Resources
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	Southeast Data, Assessment and Review
SEFIS	Southeast Fishery-Independent Survey
SEFSC	Fisheries Southeast Fisheries Science Center, National Marine Fisheries Service
SERO	Fisheries Southeast Regional Office, National Marine Fisheries Service
SPR	spawning potential ratio, stock biomass relative to an unfished state of the stock

SSB	Spawning Stock Biomass
SSC	Science and Statistics Committee
TIP	Trip Incident Program; biological data collection program of the SEFSC and Southeast States.
TPWD	Texas Parks and Wildlife Department
Z	total mortality, the sum of M and F

SEDAR

Southeast Data, Assessment, and Review

SEDAR 58

Atlantic Cobia

SECTION II: Data Workshop Report

May 2019

SEDAR
4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

1 Introduction

1.1 Workshop Time and Place

The SEDAR 58 Data Workshop meeting was held April 1-5, 2019 in Charleston South Carolina. Two data webinars were held prior to the workshop on August 29, and October 25, 2018.

1.2 Terms of Reference

1) Define the unit stock for the SEDAR 58 Atlantic Cobia stock assessment to include the US Atlantic Seaboard north of the Georgia-Florida border.

2) Review, discuss, and tabulate available life history information.
    a. Evaluate age, growth, natural mortality, and reproductive characteristics.
    b. Provide appropriate models to describe population and fleet specific (if warranted) growth, maturation, and fecundity by age, sex, or length as applicable.
    c. Evaluate the adequacy of available life-history information for conducting stock assessments and recommend life history information for use in population modeling.
    d. Provide estimates or ranges of uncertainty for all life history information.

3) Recommend discard mortality rates.
    a. Review available research and published literature.
    b. Consider research directed at these species as well as similar species from the SE and other areas.
    c. Provide estimates of discard mortality rate by fishery, gear type, depth, and other feasible or appropriate strata.
    d. Include thorough rationale for recommended discard mortality rates.
    e. Provide justification for any recommendations that deviate from the range of discard mortality provided in the last benchmark or other prior assessment.
    f. Provide estimates of uncertainty around recommended discard mortality rates.

4) Provide measures of population abundance that are appropriate for stock assessment.
    a. Consider and discuss all available and relevant fishery dependent and independent data sources.
    b. Document all programs evaluated; address program objectives, methods, coverage, sampling intensity, and other relevant characteristics.
    c. Provide maps of fishery and survey coverage.
    d. Develop fishery and survey CPUE indices by appropriate strata (e.g. age, size, area, and fishery) and include measures of precision and accuracy.
    e. Discuss the degree to which available indices adequately represent fishery and population conditions.

  f. Recommend which data sources are considered adequate and reliable for use in assessment modeling and indicate why.
  g. Rank the available indices with regard to their reliability and suitability for use in assessment modeling.
  h. Provide appropriate measures of uncertainty for the abundance indices to be used in stock assessment models.

5) Provide commercial catch statistics, including both landings and discards in both pounds and number.
    a. Evaluate and discuss the adequacy of available data for accurately characterizing harvest and discard by species and fishery sector or gear.
    b. Provide length and age distributions for both landings and discards if feasible.
    c. Provide maps of fishery effort and harvest.
    d. Provide estimates of uncertainty around each set of landings and discard estimates.

6) Provide recreational catch statistics, including both landings and discards in both pounds and number.
    a. Evaluate and discuss the adequacy of available data for accurately characterizing harvest and discard by species and fishery sector or gear.
    b. Provide length and age distributions for both landings and discards if feasible.
    c. Provide maps of fishery effort and harvest.
    d. Provide estimates of uncertainty around each set of landings and discard estimates.

7) Identify and describe ecosystem, climate, species interactions, habitat considerations, and/or episodic events that would be reasonably expected to affect population dynamics.

8) Incorporate socioeconomic information into considerations of environmental events that affect stock status and related fishing effort and catch levels as practicable.

9) Provide recommendations for future research in areas such as sampling, fishery monitoring, and stock assessment. Include specific guidance on sampling intensity (number of samples including age and length structures) and appropriate strata and coverage. Also provide recommendations for methods to improve precision/estimates of uncertainty in recreational landings.

10) Review, evaluate, and report on the status and progress of all research recommendations listed in the last assessment, peer review reports, and SSC report concerning this stock.

11) Prepare the Data Workshop Report providing complete documentation of workshop actions and decisions in accordance with project schedule deadlines (Section II. of the SEDAR stock assessment report).

1.3 List of Participants

Data Workshop Panelists

Katie Siegfried	SEFSC Beaufort
Rob Cheshire	SEFSC Beaufort
Jennifer Potts	SEFSC Beaufort
Chris Kalinowsky*	GADNR
Hank Liao	ODU
Anne Markwith	NCDMF
Andy Ostrowski	SEFSC Beaufort
Matt Perkinson	SCDNR
George Sedberry	SAFMC SSC
Justin Yost	SCDNR
Dan Crear	VIMS
Riley Gallagher/Jacob Krause	NCSU
Beth Wrege	SEFSC Miami
Alan Bianchi/Amanda Tong	NC DMF
Julie DeFilippi-Simpson	ACCSP
Amy Dukes	SC DNR
Kevin McCarthy	SEFSC Miami
Ken Brennan	SEFSC Beaufort
Wes Blow*	SAFMC Mack/Cobia AP
Collins Doughtie	SAFMC Mack/Cobia AP
Kelly Fitzpatrick*	SEFSC Beaufort
Dawn Franco	GA DNR
Bill Gorham	SAFMC Mack/Cobia AP
Alex Aspinwall	VMRC
Vivian Matter	SEFSC Miami
Bill Parker*	Fisherman – SC
Kayla Rudnay	SC DNR
Lee Southard*	Fisherman – GA
Tom Sminkey	NMFS S&T
Chris Wilson*/Drew Cathey	NC DMF
Andrew Scheld*	VIMS
Rob Cheshire	SEFSC Beaufort
Katie Siegfried	SEFSC Beaufort
Mike Denson	SC DNR
Eric Fitzpatrick	SEFSC Beaufort
Anne Lange,	SA SSC
Kevin Weng*	VIMS

* Appointees marked with an * were appointed to the workshop panel but did not attend the workshop. Most provided data and reviewed the use of the data, and were available via email or phone for questions as needed.

Council Representatives

Anna Beckwith *	SAFMC
Mel Bell	SAFMC
Steve Poland	SAFMC

*Did not attend workshop.

Council and Agency Staff

Kathleen Howington	SEDAR
Cierra Graham	SAFMC
Christina Wiegand *	SAFMC
Mike Errigo	SAFMC
Mike Larkin*	SERO
Mike Schmidtke	ASMFC

*Participated in webinars but did not attend the Data Workshop.

Data Workshop Attendees

Karl Brecker	Fisherman
Tonya Darden	SCDNR
William Garla	Fisherman
Jackie Allen	SCDNR
Matt Walker	SCDNR
Mike Rinaldi	ACCSP
Gregg Waugh	SAFMC

Webinar Participating Data Providers

Julie Califf	GADNR
Larry Beerkircher	SEFSC

1.4 List of Data Workshop Working Papers

Atlantic Cobia Data Workshop document list. List includes documents submitted for the Stock ID Work Group meeting through the Data Workshop.

	Title	Authors
Documents Prepared for the Stock ID Workshop (StID)		
SEDAR58-SID-01	Predicting the distribution of cobia, *Rachycentron canadum*, seasonally, for mid-century, and for the end-of-century	Crear et al. 2018
SEDAR58-SID-02	Use of Pop-Up Satellite Archival Tags (PSATs) to Investigate the Movements, Habitat Utilization, and Post-Release Survival of Cobia (*Rachycentron canadum*) that Summer in Virginia Waters	Jensen & Graves 2018
SEDAR58-SID-03	Summary results of a genetic-based investigation of cobia (*Rachycentron canadum*)	McDowell et al. 2018
SEDAR58-SID-04	Population Genetic Analysis of Cobia within U.S. Coastal Waters	Darden et al. 2018
SEDAR58-SID-05	Evaluation of cobia movements using tag-recapture data from the Gulf of Mexico and South Atlantic coast of the United States	Perkinson et al. 2018
SEDAR58-SID-06	Summary Report of the North Carolina Division of Marine Fisheries Cobia (*Rachycentron canadum*) Acoustic Tagging	Poland 2018
SEDAR58-SID-07	A brief summary of scientifically collected distribution data for cobia (*Rachycentron canadum*) in US waters of the Atlantic and Gulf of Mexico	Klibansky 2018
SEDAR58-SID-08	Cobia Telemetry Working Paper (revised 4/10/2018)	Young et al. 2018
SEDAR58-SID-09	Distribution and abundance of cobia (*Rachycentron canadum*) larvae captured in ichthyoplankton samples during National Marine Fisheries Service and Southeast Area Monitoring and Assessment Program fishery-independent resource surveys	Hanisko et al. 2018
SEDAR58-SID-10	Spatial and Temporal Distribution of Cobia, Southeast US and Gulf of Mexico	Wrege 2018
SEDAR58-SID-11	VIMS Cobia Tagging Program	Weng et al. 2018

Documents Prepared for the Data Workshop (DW)		
Document #	Title	Authors
SEDAR58-DW01	Analyses and applications of Cobia length-age data collected by Virginia Marine Resources Commission between 1999 and 2018 (Revised 3/29/19)	Liao et al. 2018
SEDAR58-DW02	Fishery Dependent Index for Atlantic Cobia from MRIP Data, 1981-2017	Sminkey 2018
SEDAR58-DW03	Comparisons in growth between Cobia males and females and among years using Virginia length-age data collected by Virginia Marine Resources Commission between 1999 and 2017 (revised 3/22/19)	Liao et al. 2018
SEDAR58-DW04	Discard mortality ad-hoc group (revised 4/26/19)	Discard MortalityAd-hoc Group
SEDAR58-DW05	Investigation of Cobia Length Frequency Distributions and Potential for Differences Amongst Data Sets	Yost et al. 2019
SEDAR58-DW06	Release Condition and Observed Discard Mortality of Cobia in the For-Hire Recreational Fisheries in Florida	Duffin 2019
SEDAR58-DW07	SCDNR Charterboat Logbook Program Data, 1993-2017	Errigo et al. 2019
SEDAR58-DW08	Bycatch of cobia, *Rachycentron canadum*, in the Atlantic coastal gillnet fishery (revised 4/16/19)	Carlson and McCarthy 2019
SEDAR58-DW09	Preliminary standardized index of Southeast US Atlantic cobia (Rachycentron canadum) from headboat data. (revised 4/5/19)	SERFS 2019
SEDAR58_DW10	Estimates of Historic Recreational Landings of Cobia in the Atlantic Using the FHWAR Census Method	Brennan 2019
SEDAR58-DW11	Cobia Stock ID ProcessReport Compilation	SEDAR, 2018

	Reference Documents	
SEDAR58-RD01	SEDAR 28 South Atlantic Cobia Stock Assessment Report	SEDAR 28
SEDAR58-RD02	SEDAR 28 Gulf of Mexico Cobia Stock Assessment Report	SEDAR 28
SEDAR58-RD03	List of documents and working papers for SEDAR 28 (South Atlantic Cobia and Spanish Mackeral) – all documents available on the SEDAR website.	SEDAR 28
SEDAR58-RD04	Managing A Marine Stock Portfolio: Stock Identification, Structure, and Management of 25 Fishery Species along the Atlantic Coast of the United States	McBride 2014
SEDAR58-RD05	Chapter 22: Interdisciplinary Evaluation of Spatial Population Structure for Definition of Fishery Management Units (excerpt from Stock Identification Methods – Second Edition)	Cadrin et al. 2014
SEDAR58-RD06	Mitochondrial DNA Analysis of Cobia *Rachycentron canadum* Population Structure Uisng Restriction Fragment Length Polymorphisms and Cytochrome B Sequence Variation	Hrincevich 1993
SEDAR58-RD07	Population Genetic Comparisons among Cobia from the Northern Gulf of Mexico, U.S. Western Atlantic, and Southeast Asia	Gold et al. 2013
SEDAR58-RD08	Population genetics of Cobia (*Rachycentron canadum*): implications for fishery management along the coast of the southeastern United States	Darden et al. 2014
SEDAR58-RD09	Growth, mortality, and movement of cobia (*Rachycentron canadum*)	Dippold et al. 2017
SEDAR58-RD10	Assessment of cobia, *Rachycentron canadum*, in the waters of the U.S. Gulf of Mexico	Williams, 2001
SEDAR58-RD11	Life history of Cobia, *Rachycentron canadum* (Osteichthyes: Rachycentridae), in North Carolina waters	Smith 1995
SEDAR58-RD12	A review of age, growth, and reproduction of cobia *Rachycentron canadum*, from US water of the Gulf of Mexico and Atlantic ocean	Franks and Brown-Peterson, 2002
SEDAR58-RD13	An assessment of cobia in Southeast US waters	Thompson 1995
SEDAR58-RD14	Reproductive biology of cobia, *Rachycentron canadum*, from coastal waters of the southern United States	Brown-Peterson et al. 2001

SEDAR58-RD15	Age and growth of cobia, *Rachycentron canadum*, from the northeastern Gulf of Mexico	Franks et al. 1999
SEDAR58-RD16	Synopsis of biological data on the cobia *Rachycentron canadum* (Pisces: Rachycentridae)	Shaffer and Nakamura 1989
SEDAR58-RD17	Age, growth, and reproductive biology of greater amberjack and cobia from Louisiana waters	Thompson et al. 1991
SEDAR58-RD18	Cobia (*Rachycentron canadum*) stock assessment study in the Gulf of Mexico and in the South Atlantic	Burns et al. 1998
SEDAR58-RD19	Gonadal maturation in the cobia, *Rachycentron canadum*, from the northcentral Gulf of Mexico	Lotz et al. 1996
SEDAR58-RD20	Length-weight relationships, location and depth distributions for select Gulf of Mexico reef fish species	Pulver & Whatley 2016
SEDAR58-RD21	Inshore spawning of cobia (*Rachycentron canadum)* in South Carolina	Lefebvre & Denson 2012
SEDAR58-RD22	Determining the stock boundary between South Atlantic and Gulf of Mexico managed stocks of Cobia, *Rachycentron canadum*, through the use of telemetry and population genetics	Perkinson et al. 2018
SEDAR58-RD23	SAFMC Mackerel Cobia Advisory Panel and Cobia Sub-Panel Cobia Fishery Performance Report April 2017	SAFMC Mackerel Cobia AP & Cobia Sub-Panel 2017
SEDAR58-RD24	Spawning of the Cobia, *Rachycentron canadum*, in the Chesapeake Bay Area, with Observations of Juvenile Specimens	Joseph et al. 1964
SEDAR58-RD25	SEDAR28-DW02: South Carolina experimental stocking of Cobia *Rachycentrom canadum*	Denson 2012
SEDAR58-RD26	Applying network methods to acoustic telemetry data: Modeling the movements of tropical marine fishes	Finn et al. 2014
SEDAR58-RD27	Developing a deeper understanding of animal movements and spatial dynamics through novel application of network analyses	Jacoby et al. 2012
SEDAR58-RD28	Status of the South Carolina Fisheries for Cobia	Hammond 2001
SEDAR58-RD29	Dynamic ocean management increases the efficiency and efficacy of fisheries management	Dunn et.al. 2016
SEDAR58-RD30	Using Pop-off Satellite Archival Tags To Monitor and Track Dolphinfish and Cobia	Hammond 2008
SEDAR58-RD31	Cusk (Brosme brosme) and climate change: assessing the threat to a candidate marine fish species under the US Endangered Species Act	Hare et al 2012

2 Life History

2.1 Overview

<u>Participant List</u>

Jennifer Potts, *Workgroup leader*, SEFSC Beaufort
Chris Kalinowsky*, Data provider, GADNR
Hank Liao, Data provider, ODU
Anne Markwith, Data provider, NCDMF
Andy Ostrowski, Data provider, *Rapporteur*, SEFSC Beaufort
Matt Perkinson, Data provider, SCDNR
George Sedberry, Participant, SAFMC SSC
Justin Yost, Data provider, SCDNR
Riley Gallagher, Data provider, *Rapporteur*, NCSU
Jacob Krause, Data provider, NCSU
Dan Crear, Data provider, VIMS
*Not able to attend workshop

The Life History Group (LHG) was tasked with reviewing, discussing and tabulating available life history information, which included age data, growth, natural mortality and reproductive characteristics. Life history data were limited for cobia because recreational and commercial samples are limited and there have been no directed fishery-independent surveys of the stock. The majority of the fishery landings come from the charter boat and private recreational fishery sectors, where there is a lack of directed effort to sample the catches for biological samples (e.g., age structures and reproductive tissue). The majority of the data to be considered for this assessment were from carcass collection programs instituted in Virginia and South Carolina.

In addition to evaluating the life history parameters, the LHG made research recommendations to improve our understanding of the Atlantic Cobia stock and provided an update of research recommendations from SEDAR 28. We attempted to be more concise in our new research recommendations. We acknowledge that many projects directed at better understanding of the Cobia stock identification throughout the Southeastern Region have begun, but it is too early to report findings.

2.2 Review of Working Papers

The LHG reviewed three of the working papers submitted to SEDAR 58 Data Workshop. The three papers that were germane to the life history group were S58DW01, S58DW03, and S58DW05. The other papers pertained to other work groups or *ad hoc* groups.

(SEDAR58-DW01) Analyses and Applications of Cobia Length-age Data Collected by Virginia Marine Resources Commission between 1999 and 2018. Hank Liao, Alexander Aspinwall, Rob O'Reilly, and Cynthia Jones

Summary

The Virginia Marine Resources Commission (VMRC) began collecting length-age data in 1999 from the recreational Cobia fishery, and in 2007 began accepting Cobia carcass donations (including the carcasses from Cobia tournaments) from recreational anglers. In order to determine whether the change in sampling represents the recreational catch, they compared length frequency distributions collected by VMRC from the recreational and commercial fisheries to those collected by MRIP; compared mean lengths between the cobia collected randomly by VMRC and those donated by Virginia recreational fishermen; compared year effect on the mean lengths of cobia collected by VMRC from 1999 to 2018; and evaluated cohort progressions in the landing age distributions developed using Virginia ALKs and Virginia harvest estimated by MRIP; as well as comparing length distributions between Virginia and other Atlantic states. Results indicate that the length distributions and mean lengths shifted between 1999-2006 and 2007-2018. During the earlier period, VMRC staff collected more large fish and during the later period, carcasses donated revealed a wider distribution of fish and many more smaller fish. There was no evidence suggesting that Virginia recreational fishermen intentionally or unintentionally donated their smaller carcasses.

Critique

Working paper DW01 provides a good overview and comparison of the methods used by the VMRC to collect biological data from the recreational fishery and appropriately analyzes differences between two sample periods as modifications were made to the sampling program. The sampling changes, analytical methods, results and interpretation were discussed widely at SEDAR 58. The consensus of the LHG was that changes between the two periods presented were likely due to gradual changes. One, the cobia population may be changing due to fishing pressure. Two, some fishing strategies used by recreational anglers in Virginia have changed (sight casting) that may influence the likelihood of capturing more, smaller fish. These two factors may be reflective of the recreational fishery and not related to a sampling bias associated with the fishery.

The information in this paper were useful to the LHG.

(SEDAR58-DW03) Comparisons in growth between Cobia males and females and among years using Virginia length-age data collected by Virginia Marine Resources Commission between 1999 and 2018. SEDAR58-DW03 Revised 22 March 2019. Hank Liao, Alexander Aspinwall, Rob O'Reilly, and Cynthia Jones. 2019.

Summary

This paper addresses concerns raised by working paper SEDAR58-DW01 (Liao et al. 2018) regarding length and growth data (1999-2018) from VA. That analysis found that the VA Sportfish Collection Program (a carcass donation program) did not result in the observed decreases of the mean lengths during the period of 2007 to 2018 that were found when VMRC collected fish (a specimen purchase program) for length-age data from 1999-2018. A new analysis was conducted to verify the results of SEDAR58-DW01 and to identify possible causes (e.g., change in fishing or sex ratios) for any verified changes found by further analysis of length and growth. There was a negative correlation between the sex ratio and the mean length through the time series, and variation in the mean length is explained by the sex ratio. Increasingly, anglers donated more males during the more recent years. Males are smaller than females of the same age on average. The higher sex ratio resulted in a lower growth estimate. There also seemed to be a period of low growth for females from 2013 through 2018, indicating that female Cobia perhaps grew more slowly during recent years. Significantly different sex-specific growth rates occurred between the early donation period (2007-2012) and the later donation period (2013-2018); and between the combined VMRC collections and the early donation period (no significant difference between those two data sets so they were combined), and the second donation period. These results may indicate that the donation program data did not change the calculated growth rate immediately after implementation in 2007. The data also indicate that there was a decrease in VA cobia growth rate during the recent years (2013-2018). The Liao et al. (2018) working paper (SEDAR58-DW01) concluded that the VA donation program might not be the factor causing the observed annual reductions of mean fork length in the VA samples. By examining the growth of Cobia among different time-periods, this follow-up study has drawn similar conclusions to the original working paper (SEDAR58-DW01). Possible explanations for the decrease in VA Cobia growth during the past several years include donation of more males, increased abundance of males, or increasing sample sizes, which are more representative of the true sex ratios in the catch.

Critique

A good follow-up study. The “random” VMRC specimen collection (1999 – 2006) was done by buying fish from recreational fishermen, and there may be an effect of the purchase of specimens that was not mentioned. Recreational fishermen may sell the biggest fish among those they caught to maximize payment if sold by weight.

The VA data could be used in the benchmark stock assessment, as they satisfy the SEDAR data criteria: they are the most recent, best available, and scientifically sound data.

(SEDAR58-DW05) Investigation of Cobia Length Frequency Distributions and Potential for Differences Amongst Data Sets. Justin Yost, Joseph Ballenger, and Michael R. Denson, SCDNR

Summary

This working paper described the fishery-dependent data of five different data sets: three from SCDNR (tournament fish, charter boat donations, and private recreational donations) and two from NMFS [Marine Recreational Information Program (MRIP) and Southeast Region Headboat Survey (SRHS)]. SCDNR conducted a fishery-independent tagging study; however, due to the samples coming from mostly undersized fish, and thus not comparable to fishery-dependent data, they were removed from further consideration. The authors explored fork length comparisons among the datasets and across years.

Statistical analyses were performed on the data sets reported in the working paper. Fishery-dependent data set sample sizes, total from 2007-2016, ranged from 157 fish (MRIP) to 1292 (SCDNR Charter boat donations), and mean fork lengths ranged from 994 mm (private boat recreational) to 1055 mm (Tournament; see Table 1). Based on non-parametric analyses, there was a significant difference in fork length distributions from tournaments compared to all other sectors, where fish landed in tournaments were larger. MRIP, SHRS, and private boat modes showed no significant differences in fork length distributions, suggesting they are sampling the same population of cobia. Cobia landed in the charter boat fishery were significantly larger than those landed by private recreational boat anglers, but they were not significantly different from MRIP and SRHS. Year differences were explored for SCDNR fishery-dependent data, and showed no differences among annual fork length distribution except for 2007, which was lower than all other years, which is suggestive of a strong year class in 2004 that was just large enough to enter the fishery in 2007. Fork lengths were compared across sexes and showed that females were larger than males, an expected outcome since this species experiences dimorphic growth. Fork lengths were then compared by location (offshore vs. inshore) and found that the offshore fish tended to be larger than inshore fish, which may explain some of the difference in the size of fish landed in the charter boat and private boat modes. The private boat anglers tended to fish inshore more often, while charter boats tended to fish offshore. Another possible explanation of this observation was that inshore portion of the stock appears to be overfished due to the fish being more accessible to recreational anglers.

Based on the findings of this analysis, tournament fish were larger than fish landed in other modes, as were offshore fish compared to inshore. While there were no significant differences between pooled SCDNR samples across years, except for 2007 samples (a potential strong 2004 year-class collected in 2007), there was a slight difference between charter boat landings and private boat landings, but not among other fishery-dependent data.

Critique

This working paper offers a suite of analyses across data sources, years, sex, and location. Strong year classes have been suggested to have an influence on the recreational landings. Offshore fish and tournament fish were found to be larger than inshore and other recreational data sources. Tournament samples were biased and should be excluded for describing the size and age composition of general recreational catch, but included for estimating growth curves. All other recreational fishery-dependent sources should be included in further analyses for this assessment.

2.3 Age Data

Cobia age data were compiled from several sources with five laboratories involved in the processing and reading of the samples. Data sets were from GADNR, SEFSC Beaufort, which included NCDMF samples, Gulf Coast Research Lab (GCRL), SCDNR and ODU (collections from VMRC). Following the protocol established during SEDAR28 (2013), all age data were presented as calendar-age (year-class) as converted from increment counts and edge type. Table 2.11.1 provides a breakdown of number of samples by year and by fishery. Very few age samples were collected from the commercial fishery. For the recreational fishery, the samples were further broken down by state of landing. The majority of the recreational age samples came from South Carolina and Virginia. Not all recreational fishery samples could be classified to mode of fishing because most of the samples were from carcass collection programs (donated fish carcasses) with no notation along with the sample. This issue pertained primarily to the carcass samples donated in Virginia. The fishery-independent samples were collected through SEAMAP trawl survey and hook-and-line fishing. These samples included fish that were under the minimum size limit and filled in the missing portion of the population retained in the fishery. The LHG discussed the varying aspects of the data sets and their utility in the stock assessment.

Issues with the age data sets included the inclusion of Cobia sampled from tournaments, the low sample size from the commercial fishery, and data from carcass collection programs to obtain samples from the recreational fishery. Samples from tournaments showed varying trends in sizes compared to general recreational data. Tournaments in SC showed that the fish sampled in tournaments were significantly larger than fish landed in the general recreational fishery landings (SEDAR58-DW05). In contrast, tournament samples in VA did not show a consistent pattern of larger fish on average landed during tournaments compared to general recreational fishing, but sample sizes were very low, so no real conclusion could be made (SEDAR58-DW01). Due to the differing results between states and motivations of anglers in tournaments, the LHG felt that age data from tournament samples should not be used to characterize the recreational fishery, but would be included in the population growth model. Regarding the age data from commercially harvested Cobia, the sample sizes in any one year are too low to be used for annual age composition (Table 2.11.1). If an age-structured model is used in this assessment, then the commercial age samples could be pooled for one age composition to be applied to all commercial landings.

The age data from the general recreational fishery were collected from various sources and in various ways. Sources included two primary carcass collection programs operated by

SCDNR and VMRC, a few carcass samples from NCDMF, directed studies during short periods of time and a few samples from the Southeast Region Headboat Survey (SRHS). The main concern with the data available centers around the carcass collection programs in SC and VA. NCDMF has a carcass collection program that yielded very few Cobia. Figure 2.12.1 illustrates the comparison length frequencies of MRIP intercepts in NC to the carcass donations, with no differences noted. Two working papers, SEDAR58-DW01 and SEDAR58-DW05, gave details on the other programs and attempted to compare the carcass data to MRIP and SRHS data. SCDNR and VMRC felt that it was crucial to collect biological samples of Cobia to inform management of the species better, so they instituted their carcass collection programs in 2005 and 2007, respectively. VMRC staff intercepted Cobia landed in the commercial fishery, recreational fishery and tournaments between 1999 and 2006 with limited success. Because Cobia is considered a "rare event species", MRIP and SRHS do not intercept many animals, thus a comparison to the carcass data was not informative. The data from the carcass collection programs were evaluated individually.

Concerns about the SCDNR carcass collection program were the limited location of collection points and the motivation of the anglers to donate their fish. The SCNDR program had the advantage of being able to distinguish whether the donated carcass came from a charter boat landing or private boat landing. The donation centers were limited to the southern end of South Carolina, specifically Hilton Head area, where the bulk of the fishery is located. Initially the samples were coming from a mixture of offshore and inshore/estuarine fishing, but as the inshore portion of the population was fished down and subsequently restricted by the state, effort moved near-shore/off-shore areas. Overall, a comparison of the carcass collected samples to MRIP and SRHS showed a similar mean and length range of the fish across survey types. A look at the annual trend in the length frequencies revealed the 2007 samples to be significantly smaller from all the other years. That year, the majority of the effort was directed at the inshore portion of the stock that showed a very strong year-class of age-3 fish. Heavy fishing pressure on that portion of the stock resulted in a shift of effort to offshore waters around 2010, until SCDNR closed the inshore fishery completely in 2016 during the spawning season when cobia are present. The SCDNR staff involved in Cobia research felt that the interaction with the fishers in the Hilton Head Island area and public outreach and education have contributed to the carcass collection program in a positive way. They feel that they receive virtually every Cobia landed on charter boat trips. Also, these data were used in SEDAR28. In the absence of an expanded sampling program and a directed study consisting of a more sufficient random sampling program alongside the carcass donation program to compare data, these SCDNR's carcass collection samples are the best available information about the recreational fishery in South Carolina.

Concerns about the VMRC carcass collection program were the lack of information on the fishing mode and the shift in the length frequencies through the years to more small fish in the donations. Fishermen and staff of VMRC reported that the charter boats and private boats fish for Cobia in the same areas, so selectivity of the fish in each mode was assumed the same.

Thus, general recreational age compositions should be acceptable. Most concern about the VMRC data was the shift in annual length frequencies to more small fish in the last 5 years of carcass collections. Figure 5 of SEDAR58-DW01 illustrated the largest shift to more small fish between the period of random collection by VMRC staff and the donated fish. Figures 1 and 2 of SEDAR58-DW01 provide the annual length frequencies of the samples illustrating in more detail the shift in the lengths of the fish donated to more small fish. One possible reason for the shift to more, smaller fish could have been the ease of handling the carcass to get it into a bag and into a freezer. Fishermen present during the workshop stated that it was easy to fold a large carcass and bag it, easing the concern of the LHG. One VMRC staff member stated that the fishing technique for Cobia in Virginia waters had been changing in the past 7-8 years from solely "chum fishing" to more "sight casting". The fishermen described the sight casting technique and explained why the smaller fish, presumably males, swimming with one large fish, presumably female, would be caught in higher proportions. The sight casting technique has been used for much longer in the South Carolina Cobia fishery. Another concern was raised regarding the donation of the largest fish, or "citation fish". In order for a person to receive a citation, the angler must present the fish at a tackle shop, away from donation area. A person most likely would not return to the donation site to drop off the carcass. It was noted that the largest fish (>120 cm FL) continued to be donated at a similar level across the years. The explanation of the fishery helped to understand the shifts in the lengths of the samples donated. As with SCDNR data, in the absence of an expanded sampling program and a directed study consisting of a sufficient random sampling program alongside the carcass donation program to compare data, the VMRC data are the best available information about the recreational fishery in Virginia.

Recommendations:

1. Age data from fish landed during tournaments should not be used to characterize the recreational fishery. They can be used in the population growth model.
2. If an age-structured model is used in this assessment, then the commercial age samples should be pooled for one age composition to be applied to all commercial landings.
3. The age data from SRHS and carcass collection programs can be used for to characterize the general recreational fishery.

2.4 Growth

Growth of Atlantic Cobia was modelled on the population as a whole, and on sexes separately, because this species exhibits dimorphic growth. An examination of the mean FL-at-age by state, regardless of sex, did not result in significant differences, especially between Virginia and South Carolina where the majority of the samples were from (Figure 2.12.2). Because Cobia have dimorphic growth, with females larger than males, the sex specific mean FL-at-age by state was examined, also. Male Cobia from South Carolina appeared to slightly larger at ages 3-5 than those from North Carolina and Virginia, but not by an appreciable amount or at any other ages (Figure 2.12.3a). The female Cobia did not show a difference in FL-at-age, except for age-7 (Figure 2.12.3b). These analyses suggested that it was reasonable that the growth could be modeled as one population. The LHG also modelled sex-specific growth for use in the assessment model to estimate spawning stock biomass.

Due to the preponderance of age data being obtained from fishery landings subject to minimum size limit regulations, all growth models incorporated a left-truncated size distribution correction factor applied to samples from the fishery (McGarvey and Fowler, 2002). Minimum size limits were applied as appropriate by time-period and fishery to each sample. The fish that were subject to a size limit, but their FL fell below that minimum level were removed from the data input, because the model assumes zero probability of landing below the size limit. We estimated these parameters by fitting observed length-at-biological age (fractional age) data to the von Bertalanffy model by minimizing the negative log-likelihood function and assuming constant standard deviation (sigma) of FL across all ages using AD Model Builder estimation software (http://www.admb-project.org). The biological age was based on June as month of peak spawn. The von Bertalanffy parameters and standard errors for the population model and the sex-specific models are presented in Table 2.11.2 and shown in Figures 2.12.4 and 2.12.5.

Recommendations:

1. The population growth model, incorporating the correction for the bias in size-at-age due to the minimum size limit, is appropriate to use in the stock assessment.
2. The growth model for females, incorporating the correction for the bias in size-at-age due to the minimum size limit, is appropriate to use to estimate spawning stock biomass.

2.5 Natural Mortality

The LHG explored various methods of estimating natural mortality (*M*) based on life history parameters. The LHG felt that it was not appropriate to apply one point estimate to the entire age range of the fish, such as Hewitt and Hoenig (2005) or Then et al. (2014). Charnov et al. (2013) offers an age-varying natural mortality as a function of size of the fish. The age-specific *M* was calculated using the von Bertalanffy population growth parameters, L_∞ and K, the predicted fork length at the mid-point of each age. The mid-point of each year class was used to represent the mean size of the fish in a calendar year. The age-specific estimates of *M* are presented in Table 2.11.3.

Recommendation:

Use the age specific values of *M* as calculated using the Charnov et al (2013) method.

2.6 Reproductive Biology

Very limited reproduction data were provided since the last stock assessment of cobia (SEDAR 28) with the exception of sex ratio and additional histological samples for sexual maturity estimates. Because of this lack in additional data, many of the same recommendations that were provided in SEDAR 28 were recommended for this assessment. The majority of the reproductive information on spawning seasonality, frequency, and fecundity are presented in published works by Brown-Peterson et al. (2001) and Franks and Brown-Peterson (2002), and are referenced as such. All age-related results presented in this section were based on calendar age. Information below on spawning seasonality, sexual maturity, sex ratio, and spawning frequency is based on the most accurate technique (histology) utilized to assess reproductive condition in fishes.

2.6.1 Spawning Seasonality

No new data were provided since the last assessment; thus, this section covers the conclusions from SEDAR 28.

Spawning season was determined based on the occurrence of hydrated oocytes and/or post-ovulatory follicles from spawning cobia collected along the Atlantic coast of the southeastern U.S., and has been reported to occur from April through July and peak during May and June (Brown-Peterson et al. 2001). It has been reported in the literature that cobia along the South Atlantic coast of the United States spawn from May through September (Joseph et al, 1964; Hassler and Rainville, 1975; Shaffer and Nakamura, 1989; Brown-Peterson et al, 2001), however each of these studies reported relatively low sample sizes and a fairly restricted geographic collection area. Data available from recent collection efforts (1990-2012) show that mean values of a female gonadosomatic index based on specimens collected in South Carolina waters were highest in May, and those collected in North Carolina waters peaked in June. It has also been reported in the literature that cobia spawning peaks in Virginia in July (Joseph et al., 1964; Richards, 1967; Mills, 2000).

It has been well documented that cobia begin a “migration” or move into nearshore waters in the South Atlantic when temperatures reach 20-25℃ (Shaffer and Nakamura, 1989; Biesiot et al., 1994; Smith, 1995). Figures 2.12.6, 2.12.7 and 2.12.8 describe the mean temperature profiles for coastal waters off SC, NC and VA, which suggest that these temperatures are typically found in SC in May, NC in June and VA in July. Previous samples were collected during tournaments over a broad geographic area and time-period leading researchers to conclude that the entire population was spawning over a period of several months. However, the GSI and temperature data suggest that cobia in the Southeast region may actually spawn for a much shorter period (30-45 days) that is brought on locally by critical temperatures (beginning at 20-25 and then subsiding over a 30-45 day period). This hypothesis is supported by the genetically distinct spawning aggregations identified in VA and in SC as reported in SEDAR28- DW01. If spawning were to occur over the extended season suggested in the literature, distinct population segments would not be identifiable. This is an important consideration in estimating the number of spawning days in a spawning season.

Recommendations:

The spawning season appears to be concentrated into a four-six week period for a given location based on GSI and temperature data. This coupled with differences in genetic population structure within the two known inshore aggregations provide enough uncertainty around the spawning season of the total population that the LHG recommends using spawning stock biomass in the model for spawning potential.

2.6.2 Sexual Maturity

Histological evaluation of fish gonads are considered the best method in assessing sexual maturity. After exploring the data, it was discovered that the Virginia samples were evaluated macroscopically limiting the ability to determine if a fish was immature or in an early developmental stage. For this reason, the LHG eliminated these samples from the maturity evaluation. SCDNR SEAMAP survey provided additional undersized cobia for age at maturity estimates; however, age-2 fish appear to be large enough to avoid the trawl survey and are still limited in this assessment.

Sexual maturity for male cobia in the Atlantic remain similar to findings in SEDAR 28 and appear to occur at a very small size. Because of the paucity of samples of cobia smaller than 200 mm FL, it is not possible to determine the smallest size at which male cobia reach sexual maturity, but this appears to occur well before they reach age-1. The smallest mature male evaluated by SCDNR using histological techniques was 207 mm FL and 2-4 months of age, corroborating findings reported by Brown-Peterson et al. (2001) and Brown-Peterson et al. (2002). Sample sizes of small female cobia in the dataset were also limited. Thirty-one age 0-1 fish were examined compared to only eight from SEDAR 28, and all of these fish were immature. Of the age-2 fish (n=21), 62% were sexually mature (Table 2.11.4). The only caveat regarding these animals was that they were likely the fastest growing and largest two-year olds collected from the fishery due to the 33” FL minimum size regulations. All of the age-3 fish (n=264) were determined to be sexually mature with the caveat that the slower growing age-3 fish have not recruited potentially due to the minimum size limit. Additional data support findings from SEDAR 28 suggesting female cobia above 800 mm FL are likely to be mature, regardless of age (Table 2.11.5). Smith (1995) similarly found that most 2 year-old females were sexually mature, with 25% maturity at 700-800 mm FL and 100% maturity above 800 mm FL.

Recommendations:

The size of cobia appears to be more strongly correlate with maturity than age thus a size at maturity vector is recommended (Table 2.11.6). If an age structured assessment model is used, an age at maturity vector is recommended. Due to the limited number of samples at the youngest ages and the influence of the minimum size limit on size at age of those young fish, the LHG recommends using age-2 for age at 50% maturity, with 0% mature at ages 0 and 1 and 100% of all fish age-3+ mature. Again, due to the influence of the minimum size limit on the young fish, there is a chance that not all age-3 fish are mature. When back-calculating the length of the fish to age using the von Bertalanffy growth curve, not all age-3 fish would be mature based on growth parameters. Thus, a sensitivity run, similar to SEDAR 28, could be made using 0% mature at ages 0 and 1, 50% mature at age-2, 75% mature at age-3, and 100% mature age-4+.

2.6.3 Sex ratio

VMRC and SCDNR significantly increased the amount of data for sex ratio determination since SEDAR 28. VMRC noted a change in the fork length of the donated carcasses from the Virginia recreational fishery (SEDAR58-DW01), potentially due to the changes in fishing techniques for cobia in that area and/or change in the overall population. This trend was reflected in the sex ratio going from predominately a female-based fishery to a 1:1.35 male:female ratio during the period following the last assessment. Information on cobia sex ratio by length class (mm FL), year, and age class are available in Tables 2.11.7, 2.11.8 and 2.11.9, respectively. The male:female sex ratio for all adult cobia in fishery-independent and fishery-dependent collections from 1984-2017 was **1:1.4**, which was significantly different from a 1:1 ratio based on size (Chi-square= 987.629, 28 df, P =<0.001, n = 4919), on age (Chi-square= 35.905, 16 df, P = <0.001, n=4950), and on year captured (Chi-square= 136.366, 33 df, P =

<0.001, n=5038). As expected, due to cobia having sexual dimorphic growth, evaluating the sex ratio by length show the largest fish were skewed towards females.

Recommendation for AW:

A male:female sex ratio of 1:1.4 is recommended to be used in this assessment, which is the same ratio used in SEDAR 28.

2.6.4 Spawning Frequency

No new data were provided since the last assessment thus this section covers the conclusions from SEDAR 28.

Spawning frequency estimates range from 4 to 6 days (table 2.11.10). Estimates of spawning frequency were determined according to the procedures of Hunter and Macewicz (1985) using FOMs and POFs. Cobia from southeastern United States (SEUS; n=23) and north central Gulf of Mexico (NCGOM; n=135) were estimated to spawn every 4 to 5 days (Brown-Peterson et al. 2001). Spawning frequency estimates for the SEUS were based on data from April, May, and June (spawning season).

SCDNR examined cobia collected via hook and line from estuarine and offshore waters of southern South Carolina in April-June 2007 and 2008. Fish were collected from tournaments, cooperating anglers, recreational fishing guides, and SCDNR employees. Ovaries were examined using histological techniques similar to Brown-Peterson et al. (2001), and spawning frequency was estimated using POFs following procedures of Hunter and Macewicz (1985).

The majority of the catch were late developing stage, gravid or had POF's (99%), which was not unexpected as most of the catch occurred while fish were in spawning aggregations, both inshore and offshore, as described by Lefebvre and Denson (2012) (Table 2.11.11). Spawning frequency was estimated to be 6.1 days, similar to what was reported by Brown-Peterson et al. (2001) (Table 2.11.12).

Recommendation for AW:

Use 6 days as the spawning frequency based on the larger sample size provided by SCDNR.

2.6.5 Batch Fecundity (BF)

No new data were provided since the last assessment thus this section covers the conclusions from SEDAR 28.

Only limited information to estimate fecundity is available for cobia along the Atlantic coast and Gulf of Mexico.

Batch fecundity (BF) estimates were taken from datasets published by Brown-Peterson et al. (2001) but the BF method was found to be difficult to apply to cobia as hydrated females were rarely sampled. Estimates were based on an indirect method (denoted as neutral buffered formalin or NBF method) as recently recommended by the lead investigator (Pers. Comm. Nancy Brown-Peterson). Sample size is low (n=39) and therefore observations were combined from SEUS, EGOM, and NCGOM. Relative batch fecundity ranged from 0.99 to 255 eggs/g ovary free body weight (mean 53.1, SD 59.1) by the NBF method. The data suggested a power, rather than a linear function for the relation of batch fecundity and body weight, but the coefficient of determination was low (r^2=0.146, Figure 2.12.9).

Batch fecundity alone does not fully represent reproductive investment. No size or age-based estimates are available regarding the number of spawns per year; thus, annual egg production can only be poorly estimated. A simplification is to assume that egg production is proportional to biomass of spawning females such that the number of eggs or larvae produced per gram of female body mass is constant among mature females with no effect of age structure on a per-unit basis. This is the Spawning Stock Biomass (SSB) assumption which is equivalent to the exponent b equal to 1 in the generalized fecundity (F) equation $F = aW^b$ where W = female weight.

However the batch fecundity relationship, while poorly fit, suggests b is greater than one (Figure 2.12.9). In addition, it is becoming better understood generally among fishes with indeterminate fecundity type that older and larger females are more likely to spawn more batches per year thus further increasing the likelihood that $b > 1$. While difficult to estimate, it is likely older cobia contribute disproportionately more to egg production.

Recommendation for AW:

Due to the limitations of the reproductive parameters, use female SSB as an estimate of reproductive potential.

2.7 Meristic Conversions

SEDAR 58 panel assigned the length type and fish weight for the biological data inputs to be in fork length and whole (round) weight. Thus, some data sets which have other length types included or lengths with no weights, or vice versa, needed conversion equations to predict the missing data. Data from Virginia to Georgia with paired length types and weight-length data were compiled for the regression analyses. Data sets included were from VMRC, SCDNR, SRHS, MRIP, and Smith (1995) study. Linear regressions for length-length and LN-LN transformed weight-length were modelled. The weight-length equations were converted to the power equation, $W = aL^b$, adding ½ MSE for transformation bias. Table 2.11.13 provides the parameters, standard errors, sample sizes and ranges of each independent variable.

Recommendation:

Use the meristic conversion equations as presented in Table 2.11.13.

2.8 Research Recommendations

Because the Cobia fishery is primarily a recreational fishery and considered a rare event species, sampling programs conducted by state and federal agencies do not encounter Cobia very often. For this reason, SCDNR, NCDMF and VMRC have started carcass collection programs along their coastal counties in an attempt to get more biological samples. In any carcass collection program, the donated samples may not be truly random or representative of the landings. Questions arise such as what motivates a person to donate their fish carcass, or are the donation sites evenly distributed throughout the study area. Some of the programs have offered incentives (e.g., t-shirt, hat or towel) to encourage donations. The concern of anglers leaving the landing site to file for a citation for large fish or simply to go to another location to clean fish may bias the donation of carcasses. Following the LHG discussions regarding the data available for SEDAR58, we suggest the following recommendations:

1. Validate the carcass collection programs as representing the recreational fishery. E.g., Side-by-side comparison to a random port sampling program.
2. State agencies should work together to achieve more consistency in their programs.
3. Increase public education for the importance of the programs.
4. Expand the geographic range of the donation sites.

The largest gap in biological knowledge of Atlantic Cobia is in the reproductive biology. SCDNR has been able to collect gonad tissue and histologically process the samples. Other states were able to provide macroscopic sex and maturity data, but that was not adequate to distinguish immature from maturing fish. The LHG also acknowledges that obtaining fecundity estimates is difficult for Cobia, but would greatly enhance a stock assessment. Because spawning appears to be tightly correlated with water temperature, further refinement of spawning seasons by area is needed. Some recommendations to get more reproductive biology data include:

1. Histological processing of all gonad tissue to better estimate the maturity schedule of Atlantic Cobia. In particular, focus on the fish aged 0 – 3 years and cover full geographic range of the species.
2. Determine the contribution to the population from the inshore spawning stock and the offshore spawning stock.
3. Obtain estimates of fecundity and periodicity of the Atlantic Cobia stock.

During the stock ID process of SEDAR58, there was discussion regarding the potential separation of the inshore and offshore portions of the Atlantic Cobia stock. Understanding more about that separation may be crucial to management of the population. Some research recommendations include:

1. Use otolith chemistry techniques to elucidate the contribution of inshore and offshore spawned Cobia to the Atlantic population.
2. Expand genetics studies to refine the possible stock separation of the inshore and offshore segments of the population.

The tagging studies in the area have been increasing our knowledge of the migratory pattern of the Atlantic Cobie, but they could be expanded to provide more data.

1. Direct tagging studies to obtain estimates of mortality
2. Determine tag retention and reporting rates
3. Hold a workshop to ensure consistent tagging methods across states at the program level.

2.9 Progress Report of SEDAR28 Research Recommendations

1. The LHWG recommends implementation of a tagging study along the entire east coast of Florida and the evaluation of genetic samples from the same to determine more precise stock boundaries.
Ongoing acoustic telemetry studies in Florida through South Carolina (2016 – present) and North Carolina through Virginia (2017 – present). Genetic samples are being collection along with the telemetry study.

2. Recommend developing a tagging program for inshore and offshore South Atlantic Cobia populations. The goal would be to deploy tags inshore during the spring migration and offshore during the fall and winter to get a clearer picture of fall and spring migrations and to better identify spawning areas and aggregations.
This recommendation is being accomplished with the telemetry studies referenced in point #1. There is still a need to identify spawning areas/aggregations.

3. Explore the feasibility of satellite tags for Cobia movement studies.
The state of Virginia is starting a study in 2019 and there are 27 satellite tagged fish from North Carolina to Florida.

4. Provide genetic sampling kits to interested groups to better understand the stock division line between the Gulf and Atlantic Cobia stocks. Possible collectors of genetic samples could include Charter operators, fishing clubs and state fisheries personnel.
Ongoing studies throughout the South Atlantic and Gulf of Mexico.

5. Further research is needed on Cobia release mortality.
This research is ongoing. See Release Mortality section of the SEDAR58 Data Workshop report.

6. To increase the overall amount of data available on Cobia, it is recommended that port samplers do complete workups when sampling, including otolith removal for aging, length, weight, sex, genetic sampling and record a catch location.
VMRC and SCDNR have continued their carcass collection programs, which have been successful in obtaining biological information. NCDMF has a carcass collection program, but needs to increase awareness and public participation in it. Carcass collection programs have not been able to collect all aspects of the biological information needed. See section 2.8 of the LHG report for recommendations concerning the carcass collection programs and the need for more reproductive biology data.

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2.11 Tables

Table 2.11.1. Number is annual Atlantic Cobia age samples by fishery, and for the recreational fishery, by state.

Year	Commercial	Fishery Independent	General Recreational				Tournaments		
State			VA	NC	SC	GA	VA	NC	SC
1984				3					
1985				2					
1986	1			22					
1987				18					
1988		4		9	1			7	
1989	4	10		62				16	
1990	3	17		80	3			20	
1991	1			13				3	
1992				12				8	
1993				1				15	
1994				3				13	
1995				10					
1996				13	18				
1997				7	13				
1998	5								
1999	10		124						
2000	7		111						
2001	7		52				20		
2002	36		26						
2003	2		7						
2004	2		7						
2005	6		10	2	47				66
2006	3		25		38				17
2007	12	1	25		341		31		
2008	5	7	40		276		6		
2009	3	4	106		205				
2010	3	5	106	11	215				
2011	11	23	89		217				
2012	3	5	76		223	1		1	
2013	13	8	190		300				
2014		13	287		244	3			
2015		15	342		189				
2016		15	255	11	142				
2017	5	27	239	34					
Grand Total	142	155	2117	313	2472	4	57	83	83

Table 2.11.2. Growth model parameters and standard errors (SE) for Atlantic Cobia for the population and sex-specific. Lengths are FL in mm.

Model	**N**	**L_∞**	**SE**	**K**	**SE**	**t_0**	**SE**
Population	5,088	1261.5	7.2	0.3086	0.0073	-0.5269	0.0487
Females	2,780	1333.9	7.2	0.3180	0.0077	-0.4918	0.0554
Males	1,903	1098.7	6.6	0.3651	0.0115	-0.6549	0.0633

Table 2.11.3. Age-specific natural mortality of Atlantic Cobia based on Charnov et al. (2013) and using the predicted fork length at the mid-point of each calendar age.

Age	FL (mm)	*M*
1	589	0.97
2	768	0.65
3	900	0.51
4	996	0.44
5	1067	0.40
6	1119	0.37
7	1157	0.35
8	1185	0.34
9	1205	0.33
10	1220	0.33
11	1231	0.32
12	1239	0.32
13	1245	0.32
14	1250	0.31
15	1253	0.31
16	1255	0.31

Table 2.11.4. Count of female cobia by age and reproductive phase. Reproductive phase terminology from Brown-Peterson et al., 2011.

Age	Immature	Developing	Spawning-capable	Recent	Regressing	Total
0	15					15
1	16					16
2	8	8	2		3	21
3		44	114	46	8	212
4		20	42	81	9	152
5		17	20	81	7	125
6		22	12	49	1	84
7		13	11	26	5	55
8		8	4	19		31
9		6	4	10		20
10		3	3	5		11
11		1	2	3		6
12		3				3
13		2		1		3
Total	**39**	**147**	**214**	**321**	**33**	**754**

Table 2.11.5. Female cobia mean fork length (mm) by age and reproductive phase.

Age	Immature	Developing	Spawning-capable	Recent	Regressing	Total
0	326					326
1	451					451
2	701	799	797		891	769
3		887	969	945	947	946
4		1005	1045	1032	1017	1031
5		1069	1114	1091	1081	1091
6		1107	1151	1153	1094	1140
7		1174	1173	1167	1149	1168
8		1233	1231	1210		1219
9		1256	1227	1261		1253
10		1267	1333	1308		1304
11		1210	1370	1227		1272
12		1273				1273
13		1380		1399		1386
Total	**454**	**1035**	**1036**	**1088**	**1031**	**1028**

Table 2.11.6 Size at maturity for female cobia fork length (mm).

Female FL (mm)	% Mature	n
251-300	0%	4
301-350	0%	8
351-400	0%	6
401-450	0%	4
451-500	0%	6
501-550	0%	1
551-600	0%	2
601-650	33%	3
701-750	33%	6
751-800	60%	5
801-850	100%	13
851-900	100%	36
901-950	100%	80
951-1000	100%	108
1001-1050	100%	114
1051-1100	100%	102
1101-1150	100%	88
1151-1200	100%	76
1201-1250	100%	42
1251-1300	100%	32
1301-1350	100%	14
1351-1400	100%	6
1401-1450	100%	2
Total	**95%**	**768**

Table 2.11.7**.** Sex ratio of Atlantic cobia by fork length (mm).

FL (mm)	M	F	n	M:F ratio
201-250	5		5	
251-300	7	5	12	1:0.7
301-350	5	8	13	1:1.6
351-400	10	13	23	1:1.3
401-450	13	16	29	1:1.2
451-500	10	12	22	1:1.2
501-550	7	9	16	1:1.3
551-600	6	2	8	1:0.3
601-650	6	3	9	1:0.5
651-700	7	2	9	1:0.3
701-750	14	9	23	1:0.6
751-800	23	14	37	1:0.6
801-850	193	73	266	1:0.4
851-900	440	211	651	1:0.5
901-950	433	291	724	1:0.7
951-1000	374	349	723	1:0.9
1001-1050	254	374	628	1:1.5
1051-1100	151	345	496	1:2.3
1101-1150	76	322	398	1:4.2
1151-1200	30	273	303	1:9.1
1201-1250	10	199	209	1:19.9
1251-1300	4	140	144	1:35.0
1301-1350	2	87	89	1:43.5
1351-1400	2	44	46	1:22.0
1401-1450		21	21	
1451-1500		9	9	
1501-1550		3	3	
1551-1600		2	2	
1601-1650		1	1	
Total	**2082**	**2837**	**4919**	**1:1.4**

Table 2.11.8. Sex ratio of Atlantic cobia by year.

Year captured	Male	Female	n	M:F ratio
1984	1	3	4	1:3.0
1985		2	2	
1986	17	8	25	1:0.5
1987	12	9	21	1:0.8
1988	8	16	24	1:2.0
1989	55	39	94	1:0.7
1990	55	55	110	1:1.0
1991	5	10	15	1:2.0
1992	7	16	23	1:2.3
1993	4	13	17	1:3.3
1994	8	9	17	1:1.1
1995		10	10	
1996	18	21	39	1:1.2
1997	10	14	24	1:1.4
1998	2	2	4	1:1.0
1999	10	65	75	1:6.5
2000	21	76	97	1:3.6
2001	15	49	64	1:3.3
2002	14	45	59	1:3.2
2003	1	8	9	1:8.0
2004		8	8	
2005	40	89	129	1:2.2
2006	35	48	83	1:1.4
2007	186	198	384	1:1.1
2008	143	174	317	1:1.2
2009	128	151	279	1:1.2
2010	126	196	322	1:1.6
2011	136	165	301	1:1.2
2012	147	143	290	1:1.0
2013	188	289	477	1:1.5
2014	223	288	511	1:1.3
2015	230	285	515	1:1.2
2016	159	240	399	1:1.5
2017	120	170	290	1:1.4
Total	**2124**	**2914**	**5038**	**1:1.4**

Table 2.11.9. Sex ratio of Atlantic cobia by age in years.

Age	M	F	n	M:F ratio
0	25	20	45	1:0.8
1	38	44	82	1:1.2
2	42	74	116	1:1.8
3	454	690	1144	1:1.5
4	558	660	1218	1:1.2
5	392	478	870	1:1.2
6	203	329	532	1:1.6
7	146	262	408	1:1.8
8	93	120	213	1:1.3
9	64	99	163	1:1.5
10	39	48	87	1:1.2
11	26	33	59	1:1.3
12	10	21	31	1:2.1
13	7	7	14	1:1
14	6	2	8	1:0.3
15	1	2	3	1:2
16		1	1	
Total	**2104**	**2890**	**4994**	**1:1.4**

Table 2.11.10. Spawning frequency of cobia in the Southeastern United States and North Central Gulf of Mexico using POF and FOM analysis.

	Southeastern United States Region (SEUS)	North Central Gulf of Mexico Region (NCGOM)
Spawning frequency	(n=23)	(n=135)
POFs %	19.4	24.8
Frequency (POFs)	5.2 days	4.0 days
FOM %	19.4	19.8
Frequency (FOM)	5.2 days	5.0 days

Table 2.11.11. State of ovary development of female cobia caught in South Carolina in 2007 and 2008. (*n* = number of fish; PC = percent composition.)

Stage	**Inshore**		**Offshore**		**Unknown**	
	n	PC	*n*	PC	*n*	PC
Immature	0	0	0	0	0	0
Early developing	1	2	1	3	1	1
Late Developing	51	80	20	59	97	84
Gravid	2	3	0	0	3	3
Postovulatory 1-Recent spawn	3	5	1	3	4	4
Postovulatory 2-Prior spawn	7	11	11	32	9	8
Spent	0	0	1	3	1	1
Recovering	0	0	0	0	0	0

Table 2.11.12. Mean estimated spawning frequencies of cobia from three regions in the southern United States. Spawning frequencies were estimated from the percentage of ovaries in the late developing ovarian class containing either postovulatory follicles (POF).

Spawning frequency	Inshore Captures	Offshore Captures	Unknown Capture Location	**All areas combined**
Samples (n)	64	34	115	**213**
% POFs	15.625	35.294	11.304	**16.432**
Frequency (POFs)	6.4 days	2.8 days	8.8 days	**6.1 days**

Table 2.11.13. Meristic conversion equations for Atlantic Cobia. All length types are mm and whole (round) weights (WW) are kg.

Equation	**Parameters (SE)**				**n**	**r2**	**Independent variable range**	
	a	**SE**	**b**	**SE**			**Min**	**Max**
WW = aFL^b	1.65*10-9	0.07	3.28	0.01	3238	0.97	200	1610
FL = aWW^b	489.85	0.002	0.29	0.001	3238	0.97	0.06	54.7
WW = aTL^b	1.91*10-9	0.06	3.21	0.01	2455	0.98	90	1758
TL = aWW^b	528.48	0.002	0.31	0.001	2455	0.98	0.002	54.7
FL = a + b*TL	8.19	1.55	0.88	0.00	5672	0.99	214	1753
TL = a + b*FL	5.91	1.75	1.12	0.00	5672	0.99	200	1610

2.12 Figures

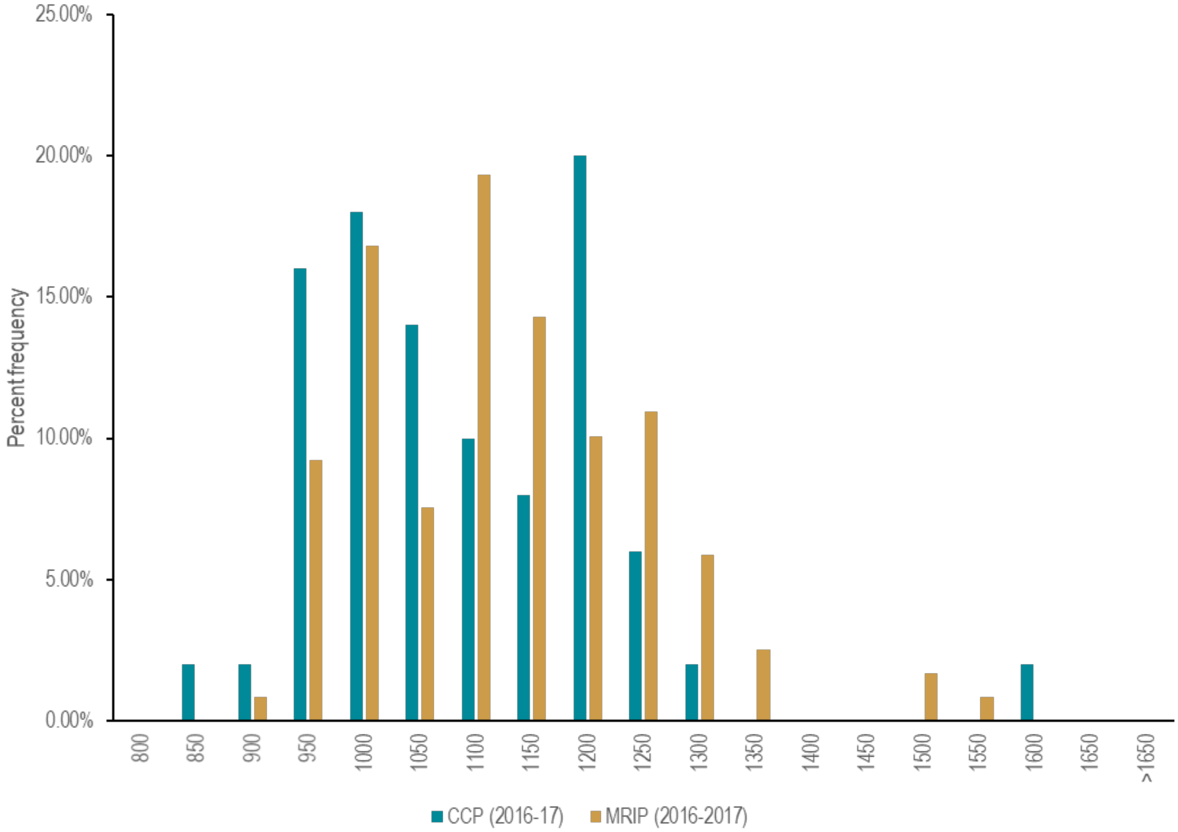


Figure 2.12.1. Comparison of 2016-2017 length frequencies of Cobia samples by MRIP and NCDMF Carcass Collection Program (CCP).

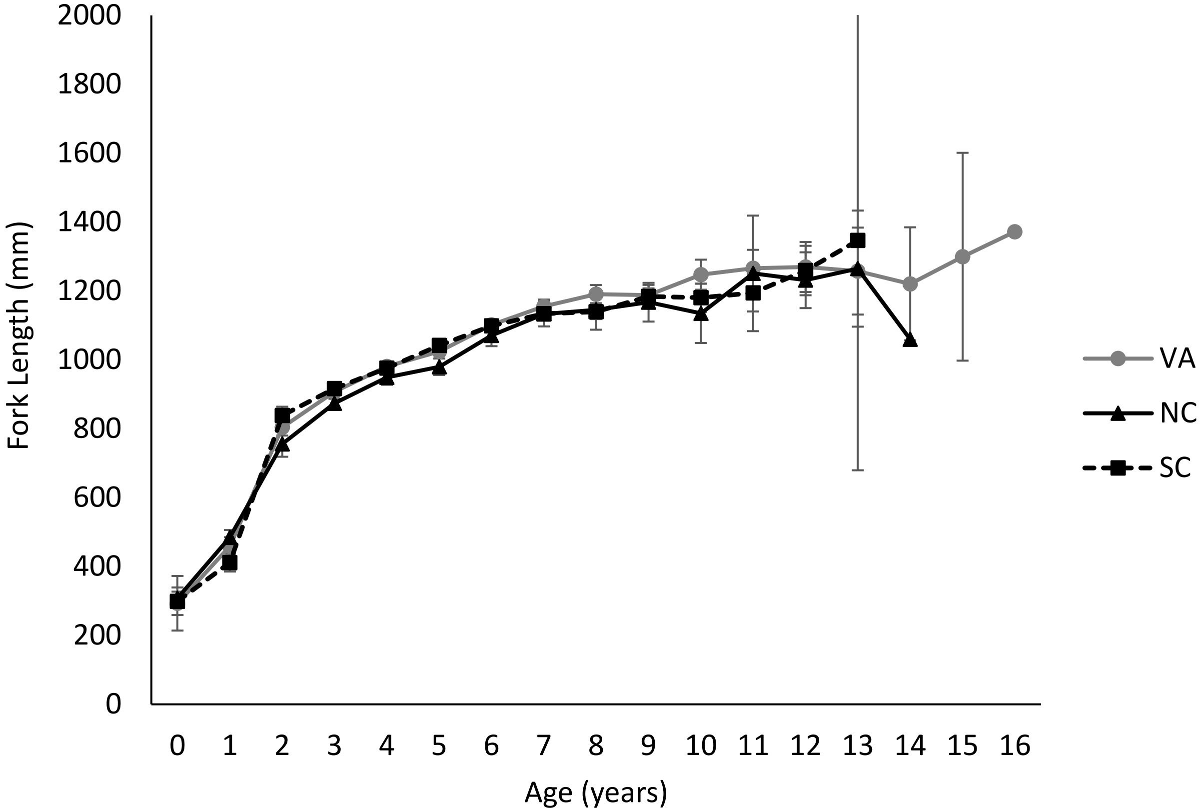
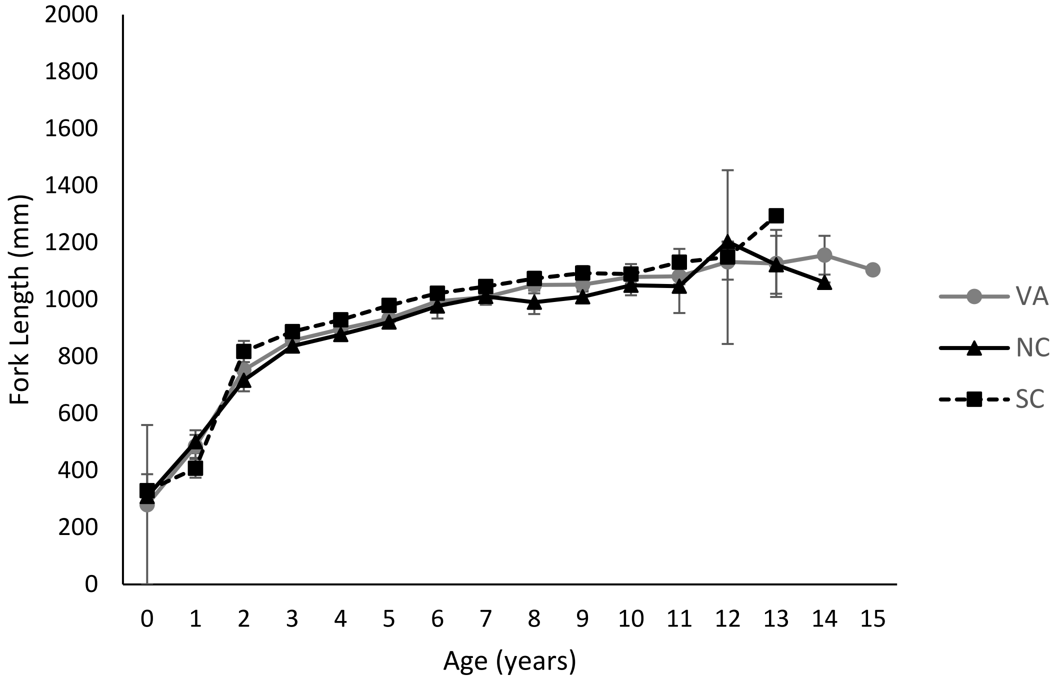


Figure 2.12.2. Mean FL-at-age by state of landing for Atlantic Cobia, regardless of sex. Error bars represent 95% confidence intervals.

A. Male Cobia



B. Female Cobia

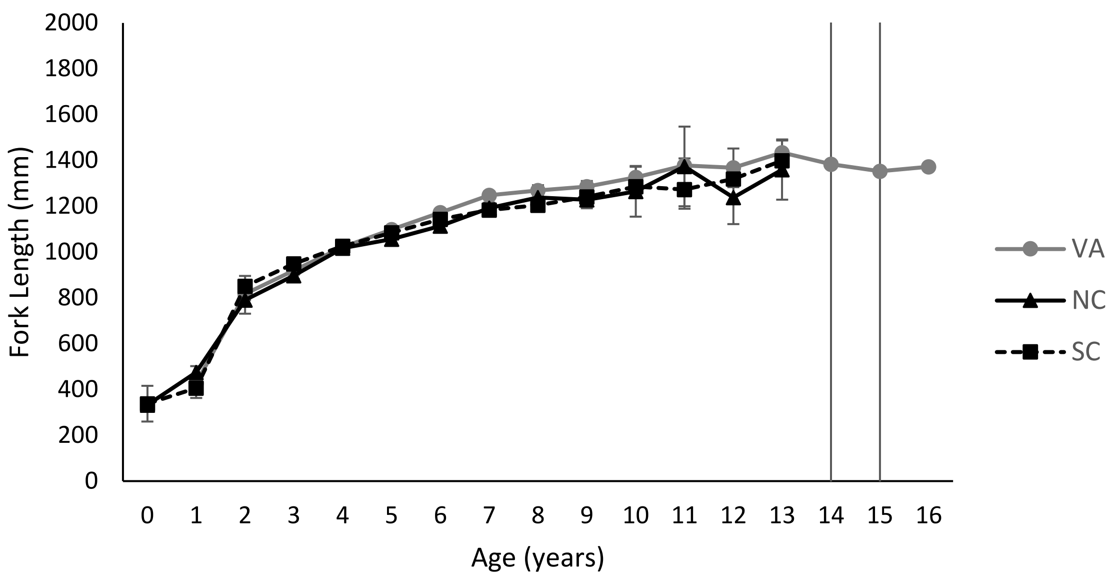


Figure 2.12.3. Sex specific mean FL-at-age by state of landing for Atlantic Cobia. Error bars represent 95% confidence intervals.

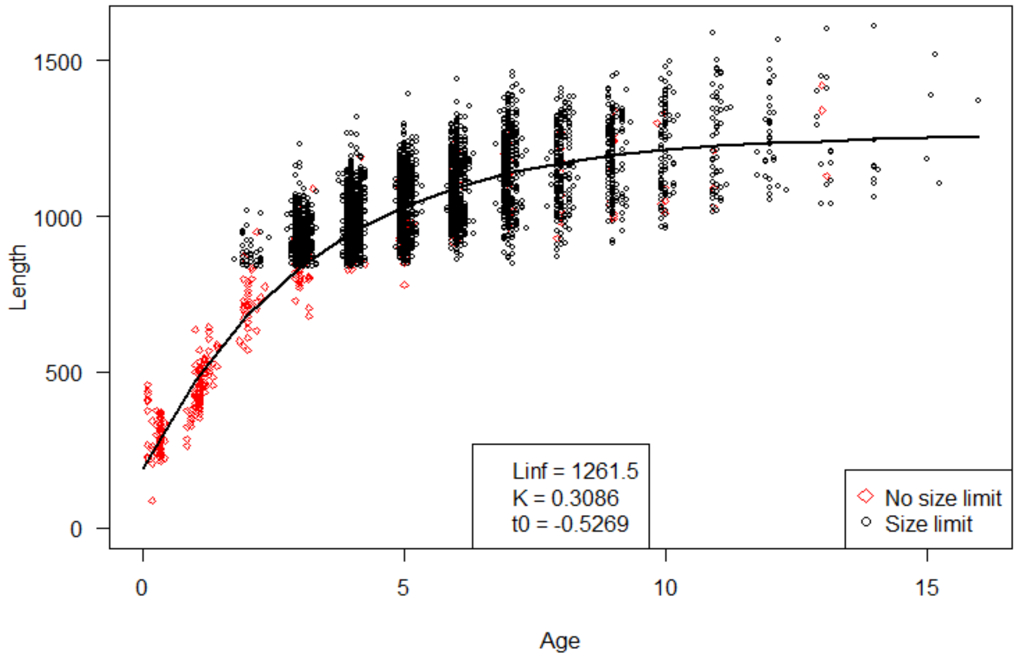


Figure 2.12.4. Atlantic Cobia fork length-at-biological age and von Bertalanffy population growth model with parameters.

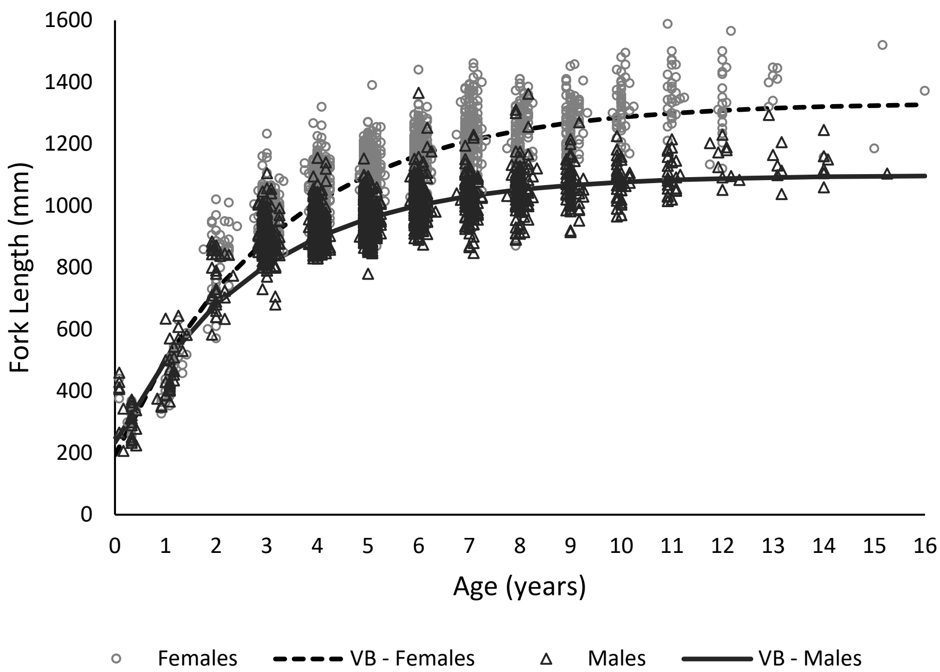


Figure 2.12.5. Atlantic Cobia fork length-at-biological age and von Bertalanffy growth models by sex of the fish.

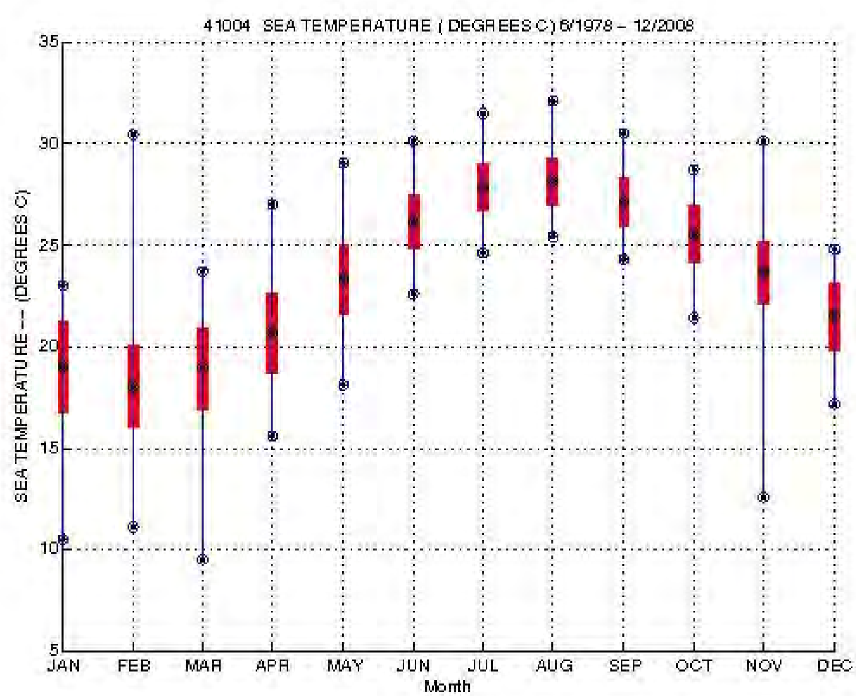


Figure 2.12.6. Mean monthly temperature profile for waters offshore of South Carolina.

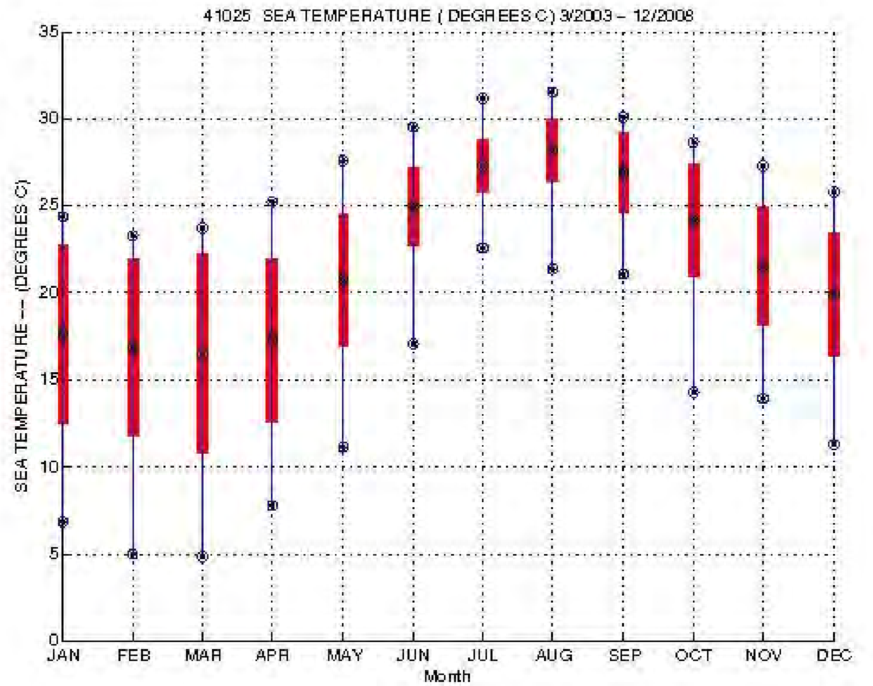


Figure 2.12.7. Mean monthly temperature profile for waters offshore of North Carolina.

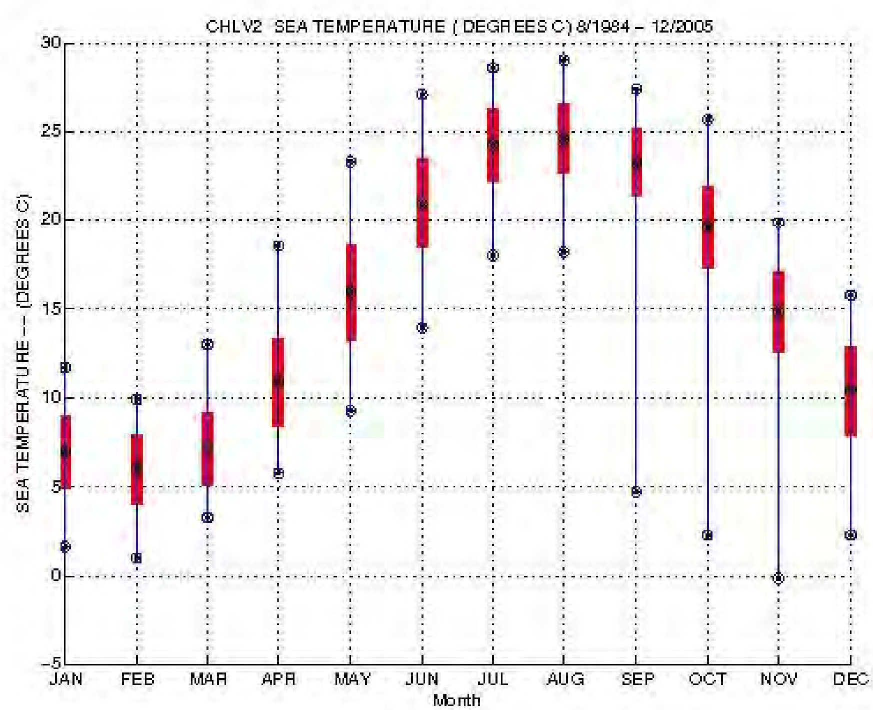


Figure 2.12.8. Mean monthly temperature profile for waters offshore of Virginia.

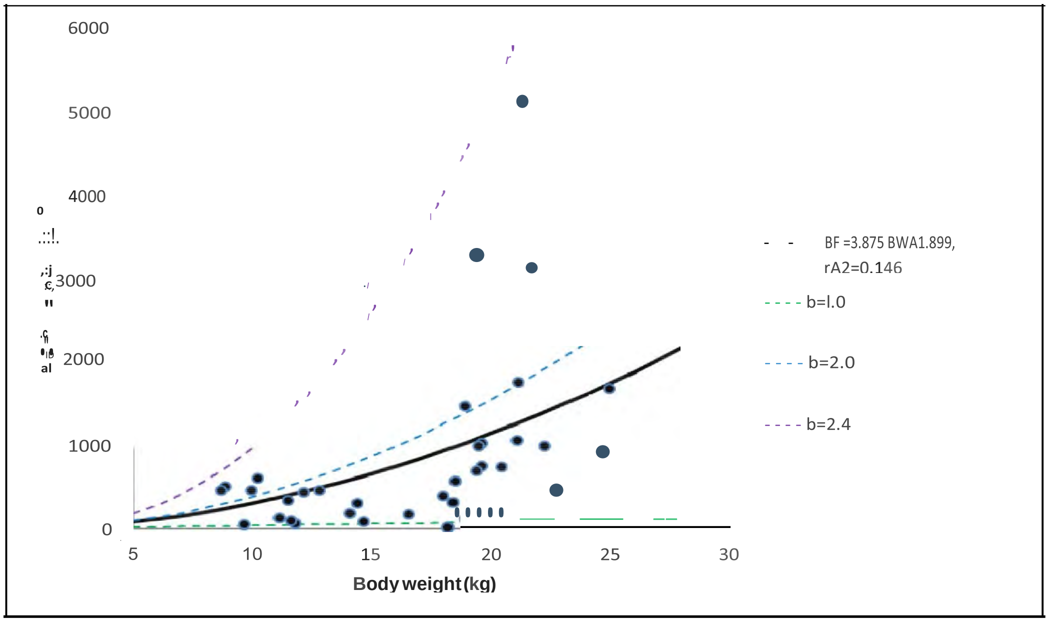


Figure 2.12.9. Power function of Cobia batch fecundity (y-axis) and female body weight. Best fish shown by solid line. Range in values of exponent *b* represented by dashed lines. (Y-axis = "Batch fecundity (1000s)"; See SEDAR (2013) Cobia stock assessment full report for original figure.)

3 Commercial Fishery Statistics

3.1 Overview

Commercial landings for the US Atlantic cobia stock were developed in whole weight pounds for the period 1928-2017 based on federal and state trip databases. Corresponding landings in numbers of fish were based on mean weights estimated from best available size composition data. The SEDAR 58 Stock ID Workshop established the Florida/Georgia state line as the delimiting stock boundary.

Commercial discards were calculated from recreational fisher reported discard rates, gear-specific (handline and gillnet) effort from the commercial fishery, and observer reported discard and kept rates.

Sampling intensity for lengths by year were considered and length compositions were developed by year.

3.1.1 Commercial Workgroup Participants

Beth Wrege	Workgroup leader	SEFSC Miami
Julie DeFilippi-Simpson	Data provider	ACCSP
Amy Dukes	Data provider	SC DNR
Eric Hiltz*	Data provider	SC DNR
Amanda Tong	Data provider	NC DMF
Alan Bianchi*	Data provider	NC DMF
Julie Califf*	Data provider	GA DNR
Larry Beerkircher*	Data provider	SEFSC Miami
Alex Aspinwall	Data provider	VA VMRC
Kevin McCarthy	Data provider	SEFSC Miami
Refik Orhun*	Data provider	SEFSC Miami
Mike Rinaldi	Data provider/rapporteur	ACCSP

*Did not attend workshop

3.1.2 Issues Discussed at the Data Workshop

Issues discussed by the commercial workgroup concerning cobia landings included the sparsity of commercial landings and discard data. Gear groupings of handline, longline, and other were originally provided, but were not used. For discards, the workgroup discussed limited available data from the CFLP (Coastal Fisheries Logbook Program).

3.2 Review of Working Papers

SEDAR58-DW04: The group reviewed this working paper, and decided to provide no comment.

SEDAR58-DW05: This working paper compares the length frequency distribution of five fishery-dependent datasets, three data sets provided by South Carolina Department of Natural Resources (SCDNR) fishery-dependent sampling program beginning in 2007 (tournament, charter boat captain donations, and private recreational donations), two traditional NMFS fishery-dependent sampling efforts operating in the region (the Marine Recreational Information Program (MRIP) and the Southeast Region Headboat Survey (SRHS)) and one fishery-independent dataset collected by SCDNR staff from a Cooperative Research Program (CRP) funded grant to determine if SCDNR's carcass collection program is an accurate representation of the recreational fishery.

SEDAR58-DW08: This paper was used to estimate discards from the gillnet fishery.
SEDAR58-DW09: The group reviewed this working paper, and decided to provide no comment.

3.3 Commercial Landings

Commercial landings of cobia were compiled from 1928 through 2017 for the Atlantic Coast north of the Florida-Georgia state line. Sources for landings in the U.S. South Atlantic (Georgia through North Carolina) included the North Carolina Division of Marine Fisheries (NCDMF) and the Atlantic Coastal Cooperative Statistics Program (ACCSP). Landings from the Mid- and North Atlantic (north of the NC-VA border were from the Virginia Marine Resources Commission (VMRC) and ACCSP. Further discussion of how landings were compiled from the above sources can be found in section 3.3.4.

3.3.1 Commercial Gears

The workgroup compiled reported gears landing cobia from various data sources. Based on the SEDAR 28 gear groupings, the predominant commercial fleets were categorized into three gear groups: handline, longline, and other. After discussions with the modeler and data compiler during the SEDAR 58 workshop, it was decided not to separate by gear but to aggregate gears to a single fleet. Cobia landings were provided as a single commercial fleet per year. The list of gears that were aggregated, **but not included in the assessment**, are found in Table 3.10.1.

3.3.2 Stock Boundaries

DW ToR #1: *Define the unit stock for the SEDAR 58 Atlantic Cobia stock assessment to include the US Atlantic Seaboard north of the Georgia-Florida border.*

Per Data Workshop Term of Reference #1, landings along the U.S. Atlantic coast north of the Georgia-Florida border were examined. The unit stock for South Atlantic cobia was defined by the SEDAR 58 Stock ID Workshop group.

A map of the area in which landings of cobia were considered can be found in Figure 3.11.1.

3.3.3 Misidentification and Unclassified Cobia

Cobia are a relatively distinct species, and there were no species identification issues known at present. No higher taxonomic groupings (i.e. Cobias) were reported in the commercial fishery. Therefore, no misidentification or classification issues accompanied reported cobia landings.

3.3.4 Commercial Landings by State

Statistics on commercial landings (1950 to present) for all species on the Atlantic coast are maintained in the ACCSP Data Warehouse. The Data Warehouse is an online database of fisheries dependent data provided by the ACCSP state and federal partners. Data sources and collection methods are illustrated by state in Section 3.3. The Data Warehouse was queried in December 2018 for all cobia landings (annual summaries by gear category) from 1950−2017 from Georgia through Maine (ACCSP 2019). Data are presented using the gear categories as determined at the Data Workshop. The specific ACCSP gears in each category are listed in Table 3.10.1. Commercial landings in pounds (whole weights using state specific conversion factors) were provided.

Multiple gear revisions occurred during the workshop. Data presented showed that the gear By Hand, Diving Gear should be reassigned into the Other category. Alignment analyses were performed for the SEDAR 28 and 58 data sets. The data from each workshop were in almost complete alignment for overlapping years, and therefore data from 1928-1949 (included in the SEDAR 28) were incorporated. The group was then informed by the lead analyst that gear groupings would not be necessary for the assessment. **All landings were then aggregated into year and state summaries.**

Georgia

GA DNR staff examined ACCSP landings and compared them to state held versions. It was determined that ACCSP landings were a match and would be used in place of state provided data for the entire time series.

South Carolina

Prior to 1972, commercial landings data were collected by various federal fisheries agents based in South Carolina, either U.S. Fish or Wildlife or National Marine Fisheries Service personnel. In 1972, South Carolina began collecting landings data from coastal dealers in cooperation with federal agents. Mandatory monthly landings reports on forms supplied by the Department are required from all licensed wholesale dealers in South Carolina. Until fall of 2003, those monthly reports were summaries collecting species, pounds landed, disposition (gutted or whole) and market category, gear type and area fished; since September 2003, landings have been reported by a mandatory trip ticket system collecting landings by species, disposition and market category, pounds landed, ex-vessel prices with associated effort data to include gear type and amount, time fished, area fished, vessel and fisherman information.

South Carolina began collecting TIP length frequencies in 1983 as part of the Cooperative Statistics Program (CSP). Target species and length quotas were supplied by NMFS and sampling targets were established for monthly commercial trips by gear sampling was set to collect those species with associated length frequencies. In 2005, SCDNR began collecting age structures (otoliths and spines) in addition to length frequencies, using ACCSP funding to supplement CSP funding. Typically for every four fish measured a single age structure was collected. This sampling periodicity was changed in 2010 to collect both a length and age structure from every fish intercepted as a recommendation from the SEFSC.

SCDNR provided landings data for cobia from 1978 – 2017. Data from 1978 – 2003 were collected in monthly totals through collaborative efforts by SCDNR and the NMFS Cooperative Statistics Program and data collected from 2004 – 2017 were more comprehensive, as SCDNR instituted a mandatory Trip Ticket Program in late 2003.

These landings data were correlated, compared, and confirmed with ACCSP data. In the years 2001 to 2003, there were differences between those data sets. For those three years, the data provided by the agency, which was greater in reported pounds, was used for this assessment.

Cobia landed weights were collected as both gutted and whole. Annual Catch Limits are categorized as "landed weight" since both categories are present in the fishery. All gutted were converted to whole weight using the state conversion factor of 1.1. Additionally, all landings through this time period were associated to single values, rather than associating them to a gear grouping. This was a suggestion made to the Commercial Working Group from the lead analyst.

North Carolina

NCDMF provided North Carolina's landings data from 1928 to 2017. This data set was a collective grouping of historical data collection by the NMFS/NCDMF Cooperative Statistics Program, its predecessors, and the NC Trip Ticket Program. Data collection continuity was sporadic in the earlier years of the dataset prior to 1950. Data continuity and accuracy dramatically increased over time. From 1994 to 2017 landings data collection was provided by the NC Trip Ticket Program and considered the most consistent and inclusive portion of the dataset. In 1999 NCDMF started sharing the landings data in the ACCSP data warehouse. Final assessment data was provided by the NC Trip Ticket Program due to the need for primary gear reassignments on multi-gear trips.

Gear categorizations were determined to be unnecessary at the time of this data workshop for a number of reason among them lack of correlations with other commercial data sets such as length frequency data. The NC commercial landings were therefore compiled annually without associated gear categorization for the reported years.

Atlantic cobia landings were reported in both whole and gutted conditions. The majority of landings were reported in gutted weight, which were converted to whole with a state conversion factor of 1.25 per pound. Whole weight records were directly supplied without conversion.

Virginia

VMRC provided Virginia's landings data from 1950 to 2017. This data set combined historical data from the NMFS prior to 1993, and mandatory reporting data from 1993 to 2017.

These data were provided at the trip level, in the original gear categories requested by the ACCSP. In addition to gear, fishing area was provided. However, both of these fields were deemed unnecessary during the SEDAR 58 process. These data were then aggregated by total pounds per year.

Combined State Results

Landings are presented in pounds whole weight, numbers of fish, and mean weight in Table 3.10.2 and shown graphically in Figures 3.11.2 and 3.11.3.

The Workgroup reported commercial landings according to the following:

- Landings should be reported as whole weight in pounds and number of fish
- Final landings data came from the following sources:
    - MD-North 1950-2017 (ACCSP)
    - VA 1950-1992 (ACCSP)
      1993-2017 (VMRC)
    - NC: 1950-2017 (NCDMF)
    - SC: 1950-2017 (SCDNR)
    - GA: 1950-2017 (ACCSP)

Whole vs. Gutted Weight

States use state-specific conversion factors for cobia to convert from the grade condition of gutted to whole weights. While this was presented as a possible issue between data sets, the group decided to remain consistent with existing practice from SEDAR 28. Whole weights in pounds were used, and a recommendation for addressing best practice for applying conversion factors can be found in later sections.

<u>Confidentiality Issues</u>

The elimination of the previous gear grouping created new confidentiality considerations. Landings of cobia were pooled across states by gear to meet the rule-of-three in the original data sets (SEDAR 28), and confidential data were flagged. Eliminating the previous gear grouping then required the combining across states to meet the rule-of-three confidentially requirements for Sedar 62. These combined state totals per-year resulted in completely non-confidential summaries. Therefore, no confidential data are flagged for the final data set of annual Cobia landings in whole weight pounds and numbers of individual fish, the Atlantic Coast states combined (ME-GA).

<u>Uncertainty</u>

The commercial workgroup estimated uncertainty in commercial fishery landings. The uncertainty estimates were determined using the same methodology used in SEDAR 28. These estimates of uncertainty are not coefficients of variation, but are estimates of possible reporting error; i.e., represent the range in actual commercial landings relative to the reported landings.

In making these uncertainty estimates, the following assumption was made:

- Landings may be underreported during all years; however, underreporting was likely highest during early years of the time series and were more accurate in recent years. This assumption was based upon the following information and data workshop expert testimony: during the period 1950 (beginning of landings time series) to 1961 landings were summarized annually by state and likely did not include landings from small scale dealers. In the years 1962 to 1977 landings data were collected annually, but under a more all-inclusive program (General Canvass). Monthly landings summaries were collected during the period 1978 to the beginning of trip ticket data collection (VA-1993, NC-1994, SC-2004, GA-2004). The most recent landings data, collected through state trip ticket programs, were assumed to be most reliable and inclusive of all commercial landings.

The group agreed, based upon expert opinion, an upper bound be set to account for underreported landings. See Table 3.10.5 for state specific bounds.

3.3.5 Converting Landings in Weight to Landings in Numbers

The weight in pounds for each sample was calculated, as was the mean weight by year. The landings in pounds whole weight were divided by the mean weight for the year to derive landings in numbers

3.4 Commercial Discards

Vertical line fishery

The data set for calculating commercial vertical line (handline, electric and hydraulic reel) vessel discard rates of cobia included all trips from vessels that reported to the coastal discard logbook program between January 1, 2002 and December 31, 2017 in the US South Atlantic. Total effort reported to the coastal logbook program were used to calculate total discards from the vertical line fishery The available data for other gears were too few for discards to be calculated or, for gillnet vessels, observer data were available for discard calculation (as described in the following section). Two methods were used to calculate discards: a continuity method following the methods of SEDAR 28 and the standard practice method developed for SEDAR 32 and used for subsequent South Atlantic assessments.

SEDAR 58 continuity methods:

- Fisher reported discard logbook data used to calculate discard rate
- Fisher reported coastal logbook data used to calculate total effort

*Total discards/year = mean discard rate (2002-2017) * yearly total effort*

- Discards calculated for vertical line (handline and bandit reels; effort=hook hours) and trolling (effort=hook hours) vessels separately, then summed and reported as vertical line continuity method in Table 3.10.4
- Dropped trips by vessels that reported "no discards" on more than 30% of trips, however, retained trips by vessels with no discards on six or fewer trips. That 30% rule was based upon the frequency of trips with no discards observed in the limited observer data examined during SEDAR 28.

SEDAR standard practice methods:

- Used discard and coastal logbook data sets

*Calculated discards/year for the years 2002-2017 = yearly discard rate * yearly total effort*

*Calculated discards/year for the years 1993-2001 = mean discard rate (2002-2006) * yearly total effort*

- Discards calculated for vertical line (handline and bandit reels; effort=hook hours) and trolling (effort=hook hours) vessels separately, then summed and reported as vertical line standard practice in Table 3.10.4

- Followed methods used beginning with SEDAR 32, includes filters to address reports of no discards and mackerel targeted trips
- Effort from trips with only mackerel landings were excluded – assumed those trips were not fishing in cobia habitat, therefore, were unlikely to catch/discard cobia
- Discard logbook data from vessels that never reported a discard of any species were excluded
- Discard logbook data from a vessel were excluded if the number of trips until a reported discard from that vessel exceeded the mean number of trips before discards were reported by vessels in the fishery + 2 standard deviations above that mean. Data were excluded from vertical line vessels with more than 20 trips before reporting discards and for trolling vessels, more than 26 trips

Discards were reported in numbers of fish. Converting numbers of fish to pounds of discarded fish used the formula recommended by the life history working group:

Whole weight in kg $= 1.91 * 10^{-9} * TL^{3.21}$

Where TL is in mm. No size composition of discards from the vertical line fishery was available from the discard logbook program. The commercial working group, therefore, recommended using the mean length of discards observed from the Virginia recreational private and charter fleets during 2016-17. Those were the only discard length data available during the data workshop. The mean length of discarded cobia in that data set was 35.78 inches TL. Mean weight of a discarded cobia was estimated as 13.21 pounds. Cobia discards in pounds from the commercial vertical line fishery are provided in Table 3.10.5

Gillnet Discards Calculated Using Observer Data

Discards from the commercial gillnet fishery were calculated following the methods described in working paper SEDAR58-DW08. Total calculated discards from the gillnet fishery are provided in Table 3.10.4. Observer data were available for the years 1999-2016. No trips were observed in 2017. Discards were calculated by disposition, live or dead.

Mean lengths (live discards 33.07 inches TL; dead discards 31.14 inches TL) of discarded cobia was calculated from available data in the gillnet observer data set. Mean weight of a dead discarded cobia was estimated to be 8.46 pounds whole weight using the TL to whole weight conversion described above. Live discard mean weight was estimated to be 10.26 pounds whole weight. Yearly total weights of discarded cobia from the commercial gillnet fishery are provided in Table 3.10.5.

Work Group Recommendations
The SEDAR 58 Commercial Work Group recommended using discards calculated following the standard practice method for the commercial vertical line fishery and discards calculated using gillnet observer data for the commercial gillnet fishery.

3.5 Commercial Effort

Map products were created that reflected commercial effort along the Atlantic Coast. The data used for those map products ranged from 2012 – 2017 and included coastal fisheries logbook program data (CFLP – federal only) from Texas to Maine. In order to preserve confidentiality, data were aggregated by month for the entire time series. Grids with confidential data or no landings were left hollow.

10 year blocks were decided in order to stay consistent with SEDAR 28, and the data were truncated at the GA/FL boundary and cut off at 30 degrees North. Effort will be defined as trips, with the trip ticket starting dates for each state as NC-1994, VA-1993, SC – 2004.

3.6 Biological Sampling

Biological sample data were obtained from the TIP sample data at NMFS/SEFSC, and ranged from 1983 to 2017. Data were filtered to eliminate those records that included a size or effort bias, non-random collection of length data, or were not from commercial trips.

The data were also filtered to reduce the number of columns from gear groups. The group reviewed the data and sample sizes, and decided they were adequate at the annual level but not the gear level.

3.6.1 Sampling Intensity

The number of fish ranged from a high of 259 (all gears combined) in 1990 for Virginia through Georgia to a low of zero for many strata. For multiple years, number of fish sampled were less than 10 for all gears for Virginia through the Georgia.

3.6.2 Length/Age Distribution

The group decided that age/length frequency data were not within the purview of the commercial group. The group provided length data from the TIP program to the data compiler, who created the mean weights. The mean weights were passed back to the commercial group, who then used those weights to convert the landings and discards from pounds to number of individuals.

3.6.3 Adequacy for Characterizing Catch

The commercial group was informed that length sampling was inadequate for separate gears, and all gears combined provided an adequate sample size. However, many years have low sample sizes and should be aggregated across years if used in the model.

3.7 Comments on Adequacy of Data for Assessment Analyses

Landings data for assessment analyses appear to be mostly adequate. There is a clear landings history for the available time series. There was no issue concerning species identification, and Cobia have been reported consistently at the species level. Definition of stock boundaries was not an issue. However, landed condition (gutted vs. whole) was discussed by the group, and it was decided to stay consistent with the approach from SEDR 28. Each state will investigate the proportion of landings in different conditions, and the group provided a research recommendation on best practice for conversion factors moving forward.

Discard calculations posed some difficulties due to scarcity of data, and only the discards from the vertical line fishery were utilized. The available data for other gears were too few for discards to be calculated or, for gillnet vessels, observer data were available for discard calculation. Biological sampling data, while suffering from small sample size, was deemed adequate.

3.8 Research Recommendations

The following recommendations stem from both review of SEDAR 28 recommendations and group discussion.

1. Programmatic funding should be allocated to expand existing observer coverage to ensure complete spatial coverage for the South Atlantic.

2. Funding should be allocated towards the development of standardized map products.
   a. This includes various federal and state logbook grids from Maine to Texas.
   b. All grids need to include SDO registration.
   c. Includes translation tables between each grid.
   d. Creation of map products that compare commercial fishing effort between the CFLP and state trip ticket data.

3. Develop statistically robust discard estimation techniques.

4. Standardize how effort data are collected, processed, and utilized in relation to catch.
   a. There may be inconsistencies among commercial data sets for effort, since there is not a vessel permit required for cobia rather an individual catch limit.
      i. A single trip ticket may group multiple individual catches together with total effort, while multiple trip tickets may separate individual catch yet replicate the vessel effort.

5. Create outreach strategies to further enhance the implementation plan for the commercial electronic logbook and include state partners. This will increase the data validity.
   a. This data collection effort will greatly improve reporting periodicity, reduce recall basis, provide increased spatial trends, provide more robust discard data, this list is endless, but should address where this data will fill in data gaps within a SEDAR

6. The group recommends a workshop to establish a best practice for converting landings (e.g., gutted to whole weight).
   a. This workshop should address multiple species and jurisdictions.

7. The group suggests that the partners include cobia in an RFP for updating federal and state specific conversion factors.

8. The group recommends a workshop to establish a best practice for assigning uncertainty to landing series, as recommended in the best practices workshop.

3.9 Literature Cited

Atlantic Coastal Cooperative Statistics Program. 2019. Annual Landings by Custom Gear Category; generated by Mike Rinaldi using ACCSP Data Warehouse, Arlington, VA: accessed January 2019.

3.10 Tables

Table 3.10.1 Specific ACCSP gears in each requested gear category for commercial cobia landings. **NOT USED**

GEAR CODE	GEAR NAME	TYPE CODE	GEAR TYPE
HANDLINE			
300	HOOK AND LINE	HOOK AND LINE	HOOK AND LINE
301	HOOK AND LINE, MANUAL	HOOK AND LINE	HOOK AND LINE
302	HOOK AND LINE, ELECTRIC	HOOK AND LINE	HOOK AND LINE
303	ELECTRIC/HYDRAULIC, BANDIT REELS	HOOK AND LINE	HOOK AND LINE
320	TROLL LINES	TROLL LINES	HOOK AND LINE
700	HAND LINE	HAND LINE	HAND LINE
701	TROLL AND HAND LINES CMB	HAND LINE	HAND LINE
760	BY HAND, NO DIVING GEAR	BY HAND, NO DIVING GEAR	BY HAND
LONGLINE			
GEAR CODE	**GEAR NAME**	**TYPE CODE**	**GEAR TYPE**
400	LONG LINES	LONG LINES	LONG LINES
401	LONG LINES, VERTICAL	LONG LINES	LONG LINES
402	LONG LINES, SURFACE	LONG LINES	LONG LINES
403	LONG LINES, BOTTOM	LONG LINES	LONG LINES
404	LONG LINES, SURFACE, MIDWATER	LONG LINES	LONG LINES
405	LONG LINES, TROT	LONG LINES	LONG LINES
OTHER			
GEAR CODE	**GEAR NAME**	**TYPE CODE**	**GEAR TYPE**
750	BY HAND, DIVING GEAR	BY HAND, DIVING GEAR	BY HAND
000	NOT CODED	NOT CODED	NOT CODED
010	HAUL SEINES	HAUL SEINES	HAUL SEINES
020	OTHER SEINES	OTHER SEINES	HAUL SEINES
022	COMMON SEINE	OTHER SEINES	HAUL SEINES

Table 3.10.1 cont. Specific ACCSP gears in each requested gear category for commercial cobia landings. **NOT USED**

OTHER			
GEAR CODE	**GEAR NAME**	**TYPE CODE**	**GEAR TYPE**
050	POUND NETS	POUND NETS	FIXED NETS
030	PURSE SEINE	PURSE SEINE	PURSE SEINES
072	TRAP NETS	OTHER FIXED NETS	FIXED NETS
090	OTTER TRAWLS	OTTER TRAWLS	TRAWLS
091	OTTER TRAWL BOTTOM, CRAB	OTTER TRAWLS	TRAWLS
092	OTTER TRAWL BOTTOM, FISH	OTTER TRAWLS	TRAWLS
095	OTTER TRAWL BOTTOM, SHRIMP	OTTER TRAWLS	TRAWLS
096	OTTER TRAWL BOTTOM, OTHER	OTTER TRAWLS	TRAWLS
097	OTTER TRAWL MIDWATER	OTTER TRAWLS	TRAWLS
110	OTHER TRAWLS	OTHER TRAWLS	TRAWLS
120	FLY NET	OTHER TRAWLS	TRAWLS
130	POTS AND TRAPS	POTS AND TRAPS	POTS AND TRAPS
131	POTS AND TRAPS, CONCH	POTS AND TRAPS	POTS AND TRAPS
132	POTS AND TRAPS, BLUE CRAB	POTS AND TRAPS	POTS AND TRAPS
139	POTS AND TRAPS, FISH	POTS AND TRAPS	POTS AND TRAPS
140	POTS AND TRAPS, SPINY LOBSTER	POTS AND TRAPS	POTS AND TRAPS
200	GILL NETS	GILL NETS	GILL NETS
201	GILL NETS, FLOATING DRIFT	GILL NETS	GILL NETS
203	GILL NETS, FLOATING ANCHOR	GILL NETS	GILL NETS
204	GILL NETS, SINK ANCHOR	GILL NETS	GILL NETS

Table 3.10.1 cont. Specific ACCSP gears in each requested gear category for commercial cobia landings. **NOT USED**

OTHER			
GEAR CODE	**GEAR NAME**	**TYPE CODE**	**GEAR TYPE**
205	GILL NETS, RUNAROUND	GILL NETS	GILL NETS
207	GILL NETS, OTHER	GILL NETS	GILL NETS
500	DREDGE	DREDGE	DREDGE
511	DREDGE, NEW BEDFORD	DREDGE	DREDGE
602	PATENT TONGS	TONGS	RAKES, HOES, AND TONGS
660	SPEARS	SPEARS	SPEARS AND GIGS
661	SPEARS, DIVING	SPEARS	SPEARS AND GIGS
662	GIGS	SPEARS	SPEARS AND GIGS
800	OTHER GEARS	OTHER GEARS	OTHER GEARS
801	UNSPECIFIED GEAR	OTHER GEARS	OTHER GEARS
802	COMBINED GEARS	OTHER GEARS	OTHER GEARS

Table 3.10.2 Table with the Cobia landings by year in whole weight pounds, numbers of individual fish, and mean weights for all Atlantic Coast states combined (ME-GA). Mean weights for 1928-1982 are the calculated average from best available size composition data. .

	Atlantic Coast		
Year	Pounds, WW	Number of individuals	Mean Weights
1928	250	11	23.15752
1929	350	15	23.15752
1930	200	9	23.15752
1931	300	13	23.15752
1932	4,515	195	23.15752
1934	25,300	1,093	23.15752
1936	9,300	402	23.15752
1937	22,400	967	23.15752
1938	23,500	1,015	23.15752
1939	11,700	505	23.15752
1940	2,500	108	23.15752
1941	1,000	43	23.15752
1947	1,800	78	23.15752
1950	11,400	492	23.15752
1951	11,800	510	23.15752
1952	3,800	164	23.15752
1953	13,700	592	23.15752
1954	28,200	1,218	23.15752
1955	9,200	397	23.15752
1956	27,100	1,170	23.15752
1957	48,600	2,099	23.15752
1958	25,500	1,101	23.15752
1959	48,900	2,112	23.15752
1960	30,700	1,326	23.15752
1961	38,700	1,671	23.15752
1962	41,100	1,775	23.15752
1963	49,900	2,155	23.15752
1964	24,500	1,058	23.15752
1965	19,900	859	23.15752
1966	12,100	523	23.15752
1967	12,800	553	23.15752
1968	10,900	471	23.15752
1969	9,000	389	23.15752
1970	9,200	397	23.15752
1971	14,400	622	23.15752
1973	4,769	206	23.15752
1974	5,511	238	23.15752

	Atlantic Coast		
Year	Pounds, WW	Number of individuals	Mean Weights
1976	5,931	256	23.15752
1977	3,492	151	23.15752
1978	2,707	117	23.15752
1979	4,616	199	23.15752
1980	8,459	365	23.15752
1981	17,838	770	23.15752
1982	31,291	1,351	23.15752
1983	18,008	740	24.35
1984	13,795	607	22.72
1985	11,307	538	21.00
1986	25,734	1,394	18.46
1987	40,740	1,876	21.71
1988	28,588	1,152	24.82
1989	33,453	2,377	14.07
1990	44,357	3,139	14.13
1991	43,816	2,105	20.81
1992	35,933	1,512	23.77
1993	39,526	2,129	18.57
1994	47,020	1,626	28.92
1995	67,557	2,576	26.23
1996	62,591	3,645	17.17
1997	63,522	1,846	34.40
1998	43,622	1,678	26.00
1999	27,474	1,345	20.42
2000	43,580	2,302	18.93
2001	42,513	2,048	20.76
2002	44,375	1,474	30.11
2003	39,310	1,489	26.39
2004	32,916	1,240	26.54
2005	28,884	1,358	21.27
2006	34,708	1,396	24.86
2008	33,876	1,135	29.84
2009	42,423	2,034	20.86
2010	56,661	1,816	31.21
2011	34,222	1,293	26.48
2012	42,811	1,832	23.37
2013	53,605	8,382	6.40
2014	70,064	2,343	29.90
2015	84,901	2,518	33.72
2016	92,535	4,063	22.77
2017	68,365	5,714	11.96

Table 3.10.3 Uncertainty in commercial landings by year range.

Year Range	Uncertainty
1928 - 1949	0.50
1950 - 1961	0.25
1962 - 1977	0.20
1978 - 1992	0.10
1993 - 2017	0.05

Table 3.10.4. Calculated yearly cobia discards from the commercial vertical line and gillnet fisheries by year. Discards are reported in number of individual fish.

Year	Cobia Vertical Line Calculated Discards Continuity Method	Cobia Vertical Line Calculated Discards Standard Practice Method	Cobia Gillnet Observer Calculated Dead Discards	Cobia Gillnet Observer Calculated Live Discards
1993	121	628	N/A	N/A
1994	148	733	N/A	N/A
1995	137	715	N/A	N/A
1996	140	753	N/A	N/A
1997	145	728	N/A	N/A
1998	118	606	N/A	N/A
1999	102	575	0	0
2000	110	899	0	0
2001	120	979	0	0
2002	107	1,346	0	190
2003	85	1,167	0	0
2004	79	399	569	0
2005	80	741	23	22
2006	89	67	22	0
2007	90	1,194	0	179
2008	90	583	69	89
2009	92	1,971	344	462
2010	79	743	118	173
2011	67	1,544	88	184
2012	60	1,303	118	417
2013	66	975	0	73
2014	64	685	100	0
2015	58	414	0	532
2016	59	875	0	32
2017	56	85	N/A	N/A

Table 3.10.5. Calculated yearly cobia discards from the commercial vertical line and gillnet fisheries by year. Discards are reported in pounds whole weight.

Year	Cobia Vertical Line Calculated Discards Continuity Method	Cobia Vertical Line Calculated Discards Standard Practice Method	Cobia Gillnet Observer Calculated Dead Discards	Cobia Gillnet Observer Calculated Live Discards
1993	1,605	8,293	N/A	N/A
1994	1,959	9,690	N/A	N/A
1995	1,814	9,449	N/A	N/A
1996	1,856	9,947	N/A	N/A
1997	1,911	9,617	N/A	N/A
1998	1,563	8,005	N/A	N/A
1999	1,346	7,602	0	0
2000	1,449	11,881	0	0
2001	1,592	12,937	0	0
2002	1,417	17,781	0	1,950
2003	1,130	15,421	0	0
2004	1,040	5,268	4,815	0
2005	1,051	9,798	195	226
2006	1,175	892	186	0
2007	1,194	15,782	0	1,837
2008	1,186	7,703	584	913
2009	1,216	26,043	2,911	4,742
2010	1,040	9,813	999	1,776
2011	882	20,399	745	1,889
2012	797	17,223	999	4,280
2013	869	12,891	0	749
2014	839	9,057	846	0
2015	763	5,472	0	5,460
2016	776	11,564	0	328
2017	738	1,119	N/A	N/A

3.11 Figures

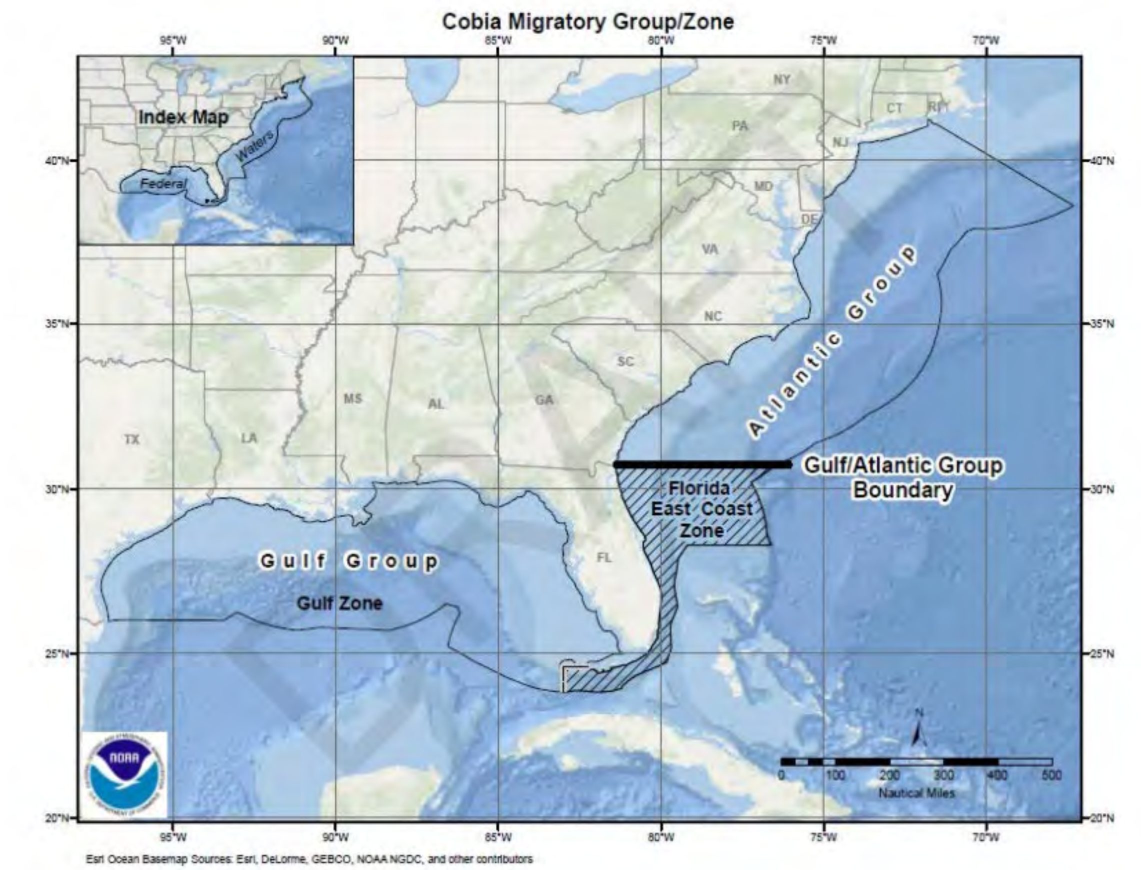


Figure 3.11.1 Region of cobia landings, included the combined states (ME-GA) along the U.S. Atlantic Coast, depicted here as the Atlantic Group.

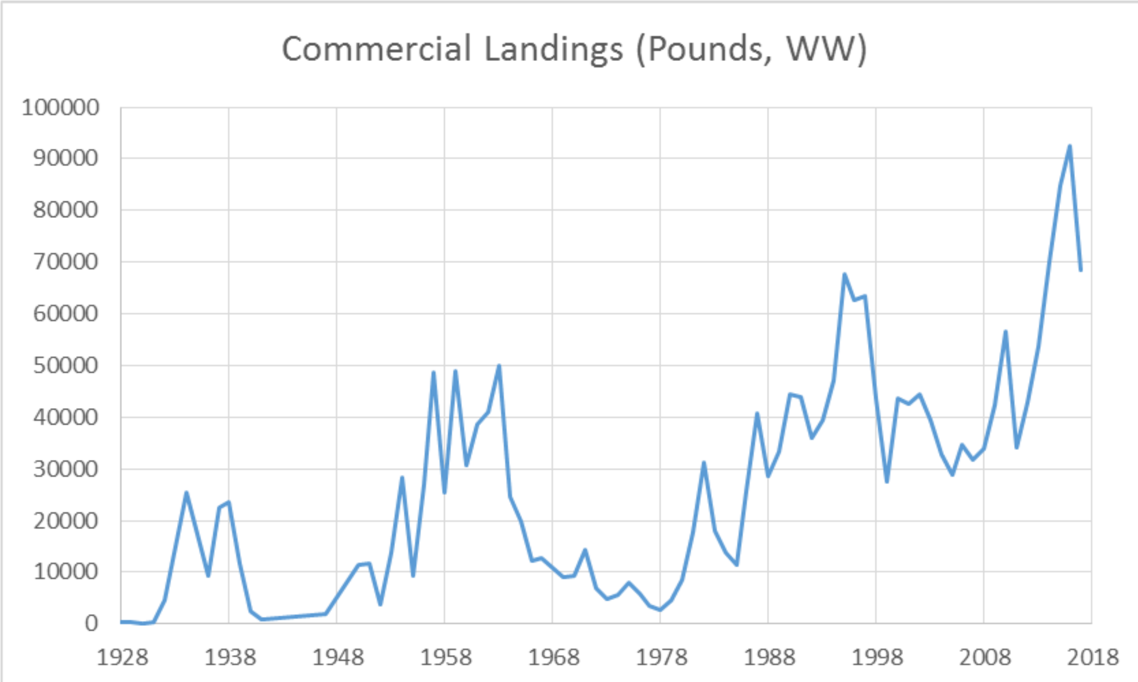


Figure 3.11.2 Cobia landings, in whole weight pounds, for all states (GA-ME) by year.

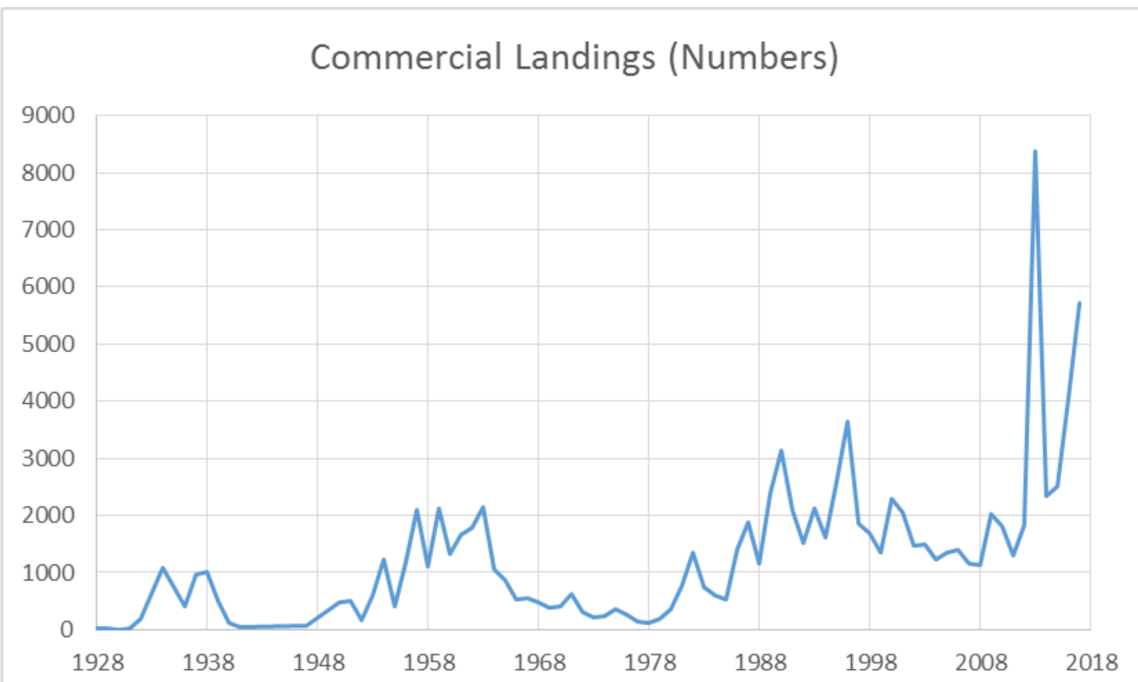
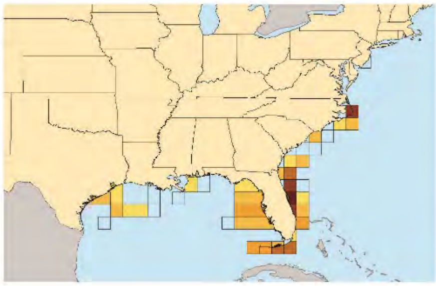
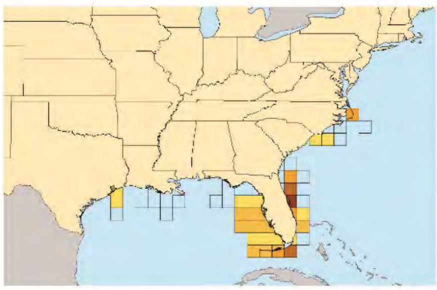


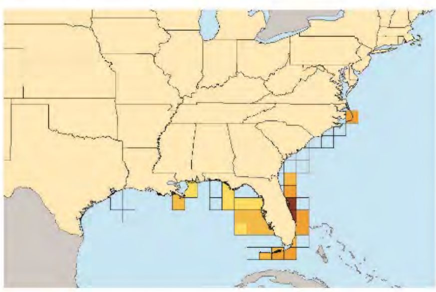
Figure 3.11.3 Cobia landings, in numbers of fish, for all states (GA-ME) by year.



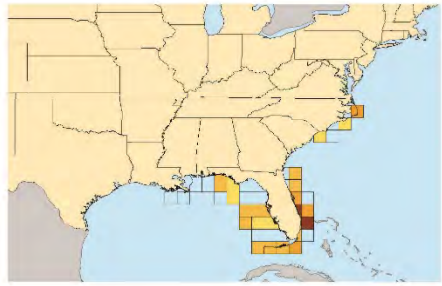
Reported Pounds of Cobia in January 2012-2017



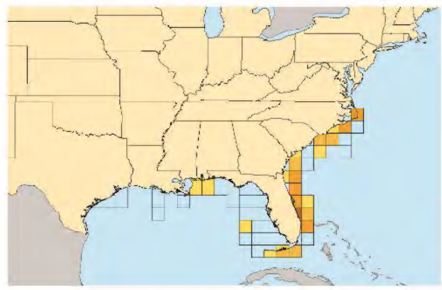
Reported Pounds of Cobia in February 2012-2017



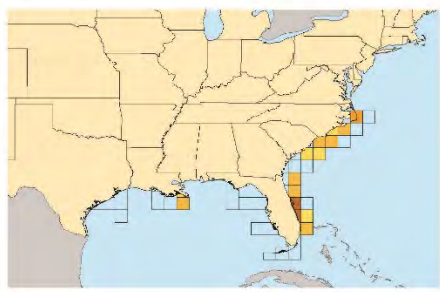
Reported Pounds of Cobia in March 2012-2017



Reported Pounds of Cobia in April 2012-2017

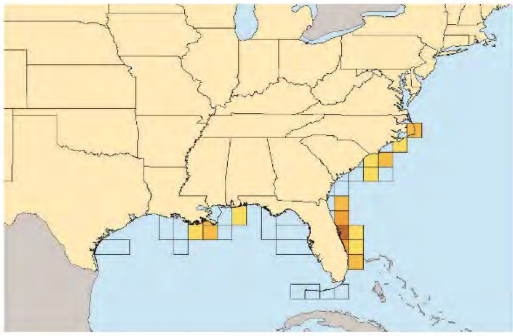


Reported Pounds of Cobia in May 2012-2017

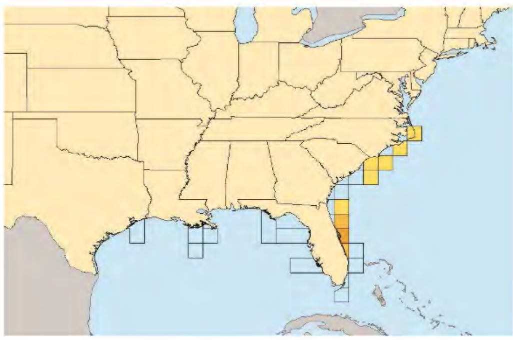


Reported Pounds of Cobia in June 2012-2017

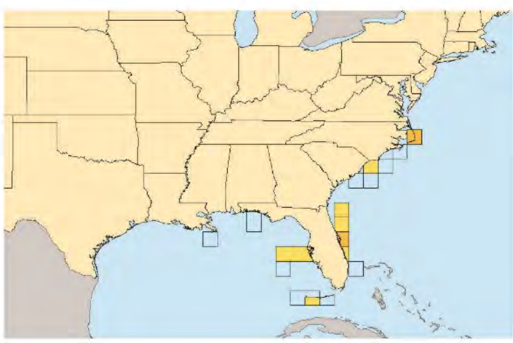
Figure 3.11.4 Maps of cobia harvest 2012-2017 in the South Atlantic as reported to the CFLP.



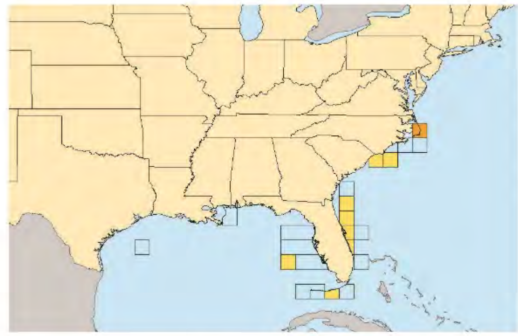
Reported Pounds of Cobia in July 2012-2017



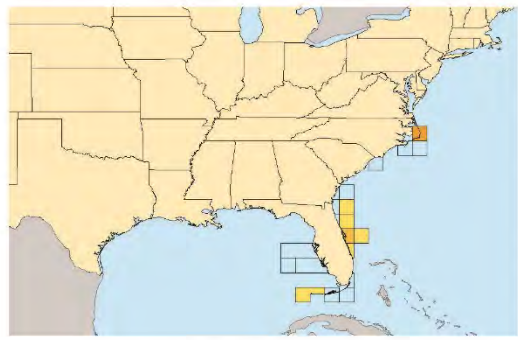
Reported Pounds of Cobia in August 2012-2017



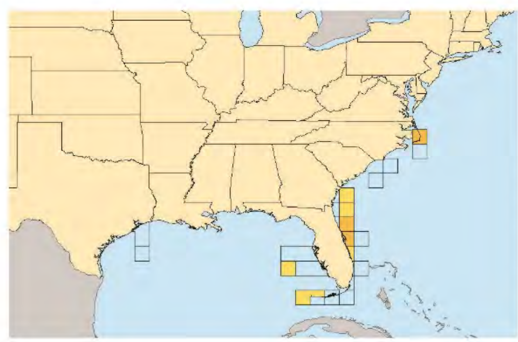
Reported Pounds of Cobia in September 2012-2017



Reported Pounds of Cobia in October 2012-2017



Reported Pounds of Cobia in November 2012-2017



Reported Pounds of Cobia in December 2012-2017

Figure 3.11.4 Cont. Maps of cobia harvest 2012-2017 in the South Atlantic as reported to the CFLP.

4 Recreational Fishery Statistics

Atlantic Cobia report

4.1 Overview

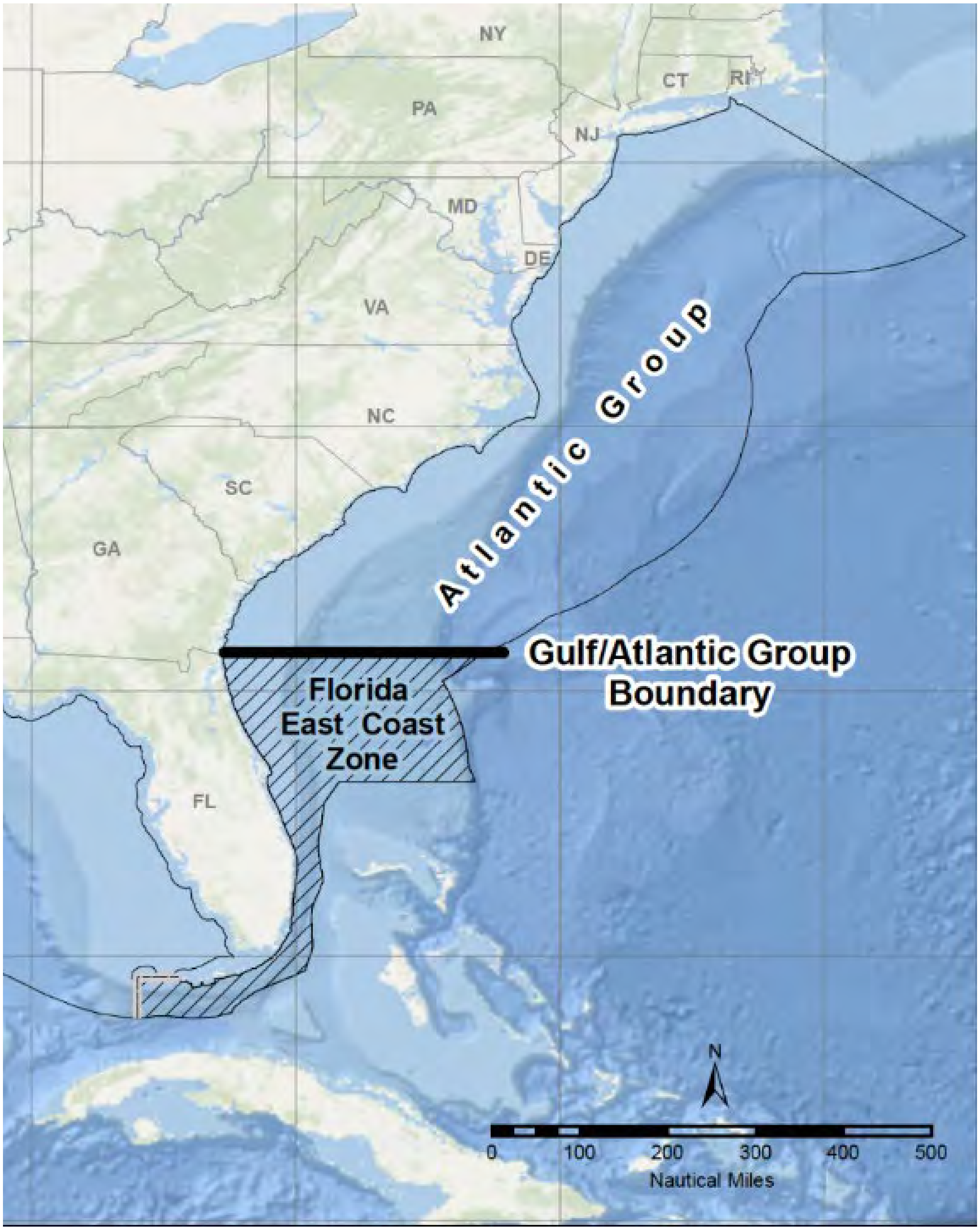
4.1.1 Group membership

Members- Ken Brennan (Leader \NMFS Beaufort), Alex Aspinwall (VMRC), Andrew Cathey (NCDNR), Collins Doughtie (Fisherman-SC), Kelly Fitzpatrick (NMFS Beaufort), Dawn Franco (GADNR), Bill Gorham (Fisherman – NC), Vivian Matter (NMFS SEFSC), Kayla Rudnay (SCDNR)

4.1.2 Issues

1) Headboat logbook forms did not include cobia on a universal form until 1984 in the South Atlantic.
2) Headboat discards. Data are available from the SRHS since 2004. Review whether they are reliable for use, and determine if there are other sources of data prior to 2004 that could be used as a proxy to estimate headboat discards.
3) Use of new MRIP FES/APAIS/FHS calibrations
4) Usefulness of historical data sources such as the Fishing, Hunting, and Wildlife-Associated Recreation Survey (FHWAR) to generate estimates of landings prior to 1981. Review whether other data sources are also available.
5) Evaluate adequacy of available data and discuss the use of new recreational Cobia data sets
6) Provide estimates of uncertainty around each set of landings and discard estimates
7) Provide length and age distributions for both landings and discards if feasible.
8) Review, evaluate, and report on the status and progress of all research recommendations listed in the last assessment,

4.1.3 South Atlantic Fishery Management Council Cobia Group Management Boundaries



4.2 Review of Working Papers

SEDAR58-DW01, *Analyses and applications of Cobia length-age data collected by Virginia Marine Resources Commission between 1999 and 2018.*

Atlantic Cobia (Rachycentron canadum) are an economically important species that have become increasingly popular amongst recreational anglers in Virginia. Since 1999, Virginia Marine Resources Commission (VMRC) has collected biological data from the recreational Cobia fishery in order to provide length-age information for future stock assessments. The precision of length-age estimates depend on the sample size (Quinn and Deriso 1999), however, the conventional collection method provides few Cobia. In order to increase the sample size of Cobia length-age data, VMRC has been collecting Cobia carcass donations (including the carcasses from Cobia tournaments) from recreational anglers through the marine sportfish collection program since 2007. Because the carcass donation program is not designed to sample randomly and fishermen donate the carcasses more or less opportunistically, the Cobia Data workshop has raised concerns on whether or not Virginia length data from carcass donations may represent the catch and be used in the future stock assessment. Therefore, it is important that the concern should be addressed properly before the data can be used. The primary goal of this study is to find out if the carcass donations have introduced biases into the length distributions toward either smaller or larger fish compared to those fish collected randomly. The specific objectives are: 1) Compare Virginia length frequency distributions collected by VMRC from the recreational and commercial fisheries to those collected by MRIP; 2) compare the mean lengths between the cobia collected randomly by VMRC and donated by Virginia recreational fishermen; 3) compare year effect on the mean lengths of cobia collected VMRC from 1999 to 2018; 4) examine cohort progressions in the landing age distributions developed using Virginia ALKs and Virginia harvest estimated by MRIP; and 5) compare length distributions between Virginia and other Atlantic states.

SEDAR58-DW07, *SCDNR Charterboat Logbook Program Data, 1993-2017*

The South Carolina Department of Natural Resources (SCDNR) charterboat logbook program was used to develop indices of abundance for Cobia from 1998-2017. The indices of abundance are standardized catch per unit effort (CPUE; catch per angler hour). A delta-lognormal GLM was used to produce annual abundance estimates for Cobia. The index is meant to describe the population trends of fish caught by charter vessels (6-pack) operating in or off of South Carolina.

SEDAR58-DW10, *Estimates of Historic Recreational Landings of Cobia in the Atlantic Using the FHWAR Census Method.*

The Fishing, Hunting, and Wildlife-Associated Recreation Survey (FHWAR) method utilizes a combination of information including U.S. angler population estimates and angling effort estimates from 1955 – 1985 FHWAR, along with estimates of recreational effort and landings from the MRIP 1981 – 1985. The FWHAR method also used both sources of information to adjust for recall bias, an issue that must be addressed when considering using the FHWAR Survey for historical recreational landings. By using data from FHWAR and the MRIP to calibrate this adjustment, the effect of the 12-month angler recall period is reduced. The historical landings of cobia that were calculated using this method show a gradual increase from 1955 to 1980. The FHWAR method could be used for other species by adjusting the geographic range of the FHWAR surveys to match management boundaries and the associated MRIP catch and effort data for a particular species.

SEDAR58-RD28, *Status of the South Carolina fisheries for cobia*

The cobia has been a recognized and desired gamefish among recreational fishermen in South Carolina since the 1960's. Throughout the majority of the state's coast very few recreational anglers actually target cobia. However, in the last decade, the recreational fishery for cobia has undergone an exponential growth in Beaufort County. It is usually taken as a fish of opportunity, where one is seen at the surface and then targeted. When targeted, anglers pursue cobia by fishing at buoys located at the mouths of bays, coastal shipwrecks and coastal artificial reefs. Only in Port Royal Sound and to a lesser extent Calibogue and St. Helena Sounds, all in Beaufort County, are adult cobia regularly found in inshore waters. This inshore spring run begins in April and can last into July. This inshore movement of cobia has come to support a major spring recreational fishery in Beaufort County.

SEDAR58-RD42, *Model-estimated conversion factors for calibrating Coastal Household Telephone Survey (CHTS) charterboat catch and effort estimates with For-Hire Survey (FHS) estimates in the Atlantic and Gulf of Mexico with application to red grouper and greater amberjack.*

In July 2018, NOAA Fisheries released new recreational catch estimates for all species and all modes, including charter mode estimates. As a result, the Southeast Fisheries Science Center (SEFSC) conducted an analysis using the newly released data to correct for the charter effort change from the Coastal Household Telephone Survey (CHTS) to the For-Hire Survey (FHS). The present analysis uses a statistically sound, consistent methodology to provide improved calibrations for estimating FHS charterboat effort and landings with associated uncertainties from CHTS estimates. Estimates based on these calibrations are calculated for all sub-regions and years in which only CHTS estimates are available, producing a consistent time series of FHS estimates across all years of recreational data collection.

The working group reviewed the working papers SEDAR58-DW01, SEDAR58-DW07 and SEDAR58-RD28 describing additional available data sources. Authors gave presentations to describe survey methods and data available from the SCDNR charterboat logbook, SC Finfish Survey, VMRC carcass program and VMRC Cobia recreational data application. These working papers were used to determine which data sets should be included in the recreational data and all decisions were presented in plenary sessions. Final outcomes are shown in section 4.3.4 Potential Sources for Additional Landings Data. SEDAR58-DW10 served as a reference for a method used in previous SEDARs for estimating historical landings. SEDAR58-RD-42 documents an update to the method used to calibrate the MRIP charter estimates for the change to the For-Hire Survey.

4.3 Recreational Landings

4.3.1 Marine Recreational Information Program (MRIP)

Introduction

The Marine Recreational Information Program (MRIP), formerly the Marine Recreational Fisheries Statistics Survey, conducted by the NOAA Fisheries (NMFS) provides estimated catch per unit effort, total effort, landings, and discards for six two-month periods (waves) each year. MRIP provides estimates for three main recreational fishing modes: shore-based fishing (SH), private and rental boat fishing (PR), and for-hire charter and guide fishing (CH). MRIP also provides estimates for headboat mode (HB) in the mid and north Atlantic regions. MRIP covers coastal Atlantic states from Maine to Florida. Sampling is not conducted in Wave 1 (Jan/Feb) north of Florida because fishing effort is very low or non-existent, with the exception of NC, where wave 1 has been sampled since 2006. When the survey first began in Wave 2 (Mar/Apr), 1981, headboats were included in the for-hire mode, but were excluded after 1985 to avoid overlap with the Southeast Region Headboat Survey (SRHS) conducted by the NMFS Beaufort, NC lab.

Until 2013, recreational catch, effort, and participation were estimated through a suite of independent but complementary surveys. Effort data were collected using two telephone surveys: (1) the Coastal Household Telephone Survey (CHTS) which used random digit dialing of coastal households to obtain detailed information about the previous two months of recreational fishing trips from the anglers and (2) the weekly For-Hire Survey which interviews charterboat operators (captains or owners) to obtain the trip information with only one-week recall period.

In the Atlantic coast charter effort estimation changed in 2004 from the CHTS to the FHS. In order to maintain a consistent time series of charter estimates, charter estimates were calibrated on the Atlantic coast prior to 2004 (SEDAR58-RD42). Figure 4.12.1 shows the CHTS and calibrated FHS charter catch estimates for Atlantic cobia from 1981 to 2003.

Catch data are collected through dockside angler interviews in the Access Point Angler Intercept Survey (APAIS), which samples recreational fishing trips after they have been completed. Catch rates from dockside intercept surveys are combined with estimates of effort from telephone interviews to estimate total landings and discards by wave, mode, and area fished (inland, state, and federal waters). Catch estimates from early years of the survey are highly variable with high proportional standard errors (PSE's), and sample size in the dockside intercept portion have been increased over time to improve precision of catch estimates.

In 2013, MRIP implemented a new Access Point Angler Intercept Survey to remove sources of potential bias from the sampling process. Then, in 2015, MRIP launched a new household Fishing Effort Survey to improve efficiency and minimize the risk of error in private boat and shore effort estimates (NOAA Fisheries 2018). Figure 4.12.2 shows the calibrated APAIS and FES catch estimates for Atlantic cobia from 1981 to 2017. Full documentation on improved survey methods and calibrations are available on the MRIP website at: https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

Coverage overlap with the Southeast Region Headboat Survey

In the South Atlantic, 1981-1985 MRIP charter and headboat modes were combined into one single mode for estimation purposes. Since the NMFS Southeast Region Headboat Survey (SRHS) began in this region in 1981, the MRIP combined charter/headboat mode must be split in order to not double the estimated landings from the headboat mode for these years. MRIP charter/headboat mode was split in these years by using a ratio of SRHS headboat angler trip estimates to MRIP charterboat angler trip estimates for 1986-1990. The mean ratio was calculated by state (or state equivalent to match SRHS areas to MRIP states) and then applied to the 1981-1985 estimates to strip out the headboat component when needed.

For cobia, which is considered a high profile species in headboat catch, the SRHS estimates will start in 1981 since captains were more likely to include this species as a write-in. Cobia MRIP charter/headboat mode was split for all years 1981-1985 and the headboat component was deleted from the MRIP dataset to avoid duplication with the SRHS.

Weight estimation

The Southeast Fisheries Science Center used the MRIP sample data to obtain an average weight by strata using the following hierarchy: species, region, year, state, mode, wave, and area (SEDAR32-DW-02). The minimum number of weights used at each level of substitution is 30 fish, except for the final species level, where the minimum is 1 fish. Average weights are then multiplied by the landings estimates in numbers to obtain estimates of landings in weight. These estimates are provided in pounds whole weight.

Catch Estimates

Final MRIP landings estimates are shown in tables 4.11.1 and 4.11.2 by year and mode and in Figure 4.12.3. Estimates are shown for the Atlantic coast, Georgia and north. There is an increase in landings over the last 10-15 years. Recreational Workgroup anglers point to an increase in angler effort, technology and social media.

4.3.2 Southeast Region Headboat Survey (SRHS)

Introduction

The Southeast Region Headboat Survey estimates landings and effort for headboats in the South Atlantic and Gulf of Mexico. The Headboat Survey was started in 1972 but only included vessels from North Carolina and South Carolina until 1975. In 1976 the survey was expanded to northeast Florida (Nassau-Indian River counties) and Georgia, followed by southeast Florida (St. Lucie-Monroe counties) in 1978. For SEDAR58, only data from Georgia north through North Carolina were included. Due to headboat area definitions and confidentiality issues, Georgia and South Carolina landings must be combined. The portion of the SRHS covering Georgia through North Carolina generally include 30-35 vessels participating in the area annually.

The Headboat Survey incorporates two components for estimating catch and effort. 1) Information about the size of fish landed are collected by port samplers during dockside sampling, where fish are measured to the nearest mm and weighed to the nearest 0.01 kg. These data are used to generate mean weights for all species by area and month. Port samplers also collect otoliths for ageing studies during dockside sampling events. 2) Information about total catch and effort are collected via the logbook, a form filled out by vessel personnel and containing total catch and effort data for individual trips. These logbooks are summarized by vessel to generate estimated landings by species, area, and time strata.

The headboat logbook was changed several times during the early years of the Headboat Survey. In the case of cobia, the logbook used in North Carolina and South Carolina did not list cobia until 1984. Georgia and Florida had a mix of the different versions in use from 1980 to 1983. The Headboat Survey did not have a universal logbook form that included cobia for all areas until 1984. However, cobia were routinely written in by captains, which was evident by examining numerous logbooks from 1980 to 1983. The write-ins may be attributed to the fact that cobia are considered a high profile species in headboat catches. Another consideration regarding this issue, cobia estimated headboat landings are consistent coast wide from 1981-1983.

Issue 1: From 1981-1983 cobia was only listed on 1 of 3 versions of the Headboat Survey logbook form being used in the South Atlantic.

Option 1: Start headboat time series in 1984 when a universal form was in use in all areas from NC- FL. MRIP headboat landings will be used 1981-1983.

Option 2: Use estimated headboat landings based on available logbook data 1981- 2017.

Decision: Option 2

Note: Because of the inconsistencies in the form in the early years, the Indices Group determined that for the index of abundance analysis, 1991 would be the most appropriate year to start the time series in order to avoid any potential bias.

Catch Estimates

Final SRHS landings estimates are shown in Table 4.11.3. and Figure 4.12.4.

4.3.3 Historic Recreational Landings

Introduction

The historic recreational landings time period is defined as pre-1981 for the charterboat, headboat, private boat, and shore fishing modes, which represents the start of the Marine Recreational Fisheries Statistics Survey (MRFSS) and availability of landings estimates for cobia. The Recreational Working Group was tasked with evaluating historical sources and methods to compile landings of cobia prior to the available time series of MRFSS and headboat estimated landings. It was decided to use a method approved in previous SEDARs, which is the FHWAR method.

FHWAR census method

The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey presented summary tables of U.S. population estimates, along with estimates of hunting and fishing participation and effort from surveys conducted by the USFWS every 5 years from 1955 to 1985 (Table 4.11.4). This information was used to develop an alternative method for estimating recreational landings prior to 1981.

The two key components from these FHWAR surveys that were used in the census method were the estimates of U.S. saltwater anglers and the estimates of U.S. saltwater days. The first objective was to determine the total saltwater anglers and saltwater days from New England to the South Atlantic (NE-SA) by using the summary information of U.S. anglers and U.S. saltwater anglers from the FHWAR surveys. The ratio of U.S saltwater anglers to the total U.S anglers was applied to the total number of anglers for the NE-SA to yield the total saltwater anglers for NE-SA. The same method was used to calculate the total saltwater days for the NE-SA from the FHWAR surveys 1955-1985.

In the FHWAR surveys the South Atlantic included the entire state of Florida, east and west coasts. In order to address the management boundaries for cobia the saltwater angler days for Florida's east and west coasts (FLE & FLW) had to be separated from the NE-SA saltwater angler days using the ratio of the MRFSS total angler trips for FL to the MRFSS total angler trips for the Atlantic (Delaware to FLW). The average ratio from 1984-1986 was applied to the total saltwater days for the NE-SA 1955-1985 to remove FL effort.

Similar to the Saltwater Angling Survey (SWAS), there was a 12 month recall period for respondents, which resulted in greater reporting bias. Research concluded this bias resulted in overestimates of both the catch and effort estimates in the FHWAR surveys from 1955 to 1985. Consequently, an adjustment for recall bias was necessary. The total saltwater days for the NE-GA 1955-1985 were adjusted for recall bias in the FHWAR surveys. The MRFSS total angler trips for the SA 1984 to1986 was averaged and divided by the total saltwater days for 1985 from the FHWAR survey. This multiplier was then applied to the total NE-GA saltwater days 1955-1985 to adjust for recall bias.

The mean CPUE for cobia in the Atlantic from the MRIP estimates from 1981 to 1985 was then applied to the adjusted saltwater angler days for the NE-GA 1955-1985 to estimate the historical cobia landings for those years (Table 4.11.4). During group discussions there was agreement that Cobia was not frequently targeted prior to 1970 and CPUE was expected to be very low.

Issue: Available historical cobia landings limited 1950-1980.
Option 1: Use available recreational time series for the MRFSS\MRIP and headboat estimates 1981-2010.
Option 2: Estimate cobia landings using the FHWAR method. Total cobia landings using the FHWAR census method (South Atlantic 1955-1980) are presented with the total estimated cobia landings (MRIP and SRHS landings) (South Atlantic 1981-2017) in Table 4.11.5 and Figure 4.12.5.
Decision: *Option 2*

4.3.4 Potential Sources for Additional Landings Data

SCDNR Charterboat Logbook Program Data, 1993 – 2017
The Recreational Fisheries Working Group discussed the possibility of replacing the MRIP charter mode estimates for South Carolina from 1993 to 2017 with the SCDNR Charterboat Logbook Program estimates. The SCDNR Charterboat Logbook Program is a mandatory trip-level reporting system, with compliance tracked monthly. Failure to comply with reporting requirements can result in a misdemeanor. These data ideally represent total catch and effort of 6-pack charter trips off South Carolina, however, the data is self-reported, with limited field validation. SCDNR charterboat logbook data were compared with MRIP charter mode estimates (Figure 4.12.6). The Recreational Fisheries Working Group recommended using the MRIP charterboat estimates instead of the SCDNR Charterboat Logbook Program estimates for 1993 – 2017. The MRIP estimates represent a longer time series and concern was expressed that replacing

the MRIP dataset with the SCDNR Charterboat logbook dataset would disrupt the continuity of the time series and would only replace landings for one state (SC) and one mode (charter). Additionally, since MRIP estimates are currently used to monitor annual catch limits (ACLs), it is recommended to use these estimates for the recreational landings data.
Recommendation: Use MRIP for charter mode landings coast-wide.

Virginia Marine Resources Commission Recreational Cobia Permit Landings
In 2016, the Virginia Marine Resources Commission (VMRC) developed a recreational cobia permit to monitor effort and landings of cobia in Virginia. The permit is required for the captain or operator of the vessel if they intend to possess or land cobia in Virginia. All permittees must report trip and catch level data on a weekly basis online through the VA Saltwater Journal, the VA Saltwater Journal App or on paper forms provided by the Commission. Permittees are required to report the number of fish kept, the number of fish released, the number of individuals on board, trip date, type of trip (Charter/Private), and mode of fishing (e.g. shore, pier, vessel, kayak). Permittees may also report the length and weight of individual fish caught on each trip. All reports of no activity or no catch are required no later than 21 days after the end of the recreational cobia season. Recreational reporting was voluntary in 2016 and became mandatory in 2017. Total recreational reported landings in 2017 from the private and charter fleet was 3,104 fish. Using the recreational reporting rate in 2017 (70.2%), the total expanded landings for the recreational fleet was 4,421 fish. Recreational reported landings through Virginia's cobia permit program should not be included in the SEDAR 58 stock assessment but may be used in later assessments as the program is further developed.

4.4 Recreational Discards

4.4.1 MRIP discards

Discarded live fish are reported by the anglers interviewed by MRIP so both the identity and quantities reported are unverified. Discarded fish size is unknown for all modes of fishing covered by MRIP. At-sea sampling of headboat discards was initiated as part of the improved for-hire surveys to characterize the size distribution of live discarded fishes in the headboat fishery, however, the SRHS produces estimates of total discards in the headboat fishery since that class of caught fish was added to the logbook (2004). All estimates of live released fish (B2 fish) in charter or charterboat/headboat combined mode were adjusted in the same manner as the landings (calibration factors, substitutions, etc. described above in section 4.3.1). Size or weight of discarded fishes is not estimated by the MRIP. Final MRIP discard estimates are shown in Table 4.11.6 by year and mode and in Figure 4.12.7. Discards increased in the last two years due to the federal closure.

4.4.2 Headboat Logbook Discards

The Southeast Region Headboat Survey logbook form was modified in 2004 to include a category to collect self-reported discards for each reported trip. This category is described on the form as the number of fish by species released alive and number released dead. Port agents instructed each captain on criteria for determining the condition of discarded fish. A fish is considered “released alive” if it is able to swim away on its own. If the fish floats off or is obviously dead or unable to swim, it is considered “released dead”. These self-reported data are currently not validated within the Headboat Survey. Due to low cobia sample sizes in the At-Sea Observer Headboat program, it was determined that the logbook discard data would be used from 2004-2017 (Table 4.11.7). The MRIP charter mode, MRIP private mode, and mean MRIP CH:SRHS discard ratio method used in SEDAR 28 (SEDAR 28-Assessment Workshop Report, 2013) were considered as sources for proxy discard estimates for headboat discards 1981-2003.

Issue 1: Proxy for estimated headboat discards from 1981-2003.

Option 1: Apply the MRFSS private boat discard:landings ratio to estimated headboat landings in order to estimate headboat discards from 1981-2003.

Option 2: Apply the MRFSS charterboat discard:landings ratio to estimated headboat landings in order to estimate headboat discards from 1981-2003.

Option 3: Mean MRIP CH:SRHS discard ratio method: Calculate the ratio of the mean ratio of SRHS discard:landings (2004-2017) and MRIP CH discard:landings (2004-2017). Apply this ratio to the yearly MRIP charterboat discard:landings ratio (1981-2003) in order to determine the yearly SRHS discard:landings ratio (1981-2003). This ratio is then applied to the SRHS landings (1981-2003) in order to estimate headboat discards (1981-2003).

Option 4: Assume negligible discards of cobia prior to 2004.

Decision: *Option 4.* The MRIP private mode discard ratio did not agree with the SRHS discard ratio and was not recommended for use (Figure 4.12.8). The MRIP charterboat discard ratio followed a similar pattern to the SRHS discards in the later years, but at a higher scale and with increased variability, therefore it was not recommended for use. The SEDAR Best Practice method (mean MRIP CH:SRHS discard ratio method) scaled the MRIP CH discard ratio to the SRHS landings, however it was impacted by the variability of the MRIP CH discard estimates and therefore was not recommended for use. Due to the extremely low catch and discards of cobia in the headboat fishery, it is recommended to assume negligible discards of cobia prior to 2004 (Figure 4.12.9). The final estimated headboat discards 2004-2017 are presented in Figure 4.12.10 along with the proxy discard estimates.

4.4.3 Headboat At-Sea Observer Survey Discards

An observer survey of the recreational headboat fishery was launched in NC and SC in 2004 and in GA and FL in 2005 to collect more detailed information on recreational headboat catch, particularly for discarded fish. Headboat vessels are randomly selected throughout the year in each state. Biologists board selected vessels with permission from the captain and observe anglers as they fish on the recreational trip. Data collected include number and species of fish landed and discarded, size of landed and discarded fish. Data are also collected on the length of the trip, area fished (inland, state, and federal waters) Forty-five cobia catch records were collected between 2004-2017 from NC, SC, and GA. Of these records only 28 included observed cobia discards. Due to low cobia sample sizes the At-Sea Observer data was not used in this assessment.

4.4.4 Virginia Marine Resources Commission Cobia Permit Reporting

Recreational Cobia Permit Discards

The VMRC recreational cobia permit requires the captain or operator of the vessel to report all activity, including the number of fish discarded. In 2016 recreational reporting was voluntary and sample size was low. A total of 92 fish were reported discarded in the charter and private boat modes combined. In 2017, a total of 9,005 cobia were reported as discarded from the charter and private fleet combined. Using the recreational reporting rate in 2017 (70.2%), the total expanded discards for the recreational fleet was 12,827 fish. This estimate potentially does not account for unpermitted, incidental catch. The total number of recreational reported discards through Virginia's cobia permit program was not recommended for inclusion due to the limited time series. However, the available discards lengths could potentially be used to characterize the discard length composition in Virginia.

4.5 Biological Sampling

4.5.1 Sampling Intensity Length/Age/Weight

MRIP Charter, Private, and Shore

The MRIP angler intercept survey includes the collection of fish lengths from the harvested (landed, whole condition) catch. Up to 15 of each species landed per angler interviewed are measured to the nearest mm along a centerline (defined as tip of snout to center of tail along a straight line, not curved over body). In those fish with a forked tail, this measure would typically be referred to as a fork length, e.g., cobia, and in those fish that do not have a forked tail it would typically be referred to as a total length with the exception of some fishes that have a single, or few, caudal fin rays that extend further. Weights are typically collected for the same fish measured although weights are preferred when time is constrained. Ageing structures and other biological samples are not collected during MRIP assignments because of concerns over the introduction of bias to survey data collection.

The number of cobia measured in the Atlantic coast (Georgia and north) in the MRIP charter fleet, private-rental mode, and shore mode are summarized by year and state in tables 4.11.8, 4.11.9, and 4.11.10, respectively. The number of angler trips with measured or weighed cobia along the Atlantic coast (Georgia and north) in the MRIP charter fleet, private-rental mode, and shore mode are summarized by year and state in tables 4.11.11, 4.11.12, and 4.11.13, respectively. Dockside mean weights of cobia weighed from MRIP in the Atlantic coast (Georgia and north) are tabulated for 1981-2017 in Table 4.11.14. There was an increase in average weight over the last 5 years (up to 38lb in 2015) which coincided with an estimated weight of 40 lbs from fisherman at the data workshop.

Headboat Survey Biological Sampling

Lengths were collected from 1972 to 2017 by headboat dockside samplers. From 1972 to 1975, only North Carolina and South Carolina were sampled whereas Georgia and northeast Florida were sampled beginning in 1976. The Southeast Region Headboat Survey conducted dockside sampling southeast portion of the US from the NC-VA border through the Florida Keys beginning in 1978. Weights are typically collected for the same fish measured during dockside sampling. Also, biological samples (scales, otoliths, spines, stomachs, and gonads) are collected routinely and processed for aging, diet studies, and maturity studies.

Annual numbers of cobia measured for length in the headboat fleet and the number of trips from which cobia were measured are summarized in Table 4.11.15. Dockside mean weights for the headboat fishery are tabulated for 1978-2017 in Table 4.11.16.

Any existing total length measurements without an associated fork length measurement were converted using the following equation derived by the Life History Working Group for the Atlantic stock at the SEDAR 58 data workshop:

FL = 8.19 + 0.88TL (N = 5672, R^2 = 0.99)

SCDNR State Finfish Survey (SFS)

Cobia lengths were collected through the SCDNR State Finfish Survey (SFS) from 1988 to 2017. The SFS collects finfish intercept data in South Carolina through a non-random intercept survey at public boat landings along the SC coast. The survey focuses on known productive sample sites, targets primarily private boat mode, and is conducted year-round (January- December) from inception through 2013, at which time SFS was only conducted in wave 1 (January and February). The survey uses a questionnaire and interview procedure similar to the intercept portion of the MRIP survey. From 1988 through March 2009, mid-line lengths were measured, and from April 2009 to 2017, total lengths were measured. A total of 427 cobia lengths were collected by SFS personnel. The Recreational Fisheries Working Group recommended the SCDNR SFS length data for all modes be used to supplement the MRIP length data for length compositions. It was decided to omit length frequencies obtained in 1988 from SFS due to a potential for data overlap between SFS and MRIP surveys, resulting in 1992 being the first representative year for this data series. A total of two data points were omitted from the SFS survey. Total length measurements from 2009-2017 were converted to fork length measurements using the following equation derived by the Life History Working Group for the Atlantic stock at the SEDAR 58 data workshop:

FL = 8.19 + 0.88TL (N = 5672, R^2 = 0.99)

Summarized length data from 1992 – 2017 can be found in Table 4.11.17.

VMRC Recreational Cobia Permit Discards

In 2016, a total of 89 cobia lengths were recreationally reported as discarded from the charter and private modes combined. The smallest discarded cobia is 482 mm total length and the largest discarded cobia is 1,422 mm total length. The average size of discarded cobia in 2016 is 964 mm total length. In 2017, a total of 1,635 cobia lengths were recreationally reported as discarded from the charter and private modes combined. The smallest discarded cobia is 406mm and the largest discarded cobia is 1,778 mm. The average size of discarded cobia in 2017 is 898 mm total length. The available discards lengths could potentially be used to characterize the discard length composition of the shore, charter, and private modes in Virginia.

Aging data

Age samples are collected as part of the SRHS sampling protocol. Age samples collected from the private/rental boat, charterboat, and shore modes are not typically collected as part of the MRIP sampling protocol. These samples come from a number of sources including state agencies, special projects, and sometimes as add-ons to the MRIP survey. The number of cobia aged from the recreational fishery (mode unknown) by year and state is summarized in Table 4.11.18. In some cases mode of catch was either not recorded or the samples were taken from freezers or coolers left outside of fishing centers or marinas and trip information was not collected. Therefore the number of trips with aged samples was not reported in any mode.

4.6 Recreational Effort

4.6.1 MRIP Recreational & Charter Effort

Effort estimation for the recreational fishery surveys are produced via the Fishing Effort Survey (FES) for private/rental boats and shore mode and the For-Hire Survey (FHS) for charterboat mode. The methods have changed during the full time series (see section 4.3 for descriptions of survey method changes and adjustments to survey estimates for uniform time-series of catch estimates). Angler trip estimates are tabulated in Tables 4.11.19 by year and mode. An angler-trip is a single day of fishing in the specified mode, not to exceed 24 hours. Figure 4.12.11 shows MRIP angler trips for Atlantic coast states, Georgia and north.

4.6.2 Headboat Effort

Catch and effort data are reported on logbooks provided to all headboats in the Survey. These forms are completed by the captain or designated crew member after each trip and represent the total number and weight of all the species kept, along with the total number of fish discarded for each species. Data on effort are provided as number of anglers on a given trip. Numbers of anglers are standardized, depending on the type of trip (length in hours), by converting number of anglers to "angler days" (e.g., 40 anglers on a half-day trip would yield 40 * 0.5 = 20 angler days). Angler days are summed by month for individual vessels. Each month, port agents collect these logbook trip reports and check for accuracy and completeness. Although reporting via the logbooks is mandatory, compliance is not 100% and is variable by location. To account for non-reporting, a correction factor is developed based on sampler observations, angler numbers from office books, and any available information. This information is used to provide estimates of total catch by month and area, along with estimates of effort.

Estimated headboat angler days have decreased in the South Atlantic in recent years (Table 4.11.20 and Figure 4.11.12). The most obvious factor which impacted the headboat fishery in both the Atlantic and Gulf of Mexico was the high price of fuel. This coupled with the economic down turn starting in 2008 has resulted in a marked decline in angler days in the South Atlantic headboat fishery. Reports from industry staff, captains\owners, and port agents indicated fuel prices, the economy and fishing regulations are the factors that most affected the amount of trips, number of passengers, and overall fishing effort.

4.7 Comments on adequacy of data for assessment analyses

Regarding the adequacy of the available recreational data for assessment analyses, the RWG discussed the following:

- Landings, as adjusted, appear to be adequate for the time period covered.
- Size data appear to adequately represent the landed catch for all modes.

4.8 Itemized list of tasks for completion following workshop

Length and age compositions will be completed before the Assessment Workshop.

4.9 Research Recommendations

4.9.1 Evaluation and progress of research recommendations from last assessment

Research recommendations from SEDAR 28 were evaluated and progress on each item is outlined below:

1) Increase proportion of fish with biological data within MRFSS sampling.
    a) Efforts are ongoing to collect more biological data such as length and weight for fish sampled within MRIP.
2) Continue to develop methods to collect a higher degree of information on released fish (length, condition, etc.) in the recreational fishery.
    a) In 2016, Virginia developed a Cobia permit data application that specifically collects information on released fish. Full description of this program can be found in section 4.3.4.
    b) North Carolina is also working on a coast-wide discard application that could provide information in the future.
3) Require mandatory reporting for all charterboats state and federal.
    a) Establishment of federal logbooks for charter captains that have valid federal finfish permits is pending approval and implementation is expected in summer of 2019.
    b) State logbook are still a work in progress with no current actions pending.
4) Continue development of electronic mandatory reporting for for-hire sector.
    a) Southeast For-Hire Integrated Electronic Reporting (SEFHIER) is currently working to provide more robust for-hire data that is timely and can be integrated with existing programs.
5) Continued research efforts to incorporate/require logbook reporting from recreational anglers.
    a) Two applications that have been created and are currently used by the recreational fishery along the Atlantic coast are My Fish Count and VA cobia permit. There is one pending application from North Carolina that will be a coast-wide application for released fish.
6) Establish a review panel to evaluate methods for reconstructing historical landings (SWAS, FWS, etc.).
    a) FHWAR method was reviewed by assessment panels and established as "Best Practice" in SEDAR Data Best Practices procedural workshop.
7) Quantify historical fishing photos for use in reconstructing recreational historical landings.
    a) SAFMC FIS funded 2018-2019
8) Narrow down the sampling universe. Identify angler preference and effort. Require a reef fish stamp for anglers targeting reef fish, pelagic stamp for migratory species, and deep water complex stamp for deep-water species. The program would be similar to the federal duck stamp required of hunters. This would allow the managers to identify what anglers were fishing for.
    a) National Saltwater Angler Registry
    b) VA cobia permit
9) Continue and expand fishery dependent at-sea-observer surveys to collect discard information, which would provide for a more accurate index of abundance.
    a) Continued in Atlantic but expansion is funding limited

4.9.2 Research recommendations

1) Improve recreational reporting applications –
    a) Standardized across states (i.e., Harbor Light Scamp app, My Fish Count app).
    b) Capable of capturing length with photo.
2) Standardize carcass collection protocols across states.
3) Increase recreational biological sampling (i.e., NC, GA).
4) Increase citizen Science involvement in tagging and tissue collection efforts.

4.10 Literature Cited

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4.11 Tables

Table 4.11.1. Atlantic coast (Georgia and north) cobia landings (numbers of fish and whole weight in pounds) for charterboat mode and charterboat/headboat mode (MRIP). CH and CH/HB mode adjusted for FHS conversion prior to 2004. CH/HB mode landings are from the Mid-Atlantic (sub-region 5) through 2003. After 2004 CH and HB modes are estimated separately in these sub-regions.

	Estimated CH Landings			Estimated CH/HB Landings		
YEAR	Number	CV	Pounds	Number	CV	Pounds
1981						
1982						
1983				6	0.00	175
1984	306	0.00	8,095			
1985	1,371	0.00	36,315	1,470	0.00	30,021
1986	1,850	0.00	49,020	284	0.00	8,535
1987	1,270	0.14	25,738			
1988	2,289	0.50	60,634			
1989	1,243	0.00	28,779	147	0.00	4,413
1990	1,594	0.00	30,089			
1991	2,327	0.00	49,835	170	0.01	5,122
1992	2,091	0.22	46,772			
1993	7,065	0.62	160,986			
1994	542	0.40	14,098	0	0.00	-
1995	3,064	0.20	97,065			
1996	3,597	0.61	60,728			
1997	574	0.00	16,986			
1998	1,240	0.31	49,435			
1999	817	0.00	24,238			
2000	498	0.46	13,984			
2001	1,297	0.23	31,659			
2002	1,853	0.12	50,689	3	0.00	104
2003	3,520	0.29	98,712	1	0.00	24
2004	3,306	0.37	103,088			
2005	1,957	0.45	56,996			
2006	823	0.31	21,106			
2007	2,833	0.00	75,931			
2008	885	0.51	24,475			
2009	820	0.35	18,682			
2010	3,167	0.25	101,689			
2011	557	0.28	21,814			
2012	564	0.02	17,410			
2013	3,010	0.03	75,319			
2014	2,109	0.12	55,709			
2015	2,473	0.23	76,530			
2016	3,694	0.32	118,920			
2017	1,209	0.26	40,872			

Table 4.11.2. Atlantic coast (Georgia and north) cobia landings (numbers of fish and whole weight in pounds) for private/rental boat mode and shore mode (MRIP).

	Estimated PR Landings			Estimated SH Landings		
YEAR	Number	CV	Pounds	Number	CV	Pounds
1981	2,631	0.00	73,051			
1982	11,196	0.02	296,597			
1983	1,611	0.00	42,670	0	0.00	0
1984	17,136	0.00	453,950	0	0.00	0
1985	12,706	0.12	314,658	0	0.00	0
1986	21,323	0.18	600,810	9,587	0.00	253,967
1987	5,898	0.06	125,737	17,585	0.00	356,453
1988	8,562	0.11	226,828	908	0.00	24,042
1989	16,959	0.25	427,494	3,234	0.39	74,905
1990	16,261	0.07	354,219	0	0.00	0
1991	11,352	0.21	288,972	7,291	0.39	156,122
1992	16,488	0.17	423,467	4,283	0.71	95,818
1993	6,668	0.06	188,731	1,804	0.00	41,100
1994	8,143	0.19	228,256	3,273	0.38	85,204
1995	20,406	0.46	619,786	3,912	0.07	123,933
1996	89,852	0.03	2,182,432	552	0.00	10,386
1997	13,382	0.07	399,009	4,674	0.00	140,494
1998	9,494	0.39	305,489	255	0.00	9,977
1999	21,346	0.51	635,678	1,469	0.00	43,591
2000	12,961	0.29	385,250	0	0.00	0
2001	9,699	0.39	276,039	424	0.00	10,353
2002	5,295	0.47	153,737	9,440	0.10	270,471
2003	47,537	0.53	1,347,668	793	0.00	22,252
2004	28,123	0.12	874,305	0	0.00	0
2005	31,221	0.40	922,669	24,007	0.08	717,807
2006	49,949	0.24	1,433,790			
2007	32,921	0.08	925,020	0	0.00	0
2008	24,544	0.03	695,791	3,195	0.00	91,728
2009	45,222	0.17	1,249,667	6,462	0.62	134,632
2010	44,851	0.14	1,468,536	2,453	1.00	81,505
2011	24,641	0.25	771,424	6,166	0.64	255,595
2012	27,400	0.04	846,529	18,287	0.00	549,691
2013	62,971	0.24	1,533,440	0	0.00	0
2014	45,441	0.25	1,255,332	4,688	0.00	121,997
2015	100,668	0.13	3,847,916	7,150	0.09	262,630
2016	57,191	0.04	1,805,571	14,810	0.00	502,403
2017	38,448	0.17	1,267,397	0	0.00	0

Table 4.11.3. Estimated headboat landings of cobia in the South Atlantic 1981-2017. Due to headboat area definitions and confidentiality issues, Georgia and South Carolina landings must be combined.

	Number			Pounds		
Year	NC	SCGA	South Atlantic	NC	SCGA	South Atlantic
1981	85		85	1,565		1,565
1982	37	13	50	644	227	871
1983	44	13	57	1,308	228	1,536
1984	43	25	68	1,077	626	1,702
1985	16	32	48	357	713	1,070
1986	53	55	108	910	821	1,731
1987	43	97	140	710	1,601	2,311
1988	82	82	164	1,984	1,796	3,780
1989	79	70	149	1,535	1,477	3,012
1990	154	49	203	4,403	1,319	5,721
1991	203	160	363	3,856	3,126	6,981
1992	201	101	302	4,505	2,231	6,737
1993	116	114	230	2,243	2,486	4,729
1994	180	118	298	3,512	2,300	5,812
1995	184	147	331	3,896	3,110	7,006
1996	46	76	122	1,347	2,192	3,540
1997	91	216	307	2,179	5,117	7,296
1998	51	200	251	1,286	4,907	6,193
1999	48	113	161	971	2,342	3,313
2000	66	141	207	1,397	2,985	4,382
2001	95	156	251	2,190	3,764	5,953
2002	75	197	272	1,739	4,428	6,167
2003	48	69	117	1,040	1,496	2,536
2004	82	125	207	2,552	3,843	6,395
2005	83	101	184	1,857	2,271	4,127
2006	40	96	136	808	1,925	2,734
2007	32	574	606	544	9,666	10,211
2008	32	203	235	775	6,136	6,911
2009	5	148	153	90	2,836	2,925
2010	20	116	136	492	3,036	3,527
2011	19	104	123	332	1,869	2,200
2012	25	112	137	343	1,513	1,855
2013	51	172	223	1,444	4,891	6,334
2014	78	157	235	2,068	4,535	6,604
2015	39	89	128	693	1,645	2,338
2016	31	53	84	520	906	1,426
2017	4		4	85		85

Table 4.11.4. FHWAR estimation method for historical cobia landings (1955-1985).

Year	US saltwater angler days	Proportion anglers NY-GA	Saltwater angler days (NY-GA)	Mean CPUE (MRFSS 1981-1985)	Recall bias adjustment	Adjusted saltwater angler days (NY-GA)	Adjusted cobia landings (n)
1955	58,621,000	0.32	6,046,942	0.0002	3.32	15,951,624	2,609
1960	80,602,000	0.29	7,712,294	0.0002	3.32	23,293,761	3,810
1965	95,837,000	0.33	10,201,818	0.0002	3.32	33,840,793	5,535
1970	113,694,000	0.33	12,305,878	0.0002	3.32	34,831,840	5,697
1975	167,499,000	0.33	17,679,316	0.0002	3.32	52,044,539	8,513
1980	164,040,000	0.32	16,783,303	0.0002	3.32	54,980,835	8,993
1985	171,055,000	0.33	18,099,435	0.0002	3.32	60,189,443	9,845

Table 4.11.5. Estimated cobia landings (number) using FHWAR census method (1955-1980), MRIP and SRHS (1981-2017) estimation methods.

Year	Est. landings (n)	Year	Est. landings (n)
1955	2,609	1987	24,893
1956	2,849	1988	11,923
1957	3,090	1989	21,732
1958	3,330	1990	18,057
1959	3,570	1991	21,504
1960	3,810	1992	23,164
1961	4,155	1993	15,766
1962	4,500	1994	12,256
1963	4,845	1995	27,713
1964	5,190	1996	94,123
1965	5,535	1997	18,938
1966	5,568	1998	11,241
1967	5,600	1999	23,794
1968	5,633	2000	13,665
1969	5,665	2001	11,672
1970	5,697	2002	16,864
1971	6,261	2003	51,969
1972	6,824	2004	31,635
1973	7,387	2005	57,370
1974	7,950	2006	50,908
1975	8,513	2007	36,360
1976	8,609	2008	28,859
1977	8,705	2009	52,657
1978	8,801	2010	50,607
1979	8,897	2011	31,487
1980	8,993	2012	46,387
1981	2,716	2013	66,204
1982	11,246	2014	52,472
1983	1,673	2015	110,419
1984	17,509	2016	75,779
1985	15,595	2017	39,661
1986	33,152		

Table 4.11.6. Atlantic coast (Georgia and north) cobia discards in numbers of fish for the recreational fishing modes by year (MRIP). CH and CH/HB mode adjusted for FHS conversion prior to 2004. CH/HB mode landings are from the Mid-Atlantic (sub-region 5) through 2003. After 2004 CH and HB modes are estimated separately in this sub-region.

	Estimated CH Discards		Estimated CH/HB Discards		Estimated HB Discards		Estimated PR Discards		Estimated SH Discards	
YEAR	Number	CV	Number	CV	Number	CV	Number	CV	Number	CV
1981	0	0.00					7,507	0.00		
1982	0	0.00					0	0.00		
1983	0	0.00	0	0.00			0	0.00	9,464	0.00
1984	0	0.00			0	0.00	0	0.00	6,108	0.00
1985	0	0.00	95	0.00	0	0.00	8,096	0.19	50,412	0.00
1986	0	0.00	0	0.00			9,112	0.00	0	0.00
1987	0	0.00					736	0.46	0	0.00
1988	229	1.00					6,044	0.23	0	0.00
1989	68	0.00	0	0.00			2,821	0.40	10,877	0.12
1990	0	0.00					9,102	0.20	1,855	0.00
1991	315	0.83	426	0.87			22,750	0.41	19,839	0.14
1992	55	0.00					7,419	0.17	7,260	0.33
1993	48	1.00					2,771	0.73	1,674	0.00
1994	21	1.00	778	0.00			12,145	0.14	19,234	0.04
1995	336	0.04					6,612	0.38	1,758	0.00
1996	153	0.57					5,336	0.39	536	0.00
1997	0	0					9,549	0.12	26,513	0.03
1998	933	0.20					16,683	0.30	10,570	0.00
1999	0	0.00					44,619	0.30	25,179	0.00
2000	1,638	0.61					11,844	0.44	12,471	0.00
2001	0	0.00					27,242	0.21	8,222	0.00
2002	66	1.00	20	0.00			26,193	0.13	9,344	0.22
2003	1,242	0.12	0	0.00			46,996	0.16	16,409	0.05
2004	5,766	0.99			38	0.00	26,219	0.09	4,057	0.00
2005	1,394	0.00					36,954	0.12	12,221	0.09
2006	458	0.58					53,641	0.10		
2007	121	0.00					41,542	0.10	8,652	0.00
2008	670	0.31					22,149	0.09	15,672	0.00
2009	961	0.80					51,407	0.12	35,669	0.32
2010	1,683	0.44					46,583	0.13	31,595	0.11
2011	595	0.38					77,698	0.11	30,021	0.15
2012	270	0.27			179	0.00	30,003	0.10	58,264	0.28
2013	1,169	0.30					66,796	0.33	12,180	0.00
2014	2,052	0.25					74,435	0.18	56,600	0.03
2015	539	0.45					73,195	0.15	24,092	0.00
2016	3,223	0.48					91,125	0.15	50,617	0.05
2017	3,742	0.07					160,939	0.31	53,899	0.00

Table 4.11.7. Estimated South Atlantic cobia discards for SRHS by year and state, 2004-2017. Discards are assumed to be negligible prior to 2004. Due to headboat area definitions and confidentiality issues, Georgia and South Carolina landings must be combined.

	NC		SCGA		South Atlantic	
Year	Released live (n)	Released dead (n)	Released live (n)	Released dead (n)	Released live (n)	Released dead (n)
2004	2	-	14	-	16	-
2005	-	-	10	-	10	-
2006	-	-	12	-	12	-
2007	-	-	36	-	36	-
2008	-	-	22	-	22	-
2009	5	-	157	1	162	1
2010	-	-	151	-	151	-
2011	3	-	28	-	31	-
2012	2	-	48	-	50	-
2013	4	-	63	-	67	-
2014	14	-	85	-	99	-
2015	1	-	71	-	72	-
2016	13	-	90	-	103	-
2017	27	-	124	-	151	-

Table 4.11.8. Number of cobia measured in the Atlantic (Georgia and north) in the MRIP charter fleet by year and state.

YEAR	GA	SC	NC	VA	MD	DE	NJ	TOTAL
1984		2						2
1985		3						3
1986	4		1	1	1			7
1987	15		5					20
1988	3	4	1					8
1989			3	1	1			5
1990			8					8
1991		1	3	2				6
1992	3	1	9					13
1993			14					14
1994			5					5
1995		2	13					15
1996		2	30					32
1997	1	2	8					11
1998		1	34					35
1999	4		6					10
2000		1	7					8
2001			10					10
2002	2	4	8	1				15
2003	1		19	1				21
2004	3	2	14					19
2005	1	1	12	1		1		16
2006	1	1	6				1	9
2007	5		5	1				11
2008	1	8	2					11
2009	2	1	3	4				10
2010	3	3	54	3	1			64
2011	1		23	1				25
2012	1	3	11	2				17
2013	1	1	12	8				22
2014	1	2	42	2				47
2015		6	43	5				54
2016		7	50	4	1			62
2017	1		24	4				29
TOTAL	54	58	485	41	4	1	1	644

Table 4.11.9. Number of cobia measured in the Atlantic (Georgia and north) in the MRIP private fleet by year and state.

YEAR	GA	SC	NC	VA	MD	NJ	TOTAL
1981			1	1			2
1982	3	2	1				6
1983	2						2
1984	3	3	2				8
1985	6	3	1	15			25
1986	3	5	5	9		1	23
1987	2		13	1			16
1988		4	15				19
1989	6	10	22	5			43
1990	1	5	35	6			47
1991		3	12	7	1		23
1992	4	4	12	10			30
1993			5	4			9
1994		1	15	10			26
1995			12	6			18
1996	1	5	10	12			28
1997		1	15	3			19
1998		3	6	5			14
1999		8	2	6	1		17
2000			5	7			12
2001	1		6	11			18
2002			9	3			12
2003		10	6	3	1		20
2004	2	4	14	3			23
2005			21	5			26
2006		2	10	5			17
2007	1	5	5	17			28
2008	9	1	4	6			20
2009		4	10	13			27
2010	4	4	36	14			58
2011	4		12	4			20
2012	6	8	10	1			25
2013	3	7	56	26			92
2014	3	6	24	13			46
2015	4	6	57	34			101
2016		7	17	31			55
2017			24	13			37
Total	68	121	510	309	3	1	1,012

Table 4.11.10. Number of cobia measured in the Atlantic (Georgia and north) in the MRIP shore mode by year and state.

YEAR	SC	NC	VA	NJ	TOTAL
1986		1			1
1987	1	2			3
1988		1			1
1989		3			3
1991		9			9
1992		3			3
1993		1			1
1994		2			2
1995		4			4
1996		1			1
1997			1		1
1998		1			1
1999		1			1
2001		1			1
2002		4	1		5
2003		1			1
2005		3	1		4
2008		1	1		2
2009		2			2
2010		1			1
2011		4			4
2012				1	1
2014		2			2
2015		7			7
2016		4			4
TOTAL	1	59	4	1	65

Table 4.11.11 Number of angler trips with measured or weighed cobia in the Atlantic (Georgia and north) in the MRIP charter fleet by year and state.

YEAR	GA	SC	NC	VA	MD	DE	NJ	TOTAL
1984		2						2
1985		3						3
1986	4		1	1	1			7
1987	11		5					16
1988	3	3	1					7
1989			3	1	1			5
1990			5					5
1991		1	3	1				5
1992	3	1	8					12
1993			7					7
1994			4					4
1995		1	10					11
1996		2	12					14
1997	1	2	5					8
1998		1	11					12
1999	4		3					7
2000		1	4					5
2001			9					9
2002	2	1	6	1				10
2003	1		12	1				14
2004	2	2	8					12
2005	1	1	4	1		1		8
2006	1	1	4				1	7
2007	4		4	1				9
2008	1	5	2					8
2009	1	1	3	4				9
2010	3	3	19	1	1			27
2011	1		12	1				14
2012	1	3	7	1				12
2013	1	1	6	1				9
2014	1	1	15	1				18
2015		5	20	2				27
2016		3	32	2	1			38
2017	1		10	2				13
TOTAL	47	44	255	22	4	1	1	374

Table 4.11.12. Number of angler trips with measured or weighed cobia in the Atlantic (Georgia and north) in the MRIP private fleet by year and state.

YEAR	GA	SC	NC	VA	MD	NJ	TOTAL
1981			1	1			2
1982	3	2	1				6
1983	1						1
1984	3	3	1				7
1985	3	3	1	12			19
1986	1	5	5	8		1	20
1987	2		13	1			16
1988		4	13				17
1989	5	8	19	5			37
1990	1	5	26	5			37
1991		3	12	4	1		20
1992	2	4	11	5			22
1993			5	4			9
1994		1	13	7			21
1995			11	6			17
1996	1	3	8	9			21
1997		1	11	3			15
1998		3	5	5			13
1999		6	2	5	1		14
2000			5	5			10
2001	1		6	8			15
2002			6	3			9
2003		9	6	3	1		19
2004	1	3	8	2			14
2005			9	5			14
2006		2	8	5			15
2007	1	3	5	14			23
2008	3	1	4	3			11
2009		3	10	13			26
2010	3	4	29	12			48
2011	4		7	4			15
2012	3	4	9	1			17
2013	2	5	32	20			59
2014	3	5	19	13			40
2015	4	4	33	27			68
2016		4	13	27			44
2017			18	12			30
TOTAL	47	98	385	257	3	1	791

Table 4.11.13. Number of angler trips with measured or weighed cobia in the Atlantic (Georgia and north) in the MRIP shore fleet by year and state.

YEAR	SC	NC	VA	NJ	TOTAL
1986		1			1
1987	1	2			3
1988		1			1
1989		3			3
1991		8			8
1992		3			3
1993		1			1
1994		2			2
1995		4			4
1996		1			1
1997			1		1
1998		1			1
1999		1			1
2001		1			1
2002		4	1		5
2003		1			1
2005		3	1		4
2008		1	1		2
2009		2			2
2010		1			1
2011		4			4
2012				1	1
2014		2			2
2015		7			7
2016		4			4
TOTAL	1	58	4	1	64

Table 4.11.14. Mean weight (lb) of cobia weighed from the MRIP in the Atlantic (Georgia and north) by year and mode, 1981-2017.

	Charterboat				Private				Shore			
YEAR	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max
1981					2	4.18	2.2	6.15				
1982					6	12.35	1.33	35.21				
1983					2	45.64	36.38	54.89				
1984	2	13.23	9.93	16.53	8	32.81	17.62	62.46				
1985	3	20.29	17.42	23.15	25	23.21	1.54	56				
1986	7	30.8	22.05	50.83	23	20.12	1.6	50.93	1	41.01	41.01	41.01
1987	20	25.24	12.13	48.64	16	16.48	0.44	34.08	3	1.29	0.29	3.15
1988	6	23.48	9.92	42.99	9	26.07	1.15	50.46	1	49.04	49.04	49.04
1989	5	12.57	1.02	28.87	43	22.49	0.45	71.62	3	24.77	0.9	53.81
1990	8	22.76	3.15	56.53	47	19.37	0.23	65.48				
1991	6	28.03	17.2	44.11	23	19.53	0.22	80.25	9	29.9	0.9	71.87
1992	13	21.41	10.55	38.11	30	29.45	5.11	56.65	3	40.19	28.19	52.59
1993	14	23.05	7.73	40.84	9	27.46	15.94	61.34	1	33.58	33.58	33.58
1994	5	34.75	22.24	52.57	26	35.25	1.66	66.99	2	24.54	18.35	30.73
1995	15	32.04	13.89	60.22	18	30.8	7.93	69.74	4	38.84	27.67	51.35
1996	32	17.19	2	66.76	28	28.01	0.13	62.62	1	32.02	32.02	32.02
1997	11	31.47	20.64	56.28	19	34.35	20.01	57.17	1	36.74	36.74	36.74
1998	35	39.8	13.07	69.15	14	35.6	10.79	80.13	1	52.03	52.03	52.03
1999	10	36.36	10.47	68.4	17	16.69	1.82	60.8	1	48.06	48.06	48.06
2000	8	32.64	13.92	62.44	12	36.6	6.87	71.58				
2001	10	25.55	10.58	58.63	18	33.63	13.23	69.09	1	67.28	67.28	67.28
2002	15	30.87	11.46	74.9	12	37.31	18.08	56.08	5	42.81	19.62	73.2
2003	21	24.07	10.8	71.22	20	29.07	18.19	65.36	1	39.55	39.55	39.55
2004	19	35.96	14.55	61.73	23	32.62	13.67	69.08				
2005	16	41.61	13.76	77.16	26	26.94	2.87	57.01	4	19.98	0.66	39.13
2006	9	27.21	14.77	38.91	17	34.64	14.77	77.65				
2007	11	28.67	14.77	58.69	28	34.24	15.43	64.99				
2008	11	25.54	10.71	60.08	20	29.01	13.45	55.12	2	40.9	20.06	61.73
2009	10	27.87	15.21	44.18	27	25.3	4.63	55.12	2	21.61	11.24	31.97
2010	64	31.2	10.14	60.12	58	34.08	4.63	81.57	1	19.84	19.84	19.84
2011	25	29.67	9.26	80.03	20	51.88	11.9	131.61	4	22.43	1.32	44.09
2012	17	45.54	3.31	84.99	25	27.41	11.9	44.78	1	3.31	3.31	3.31
2013	22	26.29	14.33	46.3	92	23.53	0.66	52.03				
2014	47	26.09	13.67	60.63	46	23.66	14.11	38.58	2	32.79	30.31	35.27
2015	54	28.99	11.02	70.99	101	39.23	7.28	135.03	7	36.41	19.4	60.41
2016	62	33.36	5.51	59.52	55	31.67	18.08	53.25	4	32.41	22.6	41.89
2017	29	35.13	14.77	82.06	37	34.66	18.74	54.72				
Total	642	29.9	1.02	84.99	1,002	29.34	0.13	135.03	65	31.59	0.29	73.2

Table 4.11.15. Number of cobia measured and positive trips in the SRHS by year and state.

Year	Fish (n)			Trips (n)		
	NC	SCGA	South	NC	SCGA	South
1974	0	3	3	0	3	3
1975	0	0	0	0	0	0
1976	0	0	0	0	0	0
1977	0	0	0	0	0	0
1978	1	0	1	1	0	1
1979	2	0	2	2	0	2
1980	1	0	1	1	0	1
1981	1	0	1	1	0	1
1982	3	0	3	3	0	3
1983	4	0	4	4	0	4
1984	3	2	5	3	2	5
1985	6	1	7	6	1	7
1986	4	3	7	4	3	7
1987	6	4	10	5	3	8
1988	2	5	7	2	5	7
1989	5	2	7	5	2	7
1990	3	6	9	1	6	7
1991	5	8	13	5	7	12
1992	9	2	11	7	2	9
1993	4	9	13	4	7	11
1994	0	9	9	0	7	7
1995	7	9	16	7	8	15
1996	3	4	7	3	3	6
1997	5	4	9	5	4	9
1998	3	6	9	3	5	8
1999	4	1	5	4	1	5
2000	0	1	1	0	1	1
2001	6	0	6	6	0	6
2002	5	1	6	4	1	5
2003	2	1	3	2	1	3
2004	4	0	4	3	0	3
2005	4	0	4	4	0	4
2006	2	2	4	2	2	4
2007	0	7	7	0	7	7
2008	2	1	3	2	1	3
2009	0	2	2	0	2	2
2010	1	7	8	1	5	6
2011	1	1	2	1	1	2
2012	0	4	4	0	2	2
2013	6	5	11	3	5	8
2014	8	14	22	5	8	13
2015	0	2	2	0	2	2
2016	1	3	4	1	3	4
2017	1	0	1	1	0	1

Table 4.11.16. Mean weight (kg) of cobia measured in the SRHS by year and state, 1972-2017.

	NC				SCGA				South Atlantic			
Year	N	Mean (kg)	Min (kg)	Max (kg)	N	Mean (kg)	Min (kg)	Max (kg)	N	Mean (kg)	Min (kg)	Max (kg)
1978	1	9.52	9.52	9.52					1	9.52	9.52	9.52
1979	2	12.35	11.7	12.99					2	12.35	11.7	12.99
1980	1	5.96	5.96	5.96					1	5.96	5.96	5.96
1981	1	4.25	4.25	4.25					1	4.25	4.25	4.25
1982	3	9.1	3.7	16.8					3	9.1	3.7	16.8
1983	4	8.81	6.5	12.93					4	8.81	6.5	12.93
1984	3	10.47	7.38	12.7	2	14.95	6.8	23.1	5	25.42	14.18	35.8
1985	6	9.7	3	17.44	1	12.6	12.6	12.6	7	22.3	15.6	30.04
1986	3	5.92	5.45	6.2	3	8.27	5.6	11.8	6	14.18	11.05	18
1987	3	11.77	9.29	13.45	4	9.8	5.5	14.3	7	21.57	14.79	27.75
1988	2	10.51	10.11	10.9	5	9.19	1.1	17.1	7	19.7	11.21	28
1989	5	8.96	6.19	12.52	2	13.33	12.38	14.28	7	22.29	18.57	26.8
1990	3	10.82	7.31	13.61	6	8.5	5.37	11.73	9	19.33	12.68	25.34
1991	5	6.69	4.15	10.36	8	9.19	3.81	14.38	13	15.88	7.96	24.74
1992	8	10.81	5.15	18.18	2	7.76	7.15	8.37	10	18.57	12.3	26.55
1993	4	9.51	7.14	12.82	9	9.98	5.51	15.3	13	19.48	12.65	28.12
1994					9	8.7	4.66	15.25	9	8.7	4.66	15.25
1995	7	9.14	6.2	12.65	9	9.7	5.03	15.43	16	18.84	11.23	28.08
1996	3	13.74	12.71	15.43	4	11.43	10.41	12.14	7	25.17	23.12	27.57
1997	5	8.93	5.94	12.29	4	10.46	7.67	13.05	9	19.39	13.61	25.34
1998	3	11.25	6.05	15.27	6	10.67	5.34	17.72	9	21.92	11.39	32.99
1999	4	10.86	9.16	12.55	1	10.39	10.39	10.39	5	21.25	19.55	22.94
2000					1	10.06	10.06	10.06	1	10.06	10.06	10.06
2001	6	10.74	4.79	14.88					6	10.74	4.79	14.88
2002	5	12.33	7.29	19.02	1	7.74	7.74	7.74	6	20.07	15.03	26.76
2003	2	14.07	10.53	17.6	1	5.66	5.66	5.66	3	19.73	16.19	23.26
2004	4	16.26	11.95	20.24					4	16.26	11.95	20.24
2005	4	10.37	6.83	15.2					4	10.37	6.83	15.2
2006	2	7.52	6.04	9	2	9.89	8.02	11.76	4	17.41	14.06	20.76
2007					7	9.35	6.93	14.83	7	9.35	6.93	14.83
2008	2	9.86	9.55	10.17	1	16.78	16.78	16.78	3	26.64	26.33	26.95
2009					2	16.06	5.91	26.21	2	16.06	5.91	26.21
2010	1	11.16	11.16	11.16	7	9.56	6.85	13.8	8	20.72	18.01	24.96
2011	1	10.32	10.32	10.32	1	5.52	5.52	5.52	2	15.84	15.84	15.84
2012					2	15.66	14.31	17	2	15.66	14.31	17
2013	6	12.28	8.06	20.07	5	11.35	6.02	23.13	11	23.63	14.08	43.2
2014	8	10.79	4.91	19.09	14	20.13	6.36	47.34	22	30.93	11.27	66.43
2015					2	8.06	7.84	8.28	2	8.06	7.84	8.28
2016	1	21.36	21.36	21.36	3	8.48	7.5	10.21	4	29.84	28.86	31.57
2017	1	7.87	7.87	7.87					1	7.87	7.87	7.87

Table 4.11.17. SCDNR State Finfish Survey number of cobia measured (total and by mode), mean length, standard deviation of length, and minimum and maximum size range (all modes combined). No length measurements were recorded during 1997 or 2013-2016 (this primarily due to the survey only being conducted in wave 1 for the latter years). Total length measurements from 2009-2017 were converted to fork length using the following equation developed for the South Atlantic stock at the SEDAR 58 data workshop: FL = 8.19 + 0.88TL (N = 5672, $R^2 = 0.99$).

Year	Cobia (n)	Fish (n)			Mean FL	Std Dev	Min FL	Max FL
		Charter	Private	Shore	(mm)	FL (mm)	(mm)	(mm)
1989	-	-	-	-	-	-	-	-
1990	-	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-	-
1992	4	-	4	-	1,122.50	146.5	986	1,305
1993	2	-	2	-	600.5	340.1	360	841
1994	-	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-	-
1996	2	-	2	-	1,496.00	33.9	1,472	1,520
1997	-	-	-	-	-	-	-	-
1998	11	-	10	1	994.2	220.9	463	1,260
1999	31	-	31	-	1,002.60	85.9	912	1,418
2000	4	-	4	-	917.3	52.7	878	995
2001	8	-	8	-	1,010.30	59.8	935	1,135
2002	22	-	22	-	1,048.10	126.3	865	1,255
2003	14	1	13	-	926.4	167.6	580	1,349
2004	16	1	15	-	968.3	188.8	835	1,452
2005	21	-	21	-	908.7	42.1	830	1,000
2006	18	-	18	-	982	163.6	845	1,502
2007	80	-	80	-	909.2	50.3	810	1,060
2008	64	-	64	-	957.7	129.5	410	1,350
2009	33	-	33	-	909.2	139	720	1,336
2010	10	-	10	-	838.3	72.7	760	976
2011	17	1	16	-	814.5	33.9	770	886
2012	19	-	19	-	961.79	130.38	752.67	1279.79
2017	1	-	1	-	880	-	880	880

Table 4.11.18. Number of cobia aged in the recreational fishery by year and state. States not shown did not age any cobia for this time period.

Year	GA	NC	SC	VA
1984		3		
1985		2		
1986		22		
1987		18		
1988		9	1	
1989		62		
1990		80	3	
1991		13		
1992		12		
1993		1		
1994		3		
1995		10		
1996		13	18	
1997		7	13	
1999				124
2000				111
2001				52
2002				26
2003				7
2004				7
2005		2	47	10
2006			38	25
2007			341	25
2008			276	40
2009			205	106
2010		11	215	106
2011			217	89
2012	1		223	76
2013			300	190
2014	3		244	287
2015			189	342
2016		11	142	255
2017		34		239

Table 4.11.19. Atlantic coast (Georgia and north) estimated number of angler trips for charterboat mode, headboat mode, and charterboat/headboat mode, private boat mode, and shore mode (MRIP). CH and CH/HB mode adjusted for FHS conversion prior to 2004. CH/HB mode estimates are from the South Atlantic (sub-region 6) from 1981-1985 and from the Mid-Atlantic (sub-region 5) from 1981-2003. After 2004 CH and HB modes are estimated separately in sub-regions 4 and 5. Headboat mode from 1981 to 1985 were excluded to avoid overlap with the SRHS.

YEAR	Estimated CH	Estimated CH/HB	Estimated HB	Estimated PR	Estimated SH
1981	188,980	3,577,559	-	17,765,901	34,007,002
1982	190,708	4,956,027		18,293,526	35,488,354
1983	214,268	3,944,756		18,960,548	37,465,725
1984	310,914	2,872,587		20,039,286	35,880,449
1985	319,869	2,984,604		22,500,116	34,287,470
1986	262,628	3,446,445		22,487,902	34,364,897
1987	273,377	2,424,739		21,588,527	34,419,954
1988	249,830	2,260,431		21,497,141	36,138,703
1989	302,899	1,762,892		21,664,812	36,751,891
1990	241,455	1,918,381		22,693,637	40,113,617
1991	274,726	2,221,546		22,754,553	40,799,495
1992	294,771	1,446,438		23,096,869	41,037,935
1993	323,906	2,473,730		23,568,468	41,906,506
1994	383,406	2,262,497		24,079,060	42,505,393
1995	454,901	2,319,843		24,291,643	42,437,852
1996	367,716	1,527,297		25,613,101	43,167,914
1997	330,886	1,964,558		27,780,753	45,284,094
1998	296,665	1,273,064		28,217,416	45,083,354
1999	251,121	1,167,321		29,971,784	49,827,082
2000	248,041	1,426,682		32,467,729	54,271,568
2001	259,310	1,696,622		33,503,927	56,328,542
2002	244,728	1,218,576		34,002,275	55,374,503
2003	250,760	1,478,871		35,092,246	57,716,219
2004	1,015,109		674,260	36,623,026	59,354,499
2005	1,222,234		767,540	37,161,398	60,477,945
2006	959,881		649,374	37,423,372	62,721,146
2007	1,465,095		971,084	38,139,032	60,228,146
2008	1,053,439		871,784	38,625,010	63,611,011
2009	1,022,662		790,333	39,264,641	63,911,446
2010	829,794		580,114	41,666,922	67,239,285
2011	981,394		580,930	37,741,397	60,658,094
2012	930,555		628,596	39,335,516	64,427,619
2013	1,086,379		968,396	37,872,952	62,103,965
2014	1,087,452		831,745	36,807,698	63,121,977
2015	1,196,276		696,087	34,715,854	61,414,441
2016	698,979		470,309	34,597,161	64,448,600
2017	773,158		596,982	35,192,629	62,657,638

Table 4.11.20 South Atlantic headboat estimated angler days by year and state, 1981-2017.

Year	NC	SCGA	South Atlantic
1981	19,374	59,030	78,404
1982	26,939	67,539	94,478
1983	23,830	65,733	89,563
1984	28,865	67,314	96,179
1985	31,384	66,001	97,385
1986	31,187	67,227	98,414
1987	35,261	78,806	114,067
1988	42,421	76,468	118,889
1989	38,678	62,708	101,386
1990	43,240	57,151	100,391
1991	40,936	67,982	108,918
1992	41,176	61,790	102,966
1993	42,786	64,457	107,243
1994	36,691	63,716	100,407
1995	40,295	64,953	105,248
1996	35,142	57,613	92,755
1997	37,189	63,056	100,245
1998	37,399	63,344	100,743
1999	31,596	57,356	88,952
2000	31,351	42,443	73,794
2001	31,779	51,602	83,381
2002	27,601	44,739	72,340
2003	22,998	37,982	60,980
2004	27,255	50,462	77,717
2005	31,573	35,797	67,370
2006	25,736	57,992	83,728
2007	29,002	62,695	91,697
2008	17,158	48,861	66,019
2009	19,468	43,010	62,478
2010	21,071	46,908	67,979
2011	18,457	46,210	64,667
2012	20,766	42,064	62,830
2013	20,547	42,853	63,400
2014	22,691	44,092	66,783
2015	22,716	41,479	64,195
2016	21,565	43,954	65,519
2017	20,170	38,655	58,825

4.12 Figures

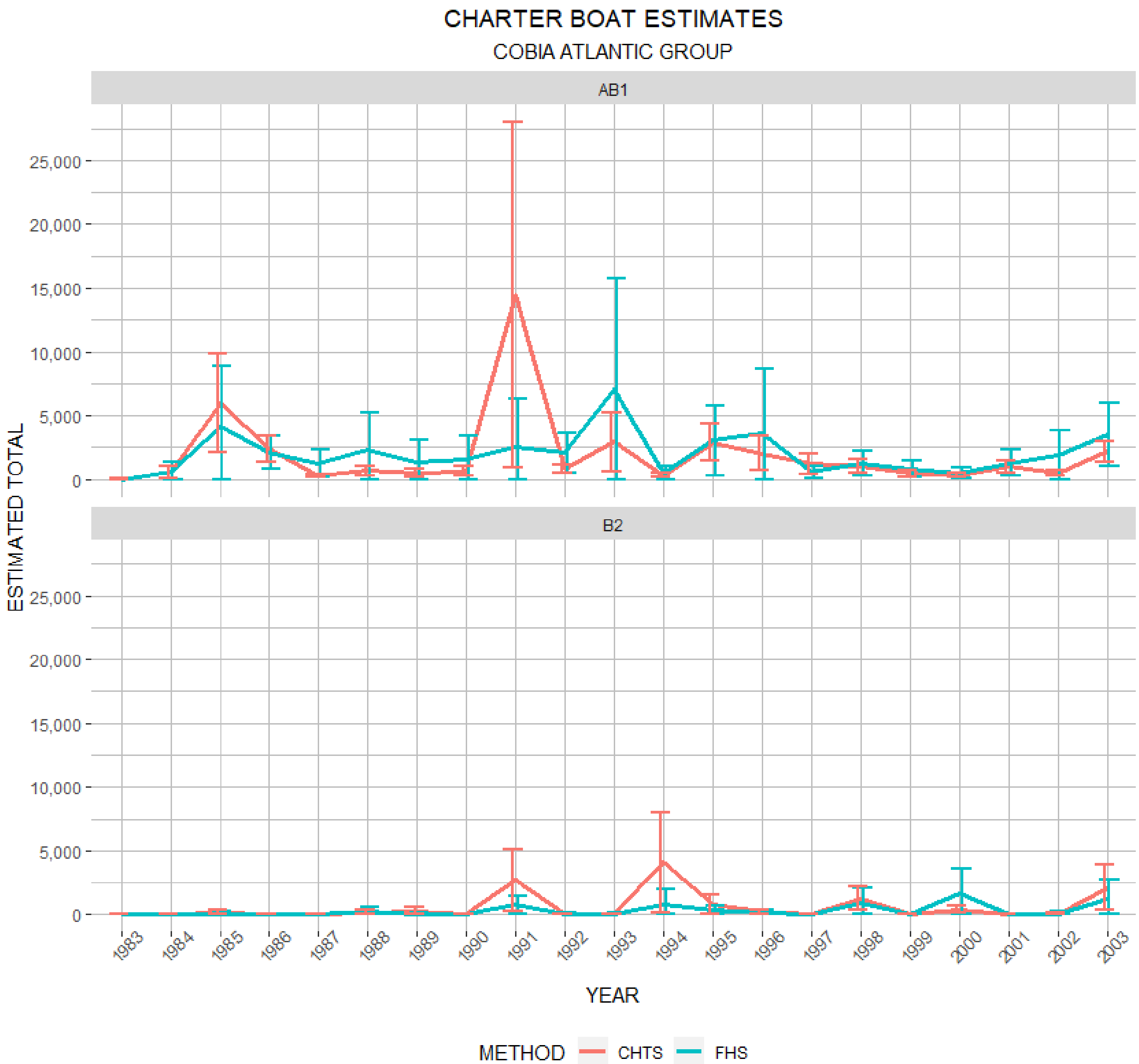
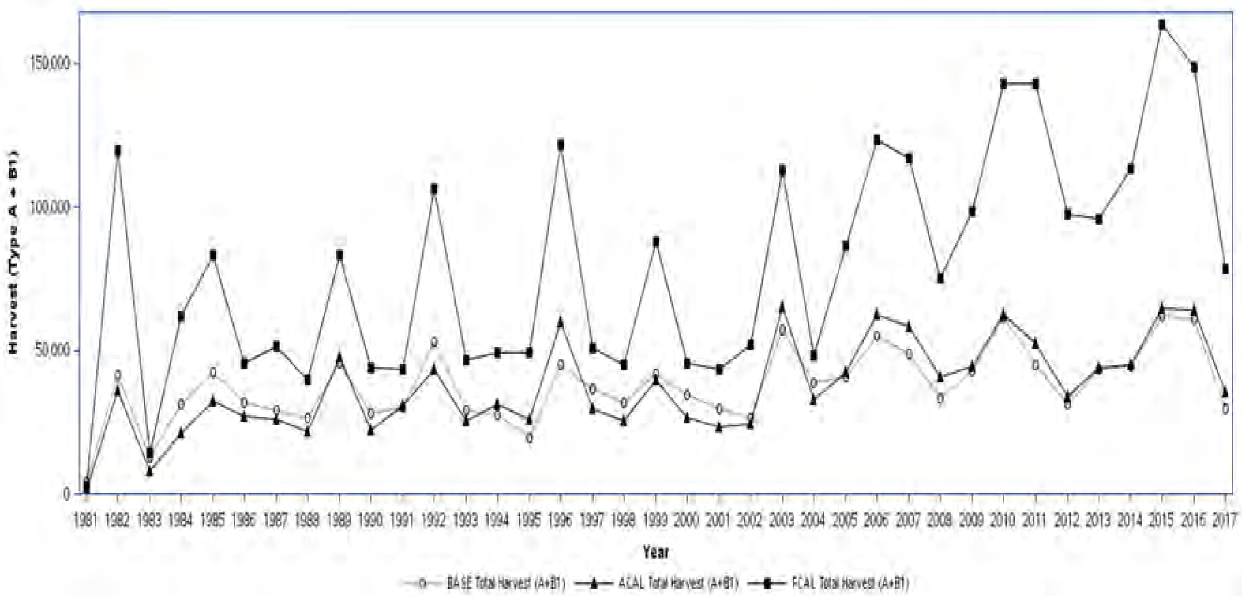


Figure 4.12.1. Coastal Household Telephone Survey (CHTS) and For-Hire Survey (FHS) charter landing (AB1) and discard (B2) estimates in numbers of fish for Atlantic cobia from 1981 to 2003.

a)



b)

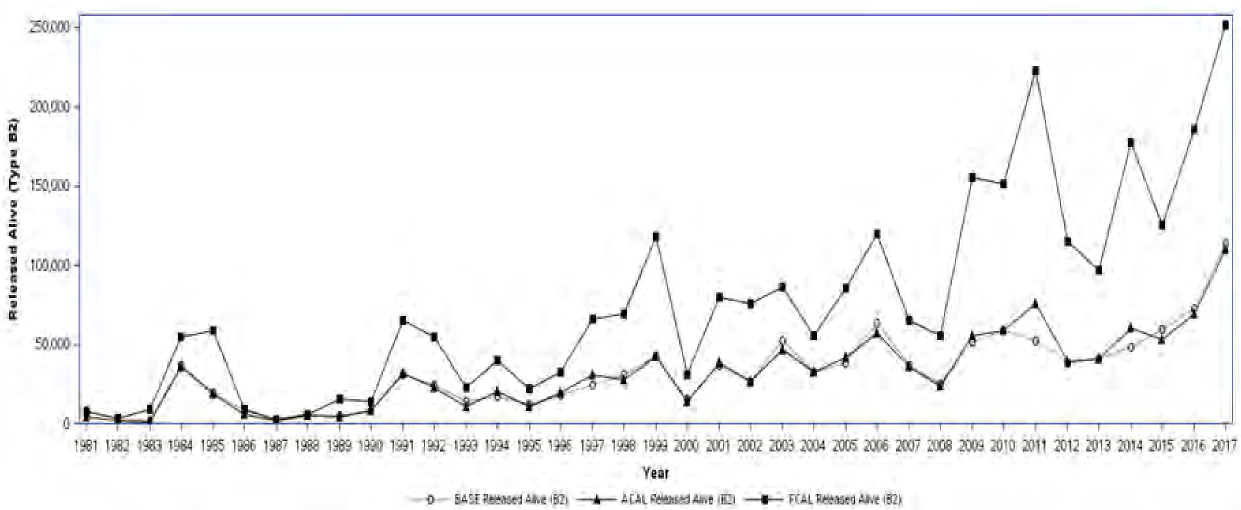
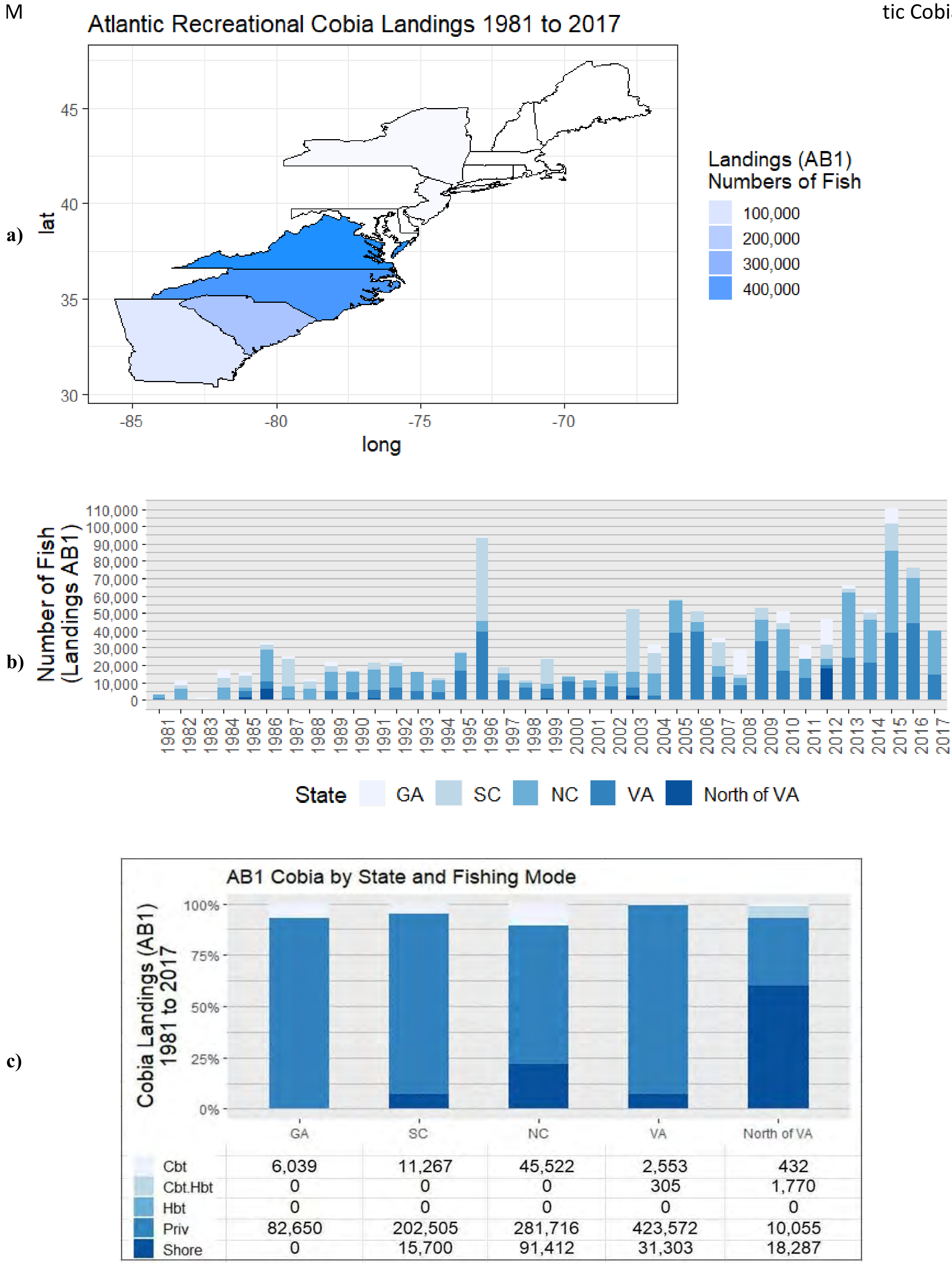


Figure 4.12.2. MRIP base (circle), APAIS calibrated (triangle), and fully calibrated APAIS and FES (square) catch estimates for Atlantic cobia from 1981 to 2017. Catch estimates are shown in numbers of fish: (a) landings and (b) discards. These calibration graphs include sub-regions 4-6. Florida could not be separated for sub-region 6 on the MRIP online comparison tool.



	GA	SC	NC	VA	North of VA
Cbt	6,039	11,267	45,522	2,553	432
Cbt.Hbt	0	0	0	305	1,770
Hbt	0	0	0	0	0
Priv	82,650	202,505	281,716	423,572	10,055
Shore	0	15,700	91,412	31,303	18,287

Figure 4.12.3. Atlantic estimated number of cobia landings from MRFSS/MRIP, and SRHS (1981 - 2017) by state (a), by state and year (b), and by state and mode (c). *Due to confidentiality concerns, SRHS landings from Georgia have been grouped together with South Carolina.

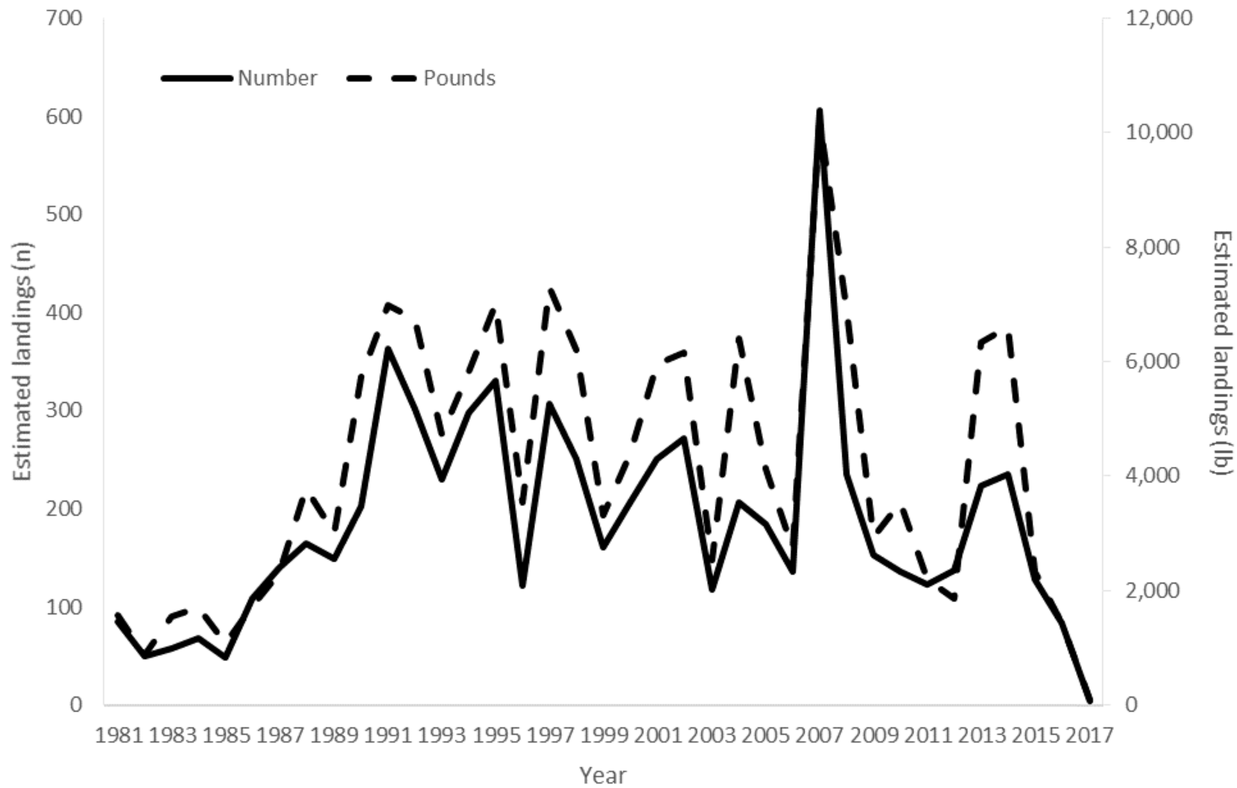


Figure 4.12.4. South Atlantic estimated cobia landings (number and pounds) for the headboat fishery, 1981-2017.

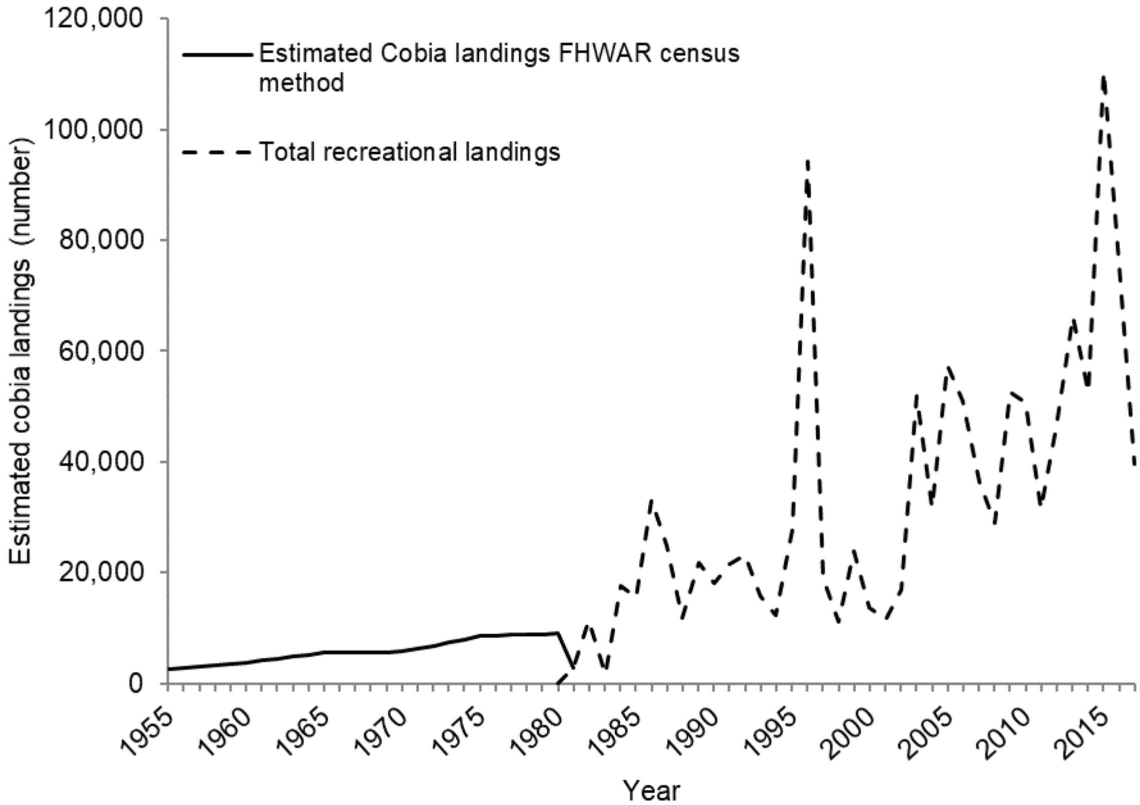


Figure 4.12.5. Estimated cobia landings (number) using FHWAR census method (1955-1984), MRFSS (1985-2003), and MRIP (2004-2017) estimation methods.

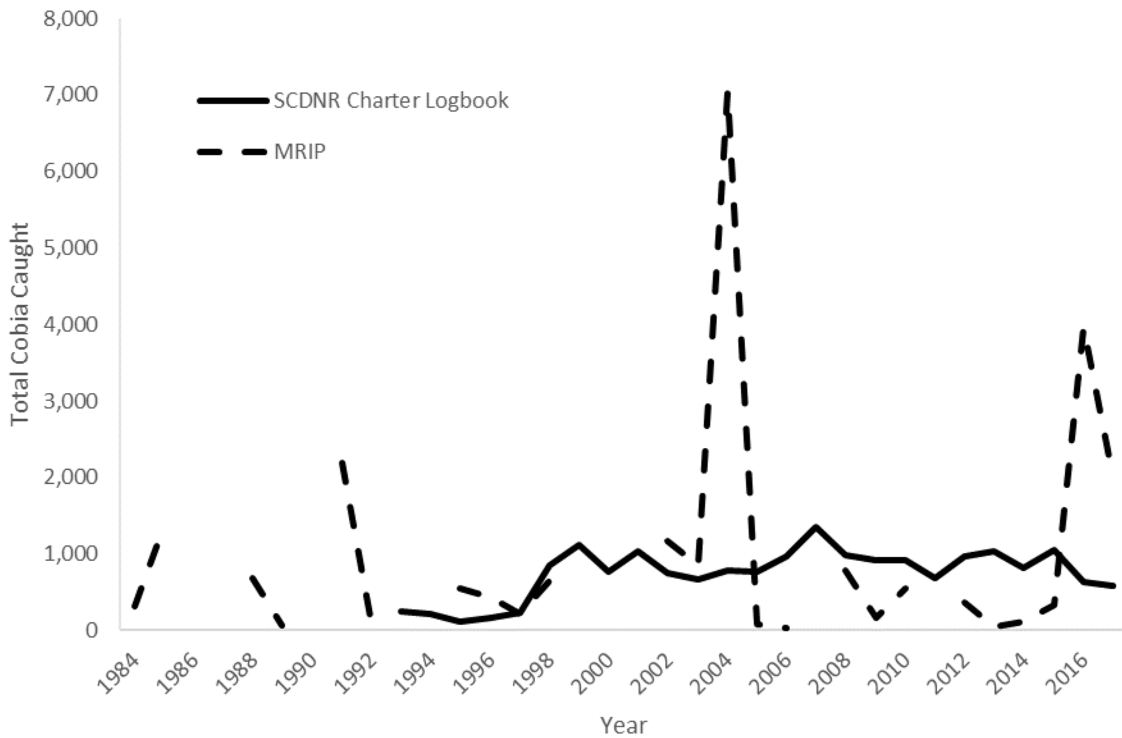
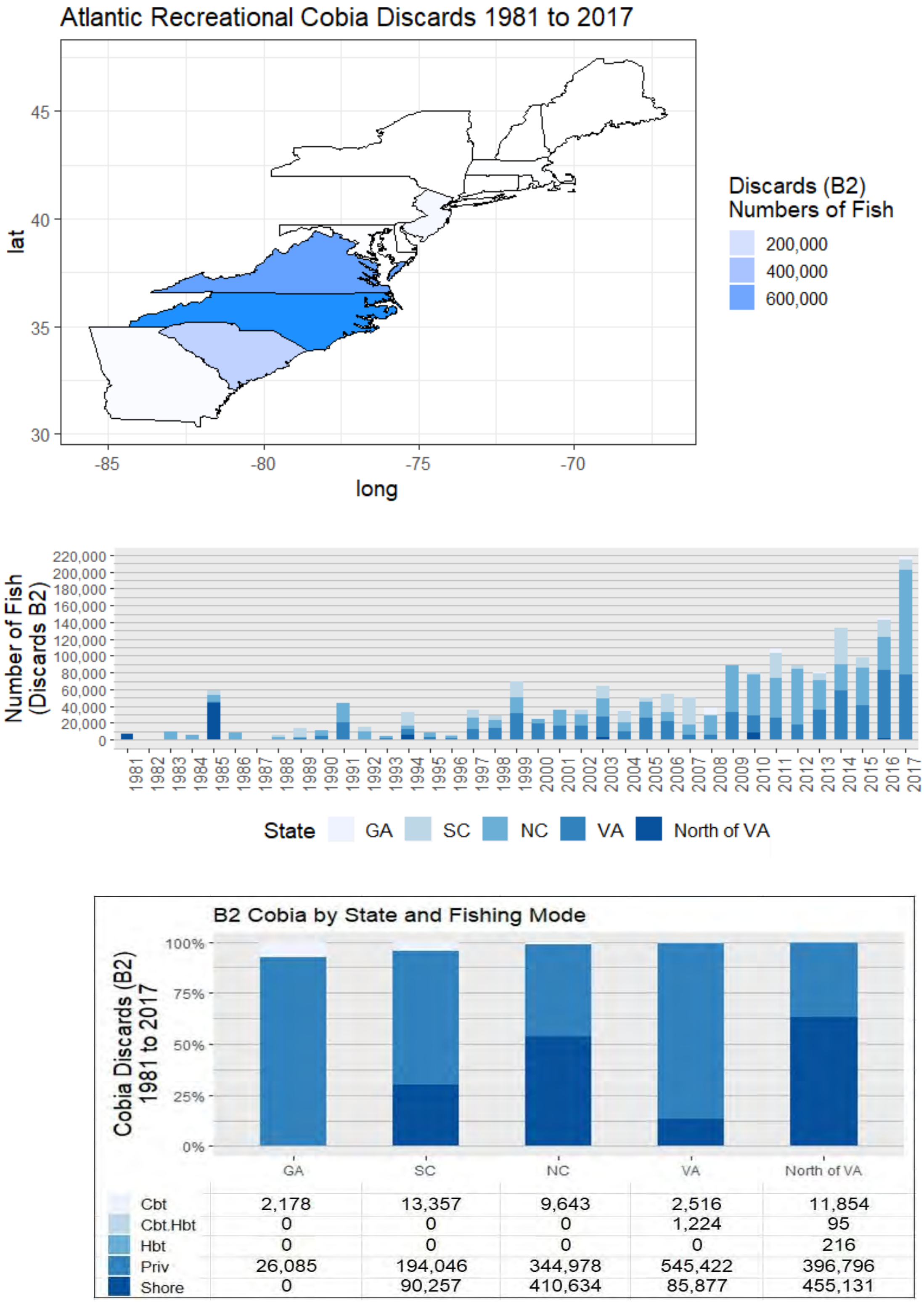


Figure 4.12.6. Comparison of South Carolina total catch (a+b1+b2) from MRFSS charter mode and SCDNR charterboat logbook program, 1993-2017.

a)
b)
c)



	GA	SC	NC	VA	North of VA
Cbt	2,178	13,357	9,643	2,516	11,854
Cbt.Hbt	0	0	0	1,224	95
Hbt	0	0	0	0	216
Priv	26,085	194,046	344,978	545,422	396,796
Shore	0	90,257	410,634	85,877	455,131

Figure 4.12.7. Atlantic estimated number of cobia discards from MRFSS/MRIP, and SRHS (1981 - 2017) by state (a), by state and year (b), and by state and mode (c). *Due to confidentiality concerns, SRHS landings from Georgia have been grouped together with South Carolina.

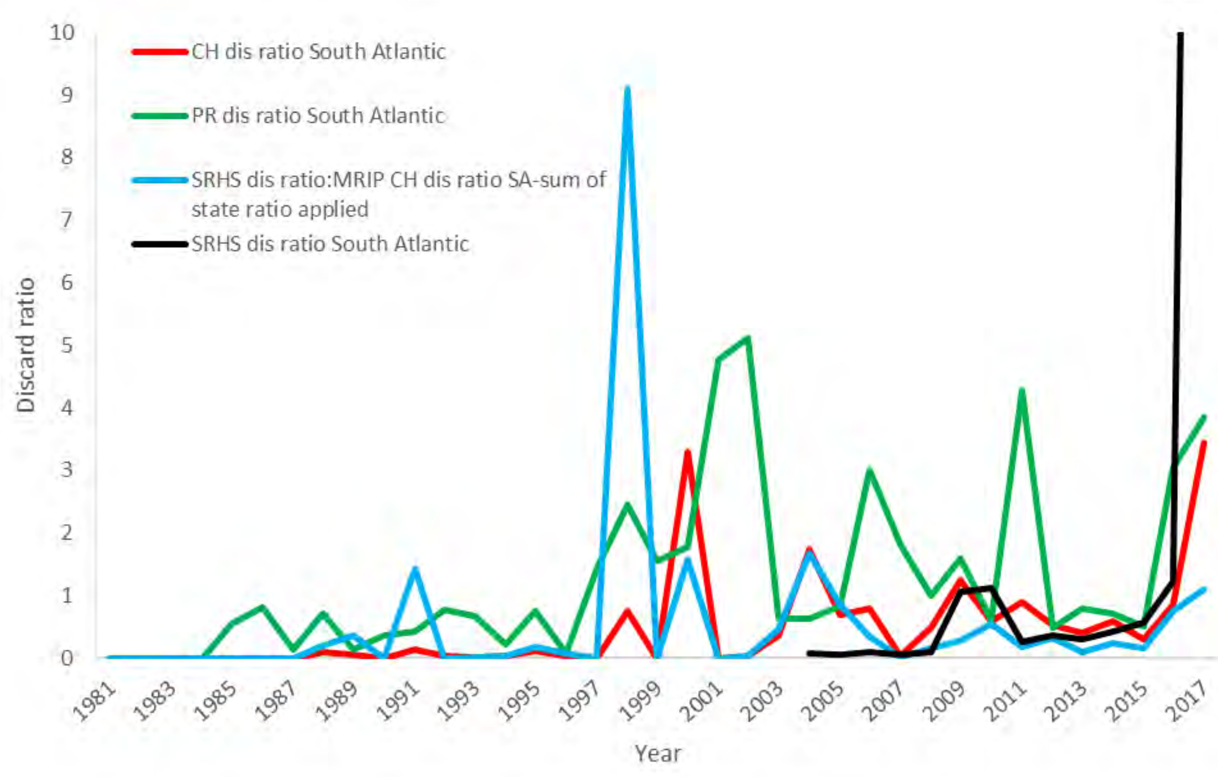


Figure 4.12.8. MRIP CH (1981-2017), MRIP PR (1981-2017), MRIP CH:SRHS discard ratio methods (1981-2017), and SRHS discard ratios (2004-2017).

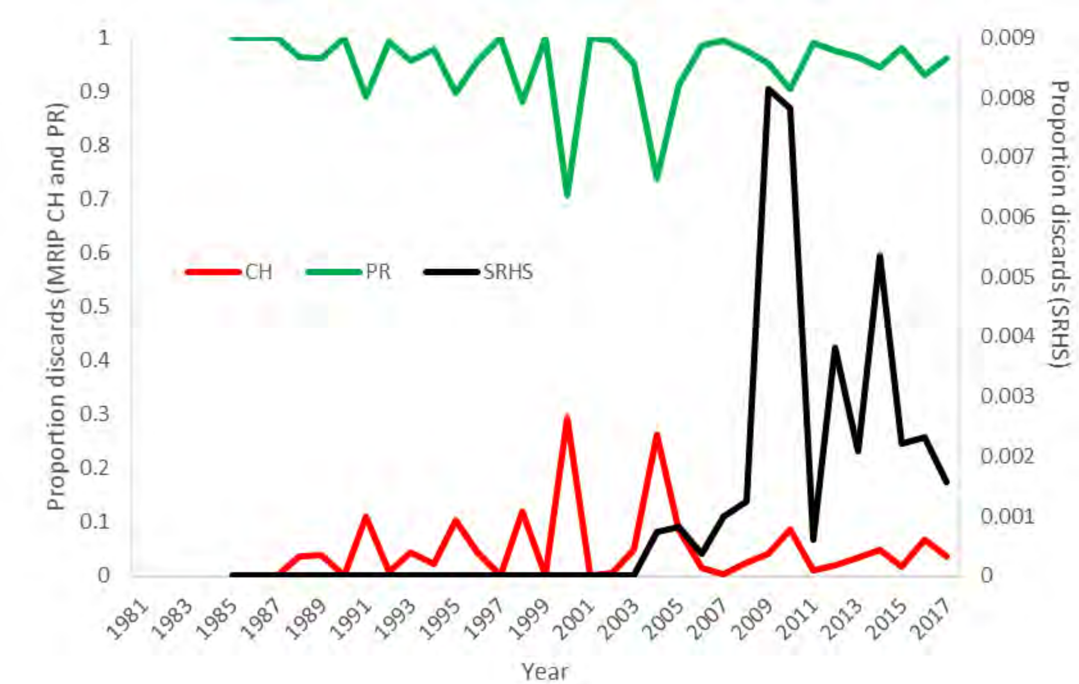


Figure 4.12.9. Proportion of cobia discards in the recreational fishery by mode, 1981-2017.

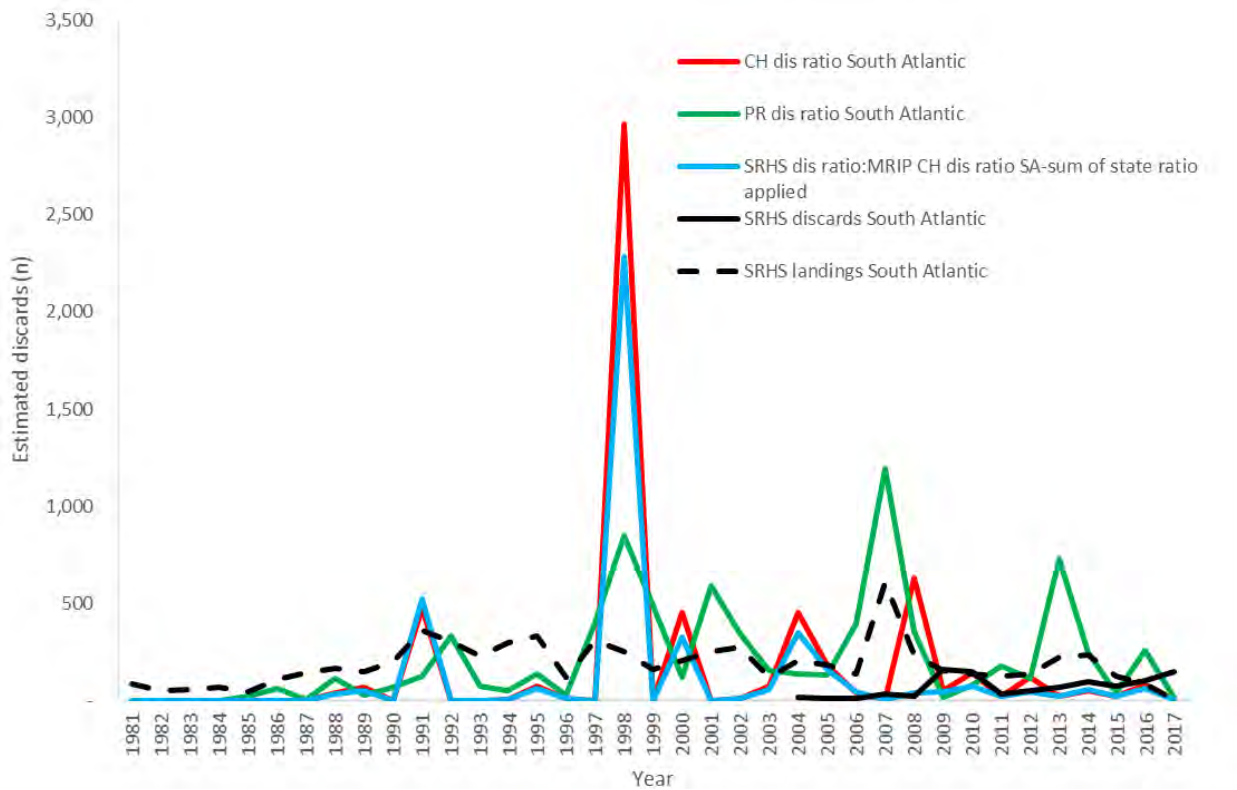
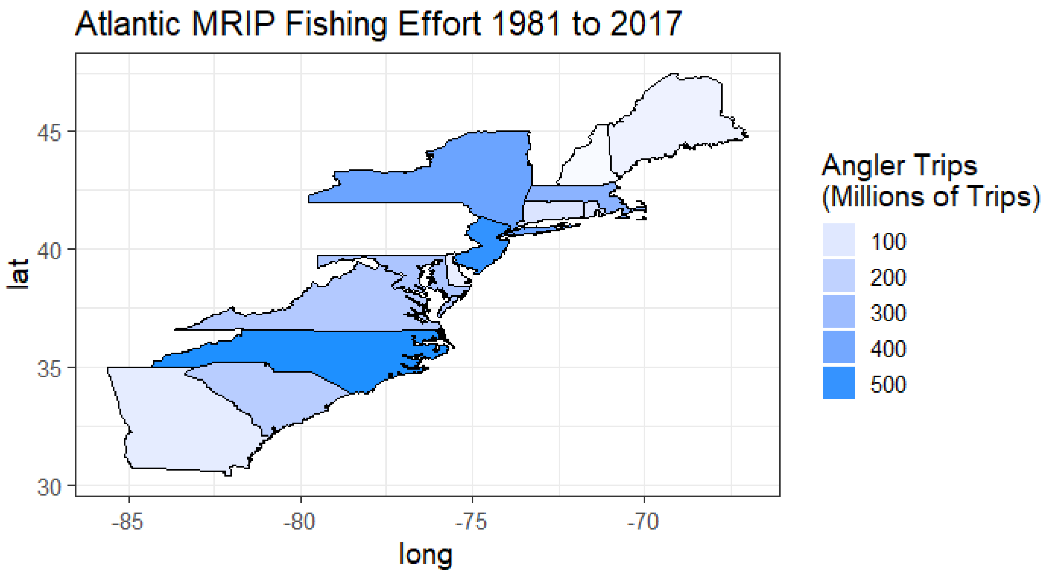
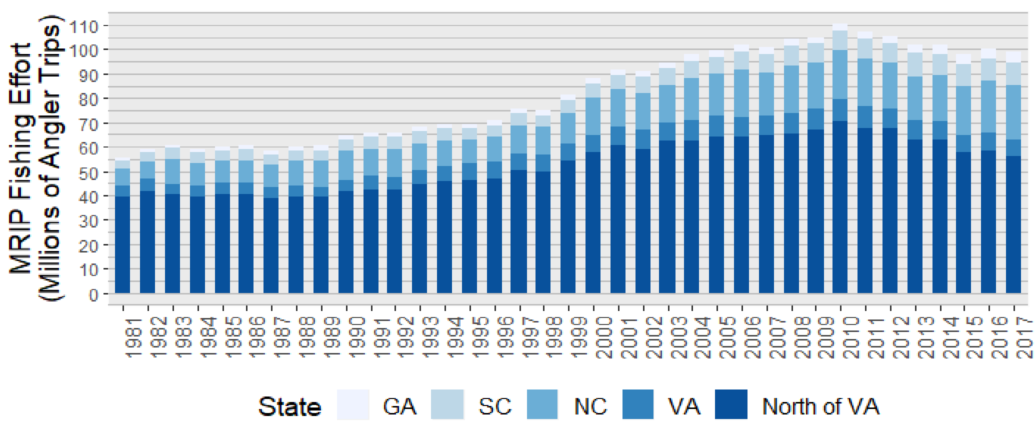


Figure 4.12.10. SRHS discards (2004-2017) and landings with calculated discards using the MRIP CH proxy (1981-2017), MRIP PR (1981-2017), and MRIP CH:SRHS discard ratio proxy methods (1981-2017).

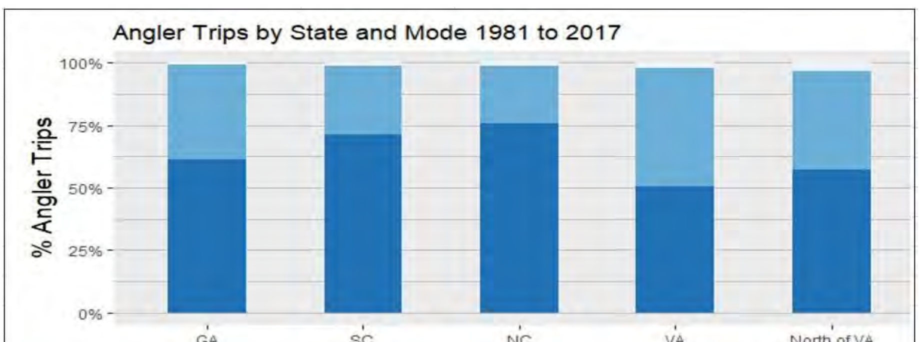
a)



b)



c)



	GA	SC	NC	VA	North of VA
Cbt	770,229	2,903,868	5,523,088	4,978,210	58,742,263
Hbt	0	0	0	292,779	9,804,648
Priv	32,507,776	62,397,921	122,191,938	116,244,647	766,170,145
Shore	53,056,703	162,237,533	396,896,505	123,284,941	1,120,478,252

Figure 4.12.11. Atlantic estimated number of angler trips from MRFSS/MRIP (1981 - 2017) by state (a), by state and year (b), and by state and mode (c).

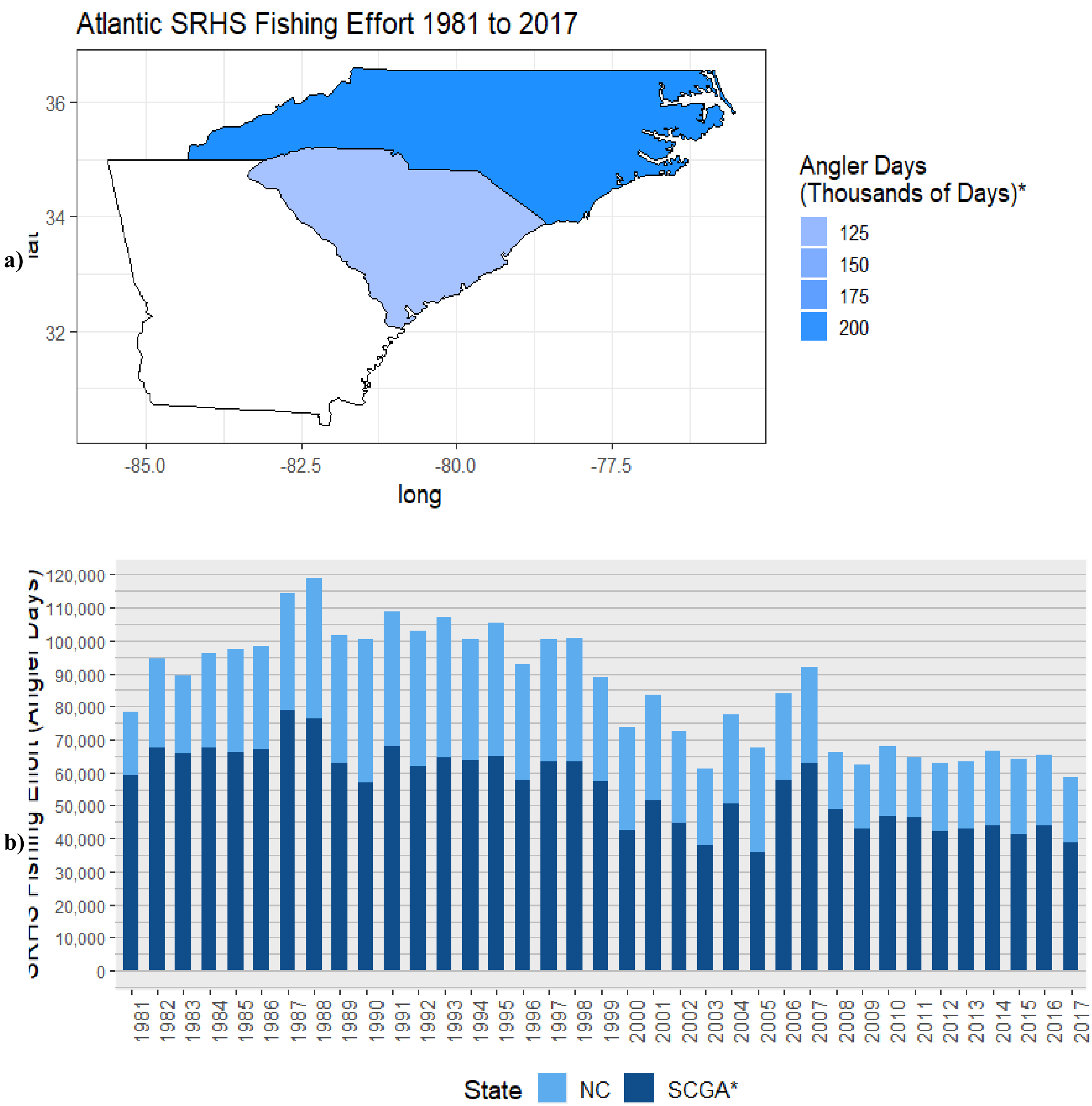


Figure 4.12.12. South Atlantic estimated number of angler days from SRHS (1981 - 2017) by State (a), and by state and year (b). *Due to confidentiality concerns, effort from Georgia has been grouped together with and South Carolina.

5 Measure of Population Abundance (Indices)

5.1 Overview

Several fishery-independent data sets were considered for use as an index of abundance during the data scoping webinar. During the data webinar, all fishery-independent datasets were deemed as needing no further consideration because of small sample sizes, limited geographic extent, or difficulty in determining effort. The NMFS bottom longline and NEFSC bottom trawl surveys were not further considered due to extremely low catches of cobia in all years and a patchy distribution of catches across areas. MARMAP chevron trap was also not further considered due to extremely low sample sizes of cobia. SEAMAP was not considered due to low sample sizes, with a percent of occurrence of 0% to 3% reported, for cobia. There is limited spatio-temporal overlap between the cobia migration and the SERFS video survey. The proportion of positive video samples was extremely low.

Several fishery-dependent data sets were considered for use as an index of abundance both during the data webinar and data workshop. During the data webinar, several datasets were deemed as needing no further consideration because of small sample sizes, limited geographic extent, or difficulty in determining effort. VA harvest reports were not further considered due to extremely low sample sizes of cobia, difficulty in determining effort, and only a small area of the species range being sampled. Data from the headboat at-sea observer program was also considered, but sample sizes were extremely low for cobia. The Southeast commercial logbook data were excluded due to low sample sizes and difficulty determining cobia effort. In addition, commercial landings are reported in pounds and the trip limit is in numbers which eliminates the ability to determine the impact of strict bag limits.

Several indices of abundance were considered by the SEDAR 58 data workshop panelists for use in the South Atlantic cobia assessment model. These indices are listed in Table 5.7.1, with pros and cons of each in Table 5.7.2. Due to the lack of data, a fishery-independent index for cobia was not developed. The DW recommended only the SRHS index for potential use in the cobia stock assessment.

5.1.1 Group membership

Membership of this DW Index Working Group (IWG) included Rob Cheshire (work group leader), Eric Fitzpatrick, Katie Siegfried, Tom Sminkey, Anne Lange, and Mike Errigo. Several other participants of the data workshop contributed in the IWG discussions throughout the week. Recreational fishers provided descriptions of changes in the fishing effort and methods over the scale of the recreational indices. This information informed several decisions on the adequacy of the data.

5.2 Review of Working Papers

The working group reviewed three working papers describing index construction; SEDAR58-DW02, SEDAR58-DW07, and SEDAR58-DW09. Presentations from these working papers served as a starting point to describe the computation of a fishery-dependent index from the MRIP recreational data, SCDNR charter boat data, and the recreational headboat data. These working papers were helpful for determining which indices should be recommended for use and were revised to reflect to the decisions during the workshop.

5.3 Fishery-independent Indices

Fishery-independent data for cobia were not available for creation of a reliable index.

5.4 Fishery-dependent Indices

5.4.1 Recreational Headboat Index (SEDAR58-DW09)

The headboat fishery in the south Atlantic includes for-hire vessels that typically accommodate 11-70 passengers and charge a fee per angler. The fishery uses hook and line gear, generally targets hard bottom reefs as the fishing grounds, and generally targets species in the snapper-grouper complex. This fishery is sampled separately from other fisheries, and the available data were used to generate a fishery-dependent index.

Headboats in the south Atlantic are sampled from North Carolina to the Florida Keys (Figure 5.8.1). The southern extent for cobia was the Georgia-Florida state boundary based on the SEDAR 58 stock identification workshop. Data have been collected since 1972, but logbook reporting did not start until 1973. In addition, only North Carolina and South Carolina were included in the earlier years of the data set. In 1976, data were collected from North Carolina, South Carolina, Georgia, and northern Florida, and starting in 1978, data were collected from southern Florida.

Variables reported in the data set include year, month, day, area, location, trip type, number of anglers, species, catch, and vessel id. Biological data and discard data were recorded for some trips in some years.

The IWG discussed inclusion of headboat data from the mid-Atlantic Vessel Trip Reports (VTRs) for areas north of North Carolina with that from the SRHS for index development. The mid-Atlantic VTR data is a limited time series and the survey covered a limited number of headboats in the region, and there are concerns about both inconsistent reporting across much of the fleet as well as under-reporting, particularly in the early years of the survey. Therefore, these data were excluded from index development.

The development of the CPUE index is described in more detail in SEDAR58-DW09. The SEDAR 58 DW index working group decisions summarized in SEDAR58-DW09 include:

- Begin data series in 1991 due to inconsistent reporting in the 1980s. Cobia were not listed on the logbook form until 1984 but these new forms were not distributed or requested consistently. Data suggest the percentage of vessels reporting cobia was ramping up in the 1980s and began to stabilize in 1991 (Figure 5.8.2).
- Full and half-day trips were included in the standardization. The working group decided that including half-day trips added additional information about the nearshore cobia population even though the proportion of trips not catching cobia increased.

5.4.2 Methods of Estimation

Data Filtering Techniques

Extreme values occur more frequently in self-reported data because there are limited methods for validating data. Recent SEDAR stock assessments have removed values at the extreme upper tail of distribution for CPUE and associated fields of self-reported fishery-dependent data. The number of anglers on a trip can also influence CPUE when calculated as fish/angler-hour. Trips with the largest 0.5% values for CPUE were removed. Removing a small percentage of the trips with extreme values is an unbiased method to correct for potential errors in self-reported data.

Logbooks submitted by vessels that participated infrequently in the fishery are likely to be less accurate and may add noise to the data. Even if a vessel fished infrequently for one year, the number of trips should be greater than 30. We removed vessels that had fewer than 30 trips in the logbook database. It is rare for a headboat to fish with few anglers. There is anecdotal information that headboats would sometimes fish with just the crew and that logbooks for these trips were submitted. Experienced crew are likely to be more efficient at catching fish than paying customers. Captains may also limit distance to reduce fuel costs for trips with few paying customers. Trips with 6 or fewer anglers were excluded.

To identify headboat trips that best characterize the cobia fishery, vessels that consistently caught cobia were selected (25 headboats representing 90% (prior to any filtering) of cobia effort and landings). Positive cobia trips from these 'core' vessels increased from 4% (all data) to 6% (model input). Selecting data using a core group of vessels while removing vessels that inconsistently or never reported cobia more appropriately reflects cobia effort in the headboat fishery.

Seasonal closures occurred in 2016 (closed June 19) and 2017 (closed January 23). 2015 was chosen as the terminal year due to these regulations. Filtering steps and justification are presented in Table 5.7.3.

Model Input

YEAR (y) - Year was necessarily included, as standardized catch rates by year are the desired outcome. Years modeled were 1991-2015.

SEASON (s) - For SEDAR 58, seven of the months (September-March) were dropped due to inconsistent cobia trips leaving two levels for season in the model (April-June, July-August). The seasonal pattern in CPUE across months seems consistent across regions.

INLET REGION (i) - The inlet regions were defined by evenly distributing the total trips into 3 latitudinal regions. The three regions include inlets from NC to GA (St. Mary's GA- Murrell's Inlet SC (1), Little River, SC – Carolina Beach NC(2), Masonboro Inlet NC – Oregon Inlet NC (3)).

TRIP TYPE (t) – Full and half day trips were included in the standardization.

VESSEL SIZE (v) - A factor was explored for the vessel size using the quartiles of the maximum number of anglers across all trips as breaks for the factors. The proxy for vessel size is the maximum anglers reported over all trips for a vessel. Due to limited data and convergence issues, vessel size was modified to two levels: 1-79 maximum anglers ('small') or greater than 79 anglers ('large').

PERCENT FULL (p)
The number of anglers reported for a trip was divided by the maximum number of anglers for a vessel to obtain an estimate of crowding. This was then divided into 4 equally spaced factors but subsequently led to convergence issues due to low sample sizes and therefore was modified to two levels: 1-47% (‘partial’) or greater than 47% (‘full’).

ANGLER PARTY SIZE (a)
The number of anglers reported for a trip was divided into 4 equally spaced factors but led to convergence issues due to low sample sizes and therefore was modified to two levels: 6-30 anglers (‘small’) or greater than 30 anglers (‘large’).

Standardization

Zero-inflated models are valuable tools for modeling distributions that do not fit standard error distributions due to excessive number of zeroes. These data distributions are often referred to as “zero-inflated” and are a common condition of count based ecological data. Zero inflation is considered a special case of over-dispersion that is not readily addressed using traditional transformation procedures (Hall 2000). Due to the high proportion of zero counts found in our data set, we used a zero-inflated mixed model approach that accounts for the high occurrence of zero values, as well as the positive counts. The model does so by combining binomial and count processes (Zuur et al. 2009).

The modeling approach used here was similar to that used in SEDAR41 for gray triggerfish and red snapper for the video index. We initially considered a full null model (1) using both a zero-inflated Poisson (ZIP) and a zero-inflated negative binomial (ZINB) formulation,

$$Count = y + s + i + t + v + p + a \mid y + s + i + t + v + p + a \qquad (1)$$

In this formulation, variables to the left of the “|” apply to the count sub-model, and variables to the right apply to the binomial sub-model. In this analysis, we favored a simpler null model because of the relatively small proportion of positive counts for cobia,

$$Count = y \mid y \qquad (2)$$

which allowed us to add covariates using a step-wise forward selection process (rather than the backward selection). However, prior to adding covariates we compared ZIP and ZINB formulations. We compared the variance structure of each model formulation using AIC and likelihood ratio tests (Zuur et al 2009) to determine the most appropriate model error structure for the development of a cobia headboat index. The results of these tests support the ZINB formulation (similar results were obtained when using the full null model). These results concur with our expectations based on the over-dispersion within the headboat data. A comparison between the fitted and original data for the ZIP and ZINB model formulations is shown in Figure 5.8.3. The rootogram (Kleiber and Zeileis 2016) in the lower panels of Figure 5.8.3 extends the Tukey (1977) rootogram to regression models. These plots are useful as diagnostics specific to overdispersion and/or excess zeros in count data models. The models attempted prior to the data workshop as well as the models presented at the data workshop (bold) are presented in Table 5.7.4.

We used a step-wise forward model selection procedure to systematically include important covariates in our model formulation. In this procedure, we added each explanatory variable one at a time, alternating between the count (negative binomial) and binomial components. The variable with the largest ΔAIC was added, and the process repeated until no variable resulted in ΔAIC>2. The final cobia ZINB model formulation included year (y), season (*s*), trip type (*t*), vessel size (*v*) and party size (*a*) in the negative binomial component, and year (y), season (s), trip type (t), vessel size (v) and inlet region (*i*) in the binomial component,

$$Count = y + s + t + v + a \mid y + s + t + v + i \tag{3}$$

Diagnostics of the final model showed no clear patterns of association between Pearson's residuals and fitted values, or between the fitted values and original data (see SEDAR58-DW09 for diagnostics) indicating acceptable model choice (Zuur et al 2009). Finally, a comparison of predicted values against the original data distribution (Figure 5.8.4) demonstrates how the model fits the original data.

5.4.2.1 Sampling Intensity

The resulting data set contained 27,700 trips with 6% positive cobia trips.

5.4.2.2 Size/Age data

The sizes/ages represented in this index should be the same as those of landings from the corresponding fleet (See section 4 of this report). However, the sample sizes for the headboat fleet are likely very small. Other recreational size and age compositions should have a similar distribution.

5.4.2.3 Catch Rates

Standardized catch rates and associated error bars are shown in Figure 5.7.5 and are tabulated in Table 5.8.5. During the DW, trip type (full day and half day trip) was included as a covariate in the final model run and was very similar to the initial index that only included full day trips. By including half day trips, the bootstrap convergence rate increased from 74% to 98% and appears to reduce the unrealistic changes in population size in a few years while the proportion positive decreased from 11% for full-day trips to 6% for full and half-day trips combined.

5.4.2.4 Uncertainty and Measures of Precision

Measures of precision were computed using a bootstrap procedure with 1000 iterations of the model using randomly sampled trips with replacement. The samples were drawn from the entire data set with the sample size matching the size of the initial data set. Annual CVs of catch rates are tabulated in Table 5.7.5 and applied to the estimated index to develop error estimates (Figure 5.8.5).

5.4.2.5 Comments on Adequacy for Assessment

The index of abundance created from the headboat data was considered by the indices working group to be adequate for potential use in the cobia assessment. The data cover the majority of the range of the stock as described for the South Atlantic and is a complete vessel census of the headboat fleet. The data set has an adequately large sample size and has a long enough time series to provide potentially meaningful information for the assessment. The sampling was consistent over time, and some of the data were verified by port samplers and observers. Headboat effort generally targets snapper-grouper species and not necessarily a focal species, which should minimize changes in catchability relative to fishery-dependent indices that target specific species. The primary caveat concerning this index was that it was derived from fishery-dependent self-reported data.

5.4.3 SCDNR Charter Boat Logbook Program (SEDAR58-DW07)

In 1993, SCDNR's Marine Resources Division (MRD) initiated a mandatory logbook reporting system for all charter vessels to collect basic catch and effort data. Under state law, vessel owners/operators carrying fishermen on a for-hire basis are required to submit monthly trip level reports of their fishing activity in waters off of SC. The charter boat logbook program is a complete census and should theoretically represent the total catch and effort of the charter boat trips in waters off of SC. The charter logbook reports include: date, number of fishermen, fishing locale (inshore, 0-3 miles, >3miles), fishing location (based on a 10x10 mile grid map), fishing method, hours fished, target species, and catch (number of landed and released fish by species) per vessel per trip. The logbook forms have remained similar throughout the program's existence with a few exceptions: in 1999 the logbooks forms were altered to begin collecting the number of fish released alive and the number of fish released dead (prior to 1999 only the total number of fish released were recorded) and in 2008 additional fishing methods were added to the logbook forms, including cast, cast and bottom, and gig. Data represent 6-pack charter vessels only and are self-reported with no field validation.

5.4.3.1 Methods of Estimation

Data

The original calculation included all SCDNR charterboat logbook entries which reported using bottom fishing as the method of fishing for that trip. Data were available from 1993 to 2010; however, it was determined by the Indices Working Group that the dataset would be truncated to only include data from 1998 onwards. This decision is due to a change in effort within the fishery. The percentage of trips reporting targeting cobia increased from an average of 2% from 1993-1997 to an average of 6% from 1998-2017.

Data Subsetting

During the Data Workshop, a method of subsetting trips to better get at effective cobia effort was developed. One method identified cobia trips using the top co-occurring species with cobia. If a trip either caught or reported targeting one of these species, it was included in the index calculation along with trips that either caught or reported targeting cobia. All other trips were excluded. Several versions of the co-occurring species were developed based co-occurrance values in the data and fishermen input.

Methods

The CPUE index was standardized using a Delta-GLM approach in a Bayesian framework using the rstan package in R (version 2.18.1, Stan Development Team 2018). The factors included in the model that were significant are Year (1998-2017), Locale (Inshore (inside the col regs line), Nearshore (0-3 miles), Offshore (outside of 3 miles)), and Month (4-8). Only April through August was used for months since these were the peak months of the fishery. Cobia catch drops off significantly outside of this time-period. The posterior distribution from the fitted model was used to estimate the uncertainty in the index (Dick pers. comm.).

5.4.3.2 Sampling Intensity

Data represent SC licensed 6-pack charter vessel trips operating in or off of SC from 1998 – 2017. SCDNR charterboat logbook vessel trips included in this analysis represent all logbook entries which reported using bottom fishing as the method of fishing. The SCDNR charterboat logbook data represent 148,739 fishing trips in which anglers caught 16,051 cobia and harvested 7,141 cobia.

5.4.3.3 Size/Age data

Limited size and age data specific to SC charter boats are available from this dataset. However, the sizes/ages represented in this index should be similar to those of landings from similar recreational fleets (See section 4 of this report).

5.4.3.4 Catch Rates

Catch per unit effort was calculated as the number of fish caught per angler-hour.

5.4.3.5 Uncertainty and Measures of Precision

The posterior distribution from the fitted model was used to estimate the uncertainty in the index (Dick pers. comm.).

5.4.3.6 Comments on Adequacy for Assessment

The index of abundance created from the SC charterboat logbook data was considered by the indices working group for use in the cobia assessment. However, although it was used in SEDAR 28, the working group decided not to recommend it for use during this assessment due to several important changes from SEDAR 28 to the present. During SEDAR 28, the dataset covered a large portion of the South Atlantic stock's geographic range and landings. Since 2015, VA landings have increased significantly, becoming one of the more important areas for cobia harvest. Also, since 2010, the SC fishery has been in decline, reducing its portion of the overall cobia landings. The catch rates for inshore/nearshore waters had decreased in recent years while offshore catch rates increased (Figure 5.8.6). The agency experts and fishermen agreed that the decline was likely driven by (1) conservation outreach to reduce harvest of cobia, (2) the gamefish status instituted in 2012, (3) changes in fishing methods (shift from bottom fishing to sight-casting in recent years), and (4) suspected localized depletion of the southern inshore cobia stock.

An attempt was made to standardize the inshore/nearshore waters to North and South. However, many of the records in recent years lacked sufficient detail to split the areas and none of the records before 2007 could be identified at this scale. The species associated with cobia vary widely across bottom and pelagic species, demonstrating the difficulty in defining trips with cobia effort. Some of the pros of this index are that it includes discards, does not have issues with the bag limit, and is a complete census, which may provide better data than a survey for rare event species like cobia. However, the panel felt the problems identifying cobia effort and the inability to standardize across areas suspected to have localized depletion decreased the confidence in this index to track population changes. One run, which included only trips where cobia were not identified as a target but were caught, was attempted based on the idea that non-directed trips were less biased. The sample size was reduced significantly, and the geographic range was limited relative to the stock, though the trend was similar to the headboat index.

5.4.4 MRIP (SEDAR58-DW02)

The Marine Recreational Information Program (MRIP) conducts complementary surveys in NY to GA (range of cobia stock being assessed) from March to December each year, providing a time series of catch and effort estimates from March 1981 through 2017 (the terminal year of this stock assessment). For this index both harvested fish per angler trip (A+B1 catch per trip) and total fish per angler trip (A+B1+B2 catch per trip) were used for cobia catch rate computation. In this analysis, no higher level taxa were included because cobia is considered unique enough that the angler can either identify the fish to species (=cobia) or has no idea what he just caught (=unidentified fish). It would not be reasonable to estimate the fraction of those unidentified fish likely to be cobia, so no adjustment for unidentified cobia is included.

For more information on the methodology and variables collected by the MRIP APAIS, see https://www.fisheries.noaa.gov/recreational-fishing-data/types-recreational-fishing-surveys#access-point-angler-intercept-survey. The APAIS Procedures Manual is available in download form (.pdf file) on this webpage.

5.4.4.1 Methods of Estimation

Data from 1981 – 2017 from Waves 3 - 5 (May-October) were used to produce an annual catch per trip index using the MRIP weighted survey data files (download at https://www.fisheries.noaa.gov/recreational-fishing-data/recreational-fishing-data-downloads#general-survey-data-downloads).

The unit of effort used was the angler-trip, defined as a single day of fishing within a specific mode by the angler. MRIP catch data from the APAIS are categorized into three types: A, available, counted, measured, weighed fish by species; B1, unavailable fish (discarded, not whole, dead) reported to species, if possible, by the angler; B2, released alive fish, reported to species, if possible, by the angler. In the newest MRIP APAIS data files, all catch records are 'standardized' to the interviewed angler, accounting for grouped type A catch by multiple anglers within a boat party. The unique interview record of catch provides for grouped catch but not all contributing anglers were interviewed. However, the record counts were adjusted such that the calculated CPUE would correctly represent the total grouped catch, per species, of the group of contributing anglers.

A directed trip methodology was used to identify and include angler-trips in the computation of the CPUE for this index. A trip directed for cobia was defined as any angler trip that caught cobia (A, B1, or B2) and any trip likely to catch cobia defined by target species reported in the interview by the angler (Table 5.7.6). Many species of fish, including grouped taxa such as unidentified sharks, were caught with at least one cobia. Several subsets of co-occurring species assemblages were employed to define trips directed at cobia (Table 5.7.6). However, the species associated with cobia cover a wide range of habitat preferences indicating mixed effort trips or opportunistic cobia fishing within a trip. The entire range from NY to GA was examined but catch of cobia north of VA was rare so additional trials were confined to VA to GA to produce an index. Only trips from May to October were included in this index (APAIS 'waves' 3 - 5) to cover the most active cobia fishing season; catches of cobia from Nov. - Apr. were rare, and appropriate inclusion of directed trips with 0 catch was even less certain so those months were not included in the annual index.

Since the CPUE measures both retained and discarded or released fish, the index should not be strongly affected by changes in bag limit regulations.

Standardization

This index was also standardized using a Delta-GLM approach following the methods of Dick (2004). The units of effort used for the nominal and standardized index were angler-hours. The factors included in the model were Year (1981-2017), Month (May-Oct), State (GA, SC, NC, and VA), and Mode (Charter, Private, and Shore). A jackknife approach was used to estimate the amount of variation in the model run as per Dick (2004).

5.4.4.2 Sampling Intensity

In the Atlantic, a total of 28,554 interviews were conducted from 1981 – 2017 in waves 3-5 that caught or targeted cobia, or targeted king mackerel (highest frequency of co-occurrance NC-GA) in VA to GA. All trips used hook-and-line gear.

5.4.4.3 Size/Age data

Length data for landed cobia is extremely rare in the MRIP APAIS time series. Length frequency distributions can be obtained from the length-frequency catch query tool on the MRIP website: https://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-data-query/queries/index. The sizes/ages represented in this index should be the same as those of landings from the corresponding fleet (See section 4 of this report) and the recommendations of the Life History Workgroup.

5.4.4.4 Catch Rates

Both the nominal and standardized indices were relatively flat and low throughout the 1980s and 1990s (Figure 5.8.7). The indices then jump up to another period of stability until 2010 at which point the nominal index trends upward until 2017. In contrast, the standardized index makes the large jump in 2010, then remains stable until it jumps again in 2016-2017, when VA really enters the fishery (Figure 5.8.7).

5.4.4.5 Uncertainty and Measures of Precision

For cobia, year, month, and state provided the greatest reductions in deviance for the positive trips model, and year, month, state, and mode for the proportion positive model.

5.4.4.6 Comments on Adequacy for Assessment

The index of abundance created from the MRIP data was not considered by the indices working group to be adequate for potential use in the cobia assessment. The dataset has good spatial coverage, which covered the entire geographic range of Atlantic cobia as described above. The index included discards and is a long time series. The index also does not have problems with the bag limit or species identification. However, the problem of correctly identifying the trips to be included in the index, based on species assemblages likely to be caught with cobia, or appropriate targeted species that could produce cobia catch, was insurmountable. The most commonly occurring co-catch in the NC-GA range was king mackerel, but they do not co-occur temporally and spatially with cobia in VA. In the mid-Atlantic range, NY-VA, the most common co-catch was Atlantic croaker, but if all trips that targeted or caught croaker were included that would add > 2 million 0-cobia trips in VA alone (VA produced only ~133,000 trips targeting or catching cobia). Due to this problem of identifying the appropriate parameters needed to include the correct effort in this CPUE index, it is recommended that the MRIP Index not be used in this cobia assessment.

An index was developed for VA-only in an attempt to evaluate trends in a very important region in the overall landings in recent years. This index has the same problems as the overall MRIP index. However, it is the only data source that covers this region. The information is included here to inform assessment analysts of potential differences in trends in a portion of the stock not included in the recommended index. After discussions with fishermen familiar with the VA fishery, two different species groups were used to identify effective cobia effort. The two groups were Bluefish (all trips that either caught or reported targeting bluefish) and sharks (all trips that either caught or reported targeting a complex of elasmobranchs including sandbar shark, blacktip shark, and cownose ray). The factors included in the model were Year (1981-2017), Month (May-Oct), and Mode (Charter, Headboat, Private, and Pier). The standardization proceeded the same as it did for the full MRIP index.

5.4.5 Other Data Sources Considered

No other datasets were introduced at the SEDAR 58 data workshop.

5.5 Consensus Recommendations and Survey Evaluations

Only the recreational headboat index was recommended for potential use in the cobia stock assessment.

5.6 Literature Cited

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5.7 Tables

Table 5.7.1. Table of the data considered for the construction of a CPUE index.

Fishery Type	Data Source	Area	Years	Units	Standardization Method	Use?
Recreational fishery-dependent	Headboat	NC-GA	1991-2015	Count/trip, caught	ZINB	Yes
Recreational charter, fishery-dependent	SCDNR Charter Logbooks	All of SC	1998-2017	Number / angler-hour, caught and discarded	Delta-GLM in Bayesian format	No
Recreational, Private/Charter/Pier	MRIP	VA-GA	1981-2017	Number/angler-hour, caught and discarded	Delta-GLM	No

Table 5.7. 2. Table of the pros and cons for each data set considered at the data workshop.

<u>Fishery-dependent indices</u>

Recreational Headboat (*Recommended for use*)

Pros:

- Vessel census
- Covers most of the management area
- Longest time series available
- Some data are verified by port samplers and observers
- Large sample size
- Non-targeted for focal species, which should minimize changes in catchability relative to fishery-dependent indices that target specific species

Cons:

- Fishery-dependent
- Does not include areas North of NC
- Mostly presence/absence
- Two most recent years unavailable due to closures

SCDNR Charterboat *(Not recommended for use)*

Pros:

- Relatively long time series
- Census of charter boats (rare species)
- Includes discards

Cons:

- Fishery-dependent
- Difficulty in defining effort (many trips catching cobia not listed as target species)
- Fishing behavior impacted by management and conservation outreach (gamefish status)
- Limited spatial coverage relative to SEDAR 58 stock definition
- Limited dockside validation
- Localized depletion for specific areas (inadequate data to standardize)

MRIP *(Not recommended for use)*

Pros:

- Includes discards
- Good spatial coverage
- Relatively long time series

Cons:

- Fishery-dependent
- Difficult to define cobia effort

- Inadequate coverage of rare event species

Table 5.7.3. Subsetting steps and justification for the cobia headboat logbook index.

Step	Filtering step	# cobia trips	# total trips	% cobia trips	Justification
1	Raw data	3,405	102,427	3%	-
2	Filter outliers (anglers and catch)	3,360	101,539	3%	Standard outlier removal procedure
3	Filter vessels with < 30 trips & less than 3 years in fleet	3,313	99,993	3%	Select vessels consistently in fleet that represent the fishery
4	Filter September - March	2,710	77,463	3%	Select months that reflect the highest probability of encountering a cobia
5	Retain 1991-2015	2,298	44,232	5%	Due to inconsisent reporting of cobia in the 1980s and seasonal closures in 2016 and 2017, the time series was truncated
6	Retain full and half daytrips only	1,988	40,502	5%	To examine the possible effects of trip type on cobia catch while eliminating the variability associated with multiday and 3/4 day trips
7	Retain "core" vessels (25)	1,728	27,700	6%	Identify vessels that consistently report cobia

Table 5.7.4. Progression of model runs leading up to the SEDAR 58 cobia data workshop for the cobia headboat logbook index. Model runs 1-11 were exploratory and examined prior to the data workshop while runs 11 and 12 were provided for the data workshop (12) or generated at the data workshop (13).

Run	Year	Region	Trip Type	Season	Percent Full	Vessel Size	Party Size
1	1981-2015	state	all, 2 levels	all years	5 levels	5 levels	5 levels
2	1981-2015	state	all, 2 levels	April - Sept.	5 levels	5 levels	5 levels
3	1981-2015	3 inlet regions	all, 2 levels	April - Sept.	5 levels	5 levels	5 levels
4	1981-2015	3 inlet regions	all, 2 levels	April - Sept.	2 levels	2 levels	2 levels
5	1992-2015	3 inlet regions	all, 2 levels	all years	5 levels	5 levels	5 levels
6	1992-2015	3 inlet regions	all, 2 levels	April - Sept.	5 levels	5 levels	5 levels
7	1992-2015	3 inlet regions	all, 2 levels	April - Sept.	2 levels	2 levels	2 levels
8	1991-2015	3 inlet regions	all, 2 levels	April - Aug.	5 levels	5 levels	5 levels
9	1991-2015	3 inlet regions	all, 2 levels	April - Aug., 2 levels	5 levels	5 levels	5 levels
10	1991-2015	3 inlet regions	all, 2 levels	April - Aug., 2 levels	2 levels	2 levels	2 levels
11	1991-2015	3 inlet regions	full day & multiday, 1 level	April - Aug., 2 levels	2 levels	2 levels	2 levels
12	**1991-2015**	**3 inlet regions**	**full day only**	**April - Aug., 2 levels**	**2 levels**	**2 levels**	**2 levels**
13	**1991-2015**	**3 inlet regions**	**full and half day**	**April - Aug., 2 levels**	**2 levels**	**2 levels**	**2 levels**

Table 5.7.5. The relative nominal *Count*, number of trips, proportion positive, standardized index, and CV for the SEDAR 58 SRHS cobia index.

Year	Relative Nominal (Count)	N	Proportion Positive	Standardized index	CV
1991	1.23	1058	0.06	1.02	0.17
1992	1.26	1204	0.07	0.95	0.16
1993	1.03	1355	0.07	0.83	0.13
1994	0.90	1230	0.06	0.72	0.11
1995	1.55	1298	0.09	1.14	0.13
1996	0.53	1211	0.04	0.46	0.11
1997	0.67	1265	0.05	0.64	0.17
1998	0.87	1197	0.06	0.78	0.14
1999	0.85	1194	0.05	0.82	0.12
2000	0.82	1292	0.05	0.77	0.14
2001	0.70	1107	0.05	0.70	0.17
2002	1.20	1048	0.07	1.17	0.16
2003	0.82	1129	0.06	0.88	0.14
2004	0.86	1302	0.06	0.89	0.13
2005	1.14	973	0.06	1.09	0.13
2006	0.71	1110	0.05	0.85	0.15
2007	1.50	1162	0.09	1.59	0.19
2008	1.30	974	0.09	1.37	0.10
2009	0.78	859	0.05	1.08	0.12
2010	0.74	1120	0.05	1.00	0.20
2011	0.81	1026	0.06	0.83	0.16
2012	0.90	920	0.07	1.09	0.14
2013	1.77	829	0.11	2.04	0.15
2014	1.13	960	0.08	1.23	0.12
2015	0.96	877	0.05	1.04	0.13

Table 5.7.6. MRIP top ten species associations with cobia for the mid-atlantic (VA-North) and South Atlantic (NC-GA).

Mid-Atlantic		South Atlantic	
Species	Fish	Species	Fish
COBIA	525	COBIA	2413
ATLANTIC CROAKER	98	KING MACKEREL	352
BLUEFISH	56	BLACK SEA BASS	238
SUMMER FLOUNDER	50	BLUEFISH	221
SPOT	40	LITTLE TUNNY	196
COWNOSE RAY	37	SPANISH MACKEREL	180
UNIDENTIFIED (SHARKS)	32	DOLPHIN	172
BLACK SEA BASS	29	GREATER AMBERJACK	134
SANDBAR SHARK	17	PINFISH	134
OYSTER TOADFISH	15	GREAT BARRACUDA	124

5.8 Figures

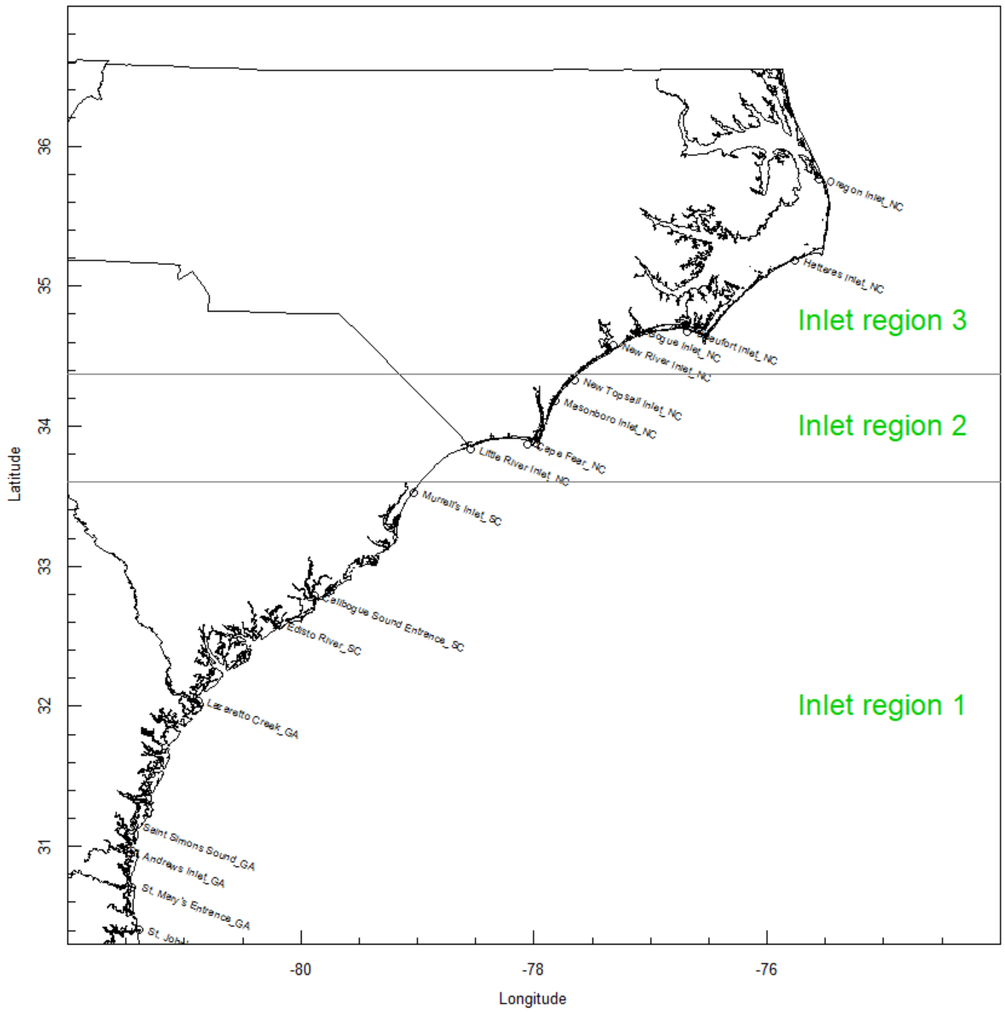

Figure 5.8.1. Map of headboat sampling area definition, inlet region (i). The delineation was determined using tertiles of inlet from positive cobia trips. None of the Florida information was included.

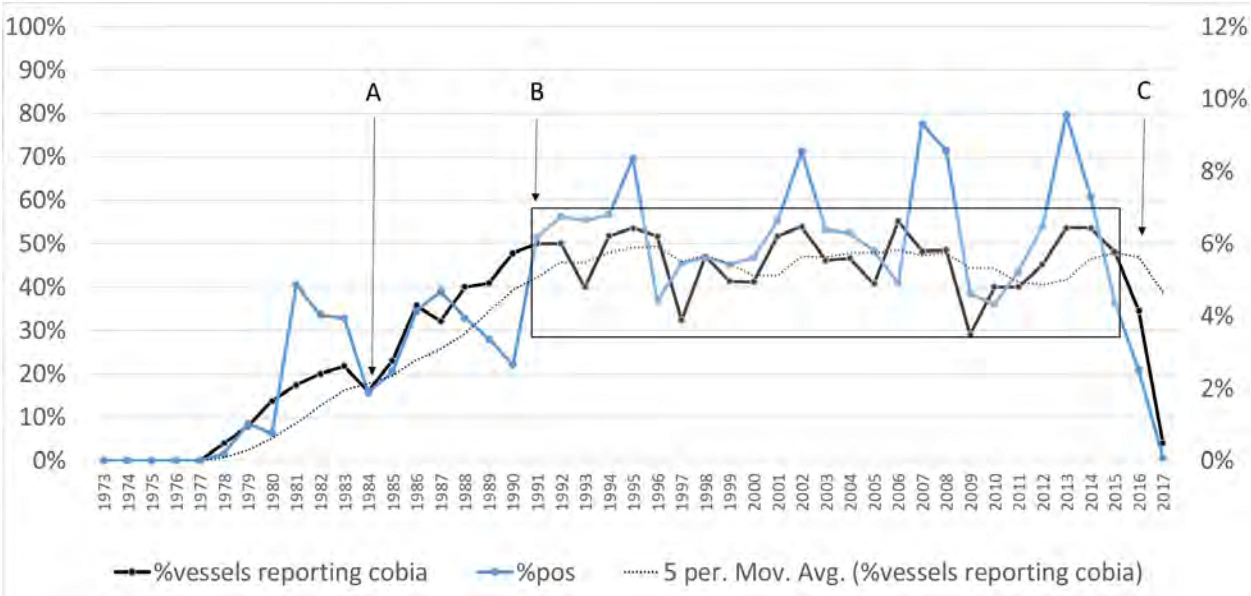

Figure 5.8. 2. Percentage of headboats reporting cobia (black line) and percentage of total headboat trips that reported cobia (blue line). The year cobia were added to the headboat logbook form (A), year where full reporting is assumed (B), and period with closures (C) are shown. The box shows the years included in the headboat index.

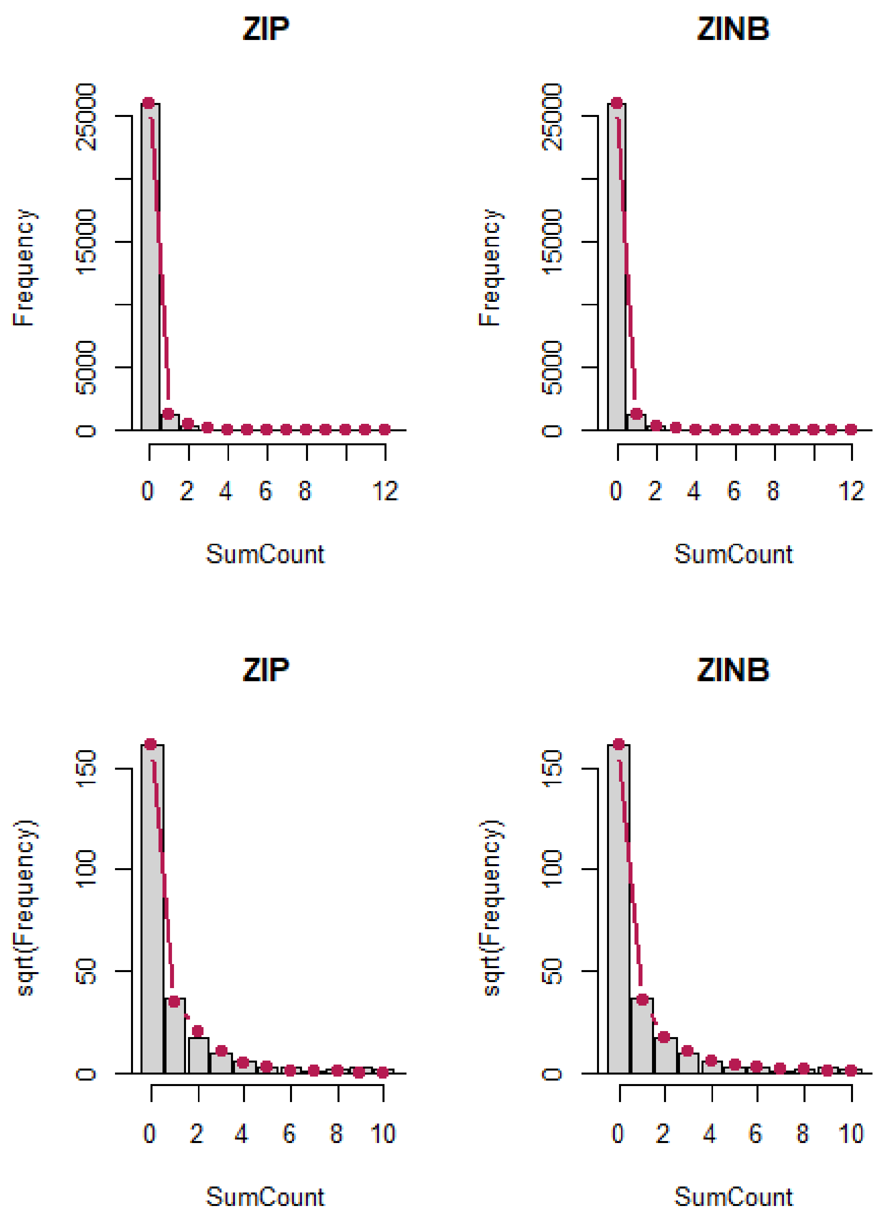

Figure 5.8.3. Model formulation comparison, with ZIP (left) and ZINB (right) fitted values plotted against the original data distribution with all covariates included. The lower panels are square root transformed and truncated at 20 fish for inspection of goodness of fit over the range of values for the bulk of the data.

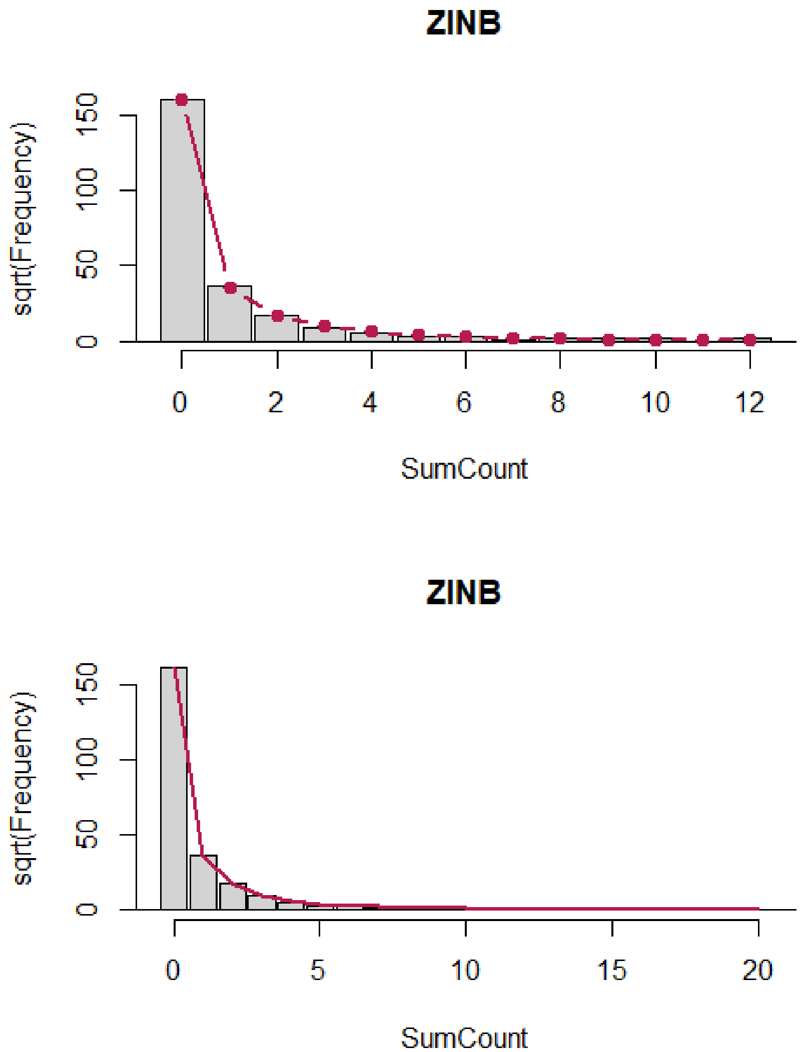

Figure 5.8.4. Model diagnostic plots of fitted model values (red line) against the original data distribution for the preferred model.

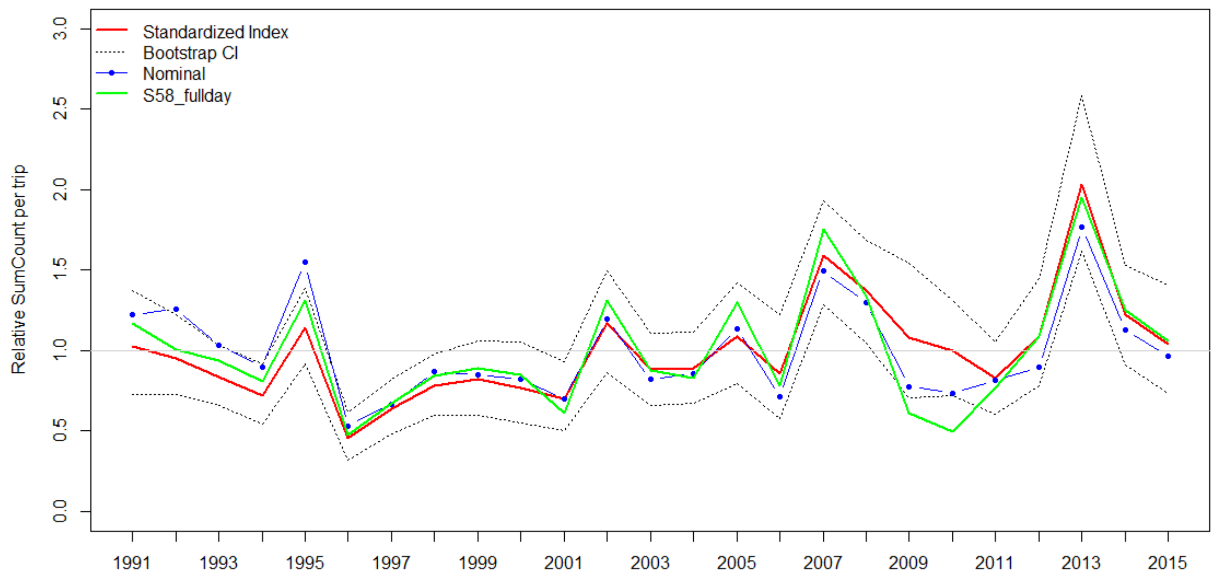

Figure 5.8.5. Relative standardized index (solid red line) with 2.5% and 97.5% confidence intervals (dashed lines) and the relative nominal index (blue) for cobia in the SRHS headboat logbook data and the standardized index with full day trips only (green).

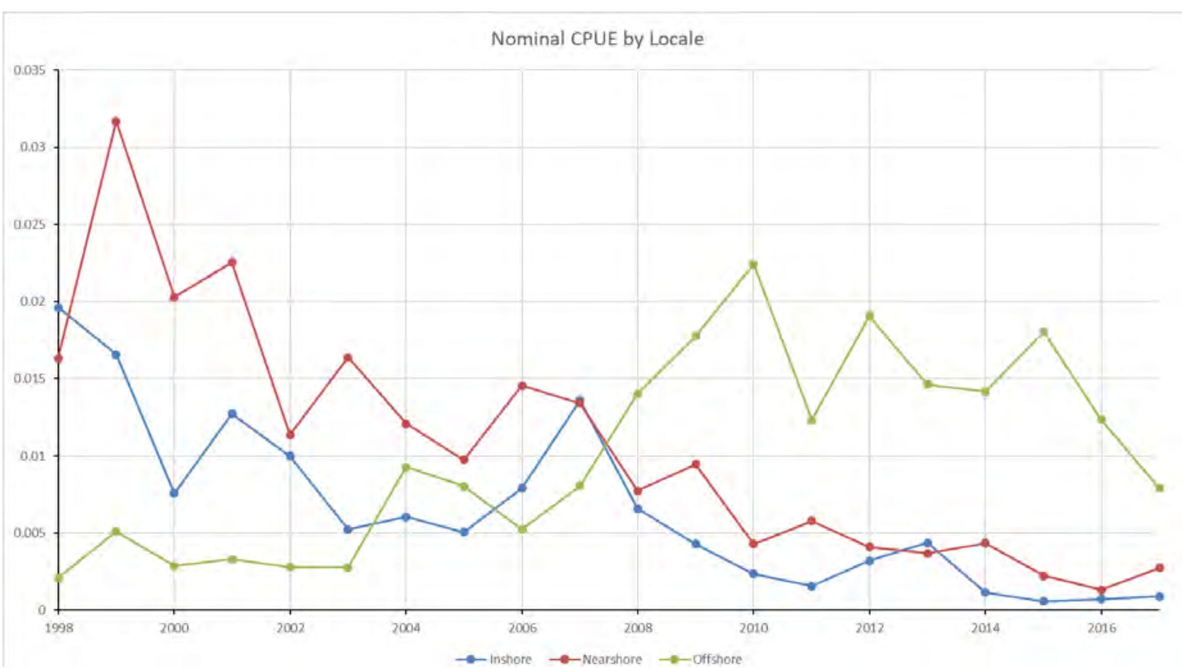

Figure 5.8.6. Nominal SC charter logbook CPUE by locale.

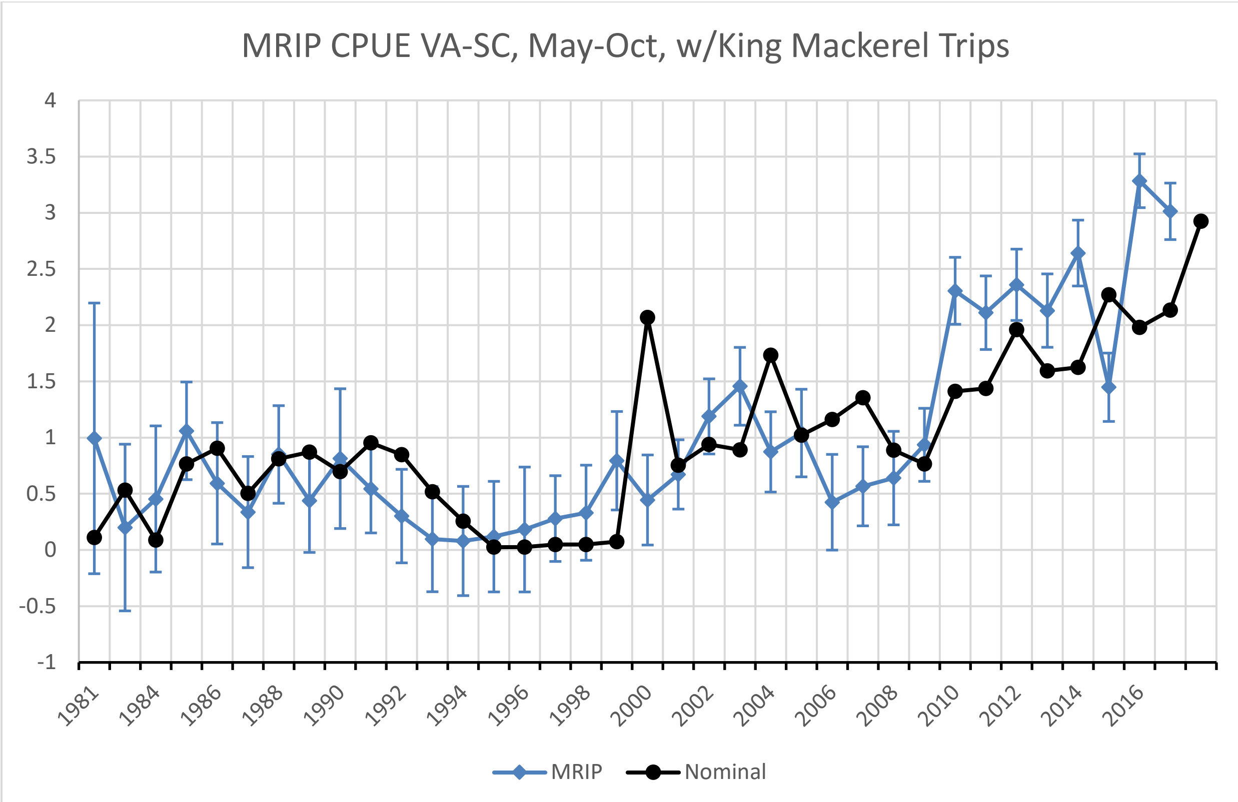

Figure 5.8.7. MRIP nominal and standardized indices using king mackerel trips to define cobia trips in addition to trips catching cobia or listed as targeting cobia.

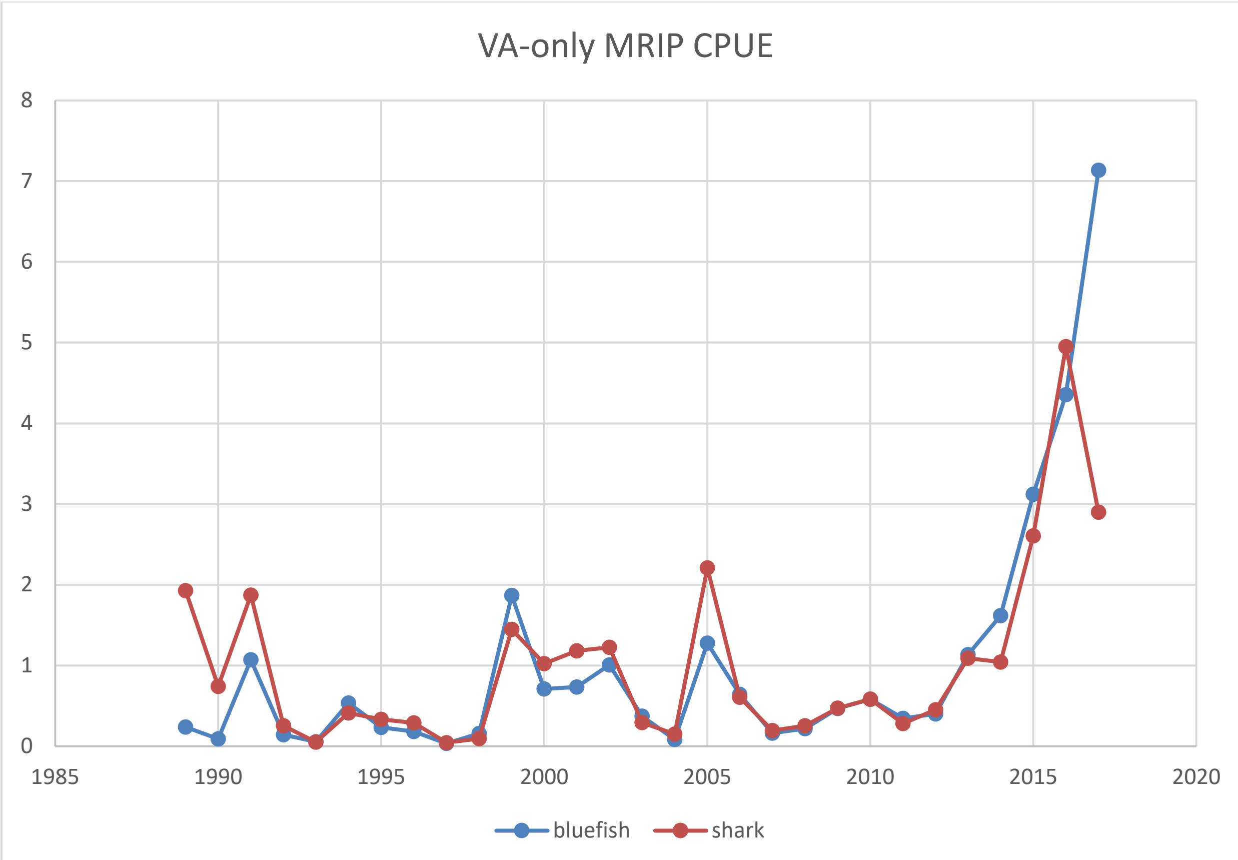

Figure 5.8.8. Virginia-only MRIP CPUE for private, charter, and pier anglers.

5.9 Research Recommendations

5.9.1 Review of SEDAR 28 Research Recommendations

- SEDAR 28 DW - Explore SEFIS video data as a potential fishery independent index of abundance for cobia.

  The SEFIS video data are collected in association with the chevron trap survey and were evaluated for use in SEDAR 58. This survey focuses on bottom species and takes place outside of the primary cobia season. Cobia have been observed on very few occasions (1-3%) in the videos. It is unlikely that this survey would provide a useful index of cobia abundance.

- SEDAR 28 DW - Using simulation analysis, evaluate the utility of including interaction terms in the development of a standardized index and identify the potential effects these interaction terms have on stock assessments.

  Simulation analyses evaluating the utility of including interaction terms in developing a standardized index, to our group's knowledge, have not been attempted for cobia.

- SEDAR 28 AW - Develop a fishery-independent sampling program for abundance of cobia and other coastal migratory species. Fishery -dependent abundance indices used in this assessment were uncertain in part due to the lack of an effective sampling methodology.
  No new fishery-independent surveys have been implemented for cobia and other coastal migratory species.

5.9.2 Research Recommendations

- Develop a fishery-independent sampling program for abundance of cobia and other coastal migratory species.
- Improve MRIP coverage for rare event species
- Improve validation methods for SC Charter Logbook
- Improve effort definition of gear and target species within trips (mixed effort)

6 Discard Mortality

6.1 Overview

An ad-hoc panel discussed discard mortality during the SEDAR 58 Data Workshop. Participants included data providers, analysts, and professionals from the fishing industry representing both commercial and recreational fisheries. The panel reviewed available data and relevant research results to provide recommended estimates of discard mortality for each fishery.
ToR #6 Provide recreational catch statistics, including both landings and discards in both pounds and number.

a) Evaluate and discuss the adequacy of available data for accurately characterizing harvest and discard by species and fishery sector or gear.
b) Provide length and age distributions for both landings and discards if feasible.
c) Provide maps of fishery effort and harvest.
d) Provide estimates of uncertainty around each set of landings and discard estimates.

6.1.1 Recreational fishery

A total of five (5) data sources were recommended by the ad-hoc group including: 1.) The South Carolina Department of Natural Resources (SCDNR) Cobia Broodstock Collection Program, 2.) An Acoustic Telemetry Study (Young et al. 2018), 3.) SCDNR Charterboat Logbook Program, 4.) A Virginia Institute for Marine Sciences (VIMS) Satellite Archival Tag Study (Jensen and Graves 2018) and 5.) The Commercial Logbook Program (NOAA SEFSC). Additional fish in an unpublished paper from North Carolina State University (NCSU) and North Carolina Division of Marine Fisheries were included in the acoustic telemetry analysis. The discard mortality ad-hoc group reviewed each data source independently and outlined all major uncertainties when estimating mortality. After further review, the ad-hoc group decided to use data from the acoustic telemetry study (Young et al. 2016) and the commercial logbook program to estimate discard mortality for each sector. All other studies/programs were used to confirm or inform upper and lower bounds around the mortality estimates as sensitivity runs on the model.

Jacob Krause, a PhD candidate from NCSU, used a Cormack-Jolly-Seber model on data provided from the acoustic telemetry study to estimate release mortality (i.e. any mortality associated with catch-and-release and the surgical procedure to insert a transmitter). Jacob found that the median mortality estimate was 4.6% (95% credible interval; 0.3%, 12.4%). There was discussion amongst the group if cobia caught by researchers are reflective of the recreational fishery. It was determined that researchers are using the same methods and techniques to catch cobia as seen in the recreational fishery. The group recognized there could be additional mortality due to the increased handling time and surgical process which was not typical of the recreational fishery, as such the release mortality estimate may provide an upper bound for discard mortality. Recognizing the aforementioned uncertainties in release mortality, the group found that the model was appropriate for use in estimating discard mortality.

The second data source used to estimate discard mortality was the commercial logbook data provided by NOAA SEFSC. The commercial logbook data estimated discard mortality from handline gear. Other estimated discards from the commercial logbook data included the bandit fishery and the long line fishery. The ad-hoc group updated discard mortality estimates from the commercial logbook data as was done previously in SEDAR 28. The discard mortality estimate for the handline fishery was 5.5%, which is consistent with the handline discard mortality estimate from SEDAR 28. The ad-hoc group noted that the overall mortality of cobia was relatively low. Estimates of discard mortality ranged from 0% (VIMS Satellite Archival Tag Study) to 12.4% (Upper bound from acoustic telemetry study). The group determined that a 0% lower bound estimate was not realistic and therefore adopted the lower bound (2%) from the SEDAR 28 assessment. The group decided that 5 % was a reasonable discard mortality estimate for the recreational hook and line fishery based on results from additional data sources and the discard mortality estimate from SEDAR 28 (5%).

6.1.2 Commercial fishery

Commercial dead discards were estimated using three data sources: 1.) Shark Gillnet observer program (NMFS), 2.) North Carolina Division of Marine Fisheries (NCDMF) Gill Net Observer Program, and 3.) NMFS Supplemental Discard Logbook Program. The shark gill net observer program was designed to monitor bycatch from the shark gill net fishery. The NCDMF observer program was designed to monitor fisheries for protected species interactions in the inshore gill net fishery by onboard observations. The ad-hoc group noted that the sample size of interactions for gill net gears is small (n< 10 fish/year) and for several years the sample size is less than five observed fish. The group noted that there were no releases in 2010 however, that observation was still considered in the time-series average. Discard mortality was estimated by dividing the total number of dead releases (27 fish released dead) by the total number of all releases (64 releases) from the time-series (2004-2017). The discard mortality estimate was 45%, which is well within the bounds of the gill net discard mortality estimate from SEDAR 28. The Supplemental Discard Logbook Program provided disposition (discarded dead, most animals discarded dead, discarded alive, most animals discarded alive, kept for bait, unknown, or unreported) of animals caught in commercial fisheries. In the South Atlantic, 20% of federally permitted vessels were required to report discarded fish and protected species since 2001 (2002 was the first full year of reporting). Discard logbook disposition data were used to estimate discard mortality for the commercial vertical line (handline, electric and hydraulic reel, and trolling gear) fishery. A single value for discard mortality was estimated as the number of cobia released dead (assumed to be the total of those reported as "released dead" plus the number reported as "most animals released dead") divided by the total number of reported discards. The estimated discard mortality for the commercial vertical line fishery was 5.6%. That estimate falls within the range of discard mortalities for recreational hook and line gear.

Observed immediate discard mortality for gill net gears was 55%. The working group recommended an upper bound of 77% discard mortality as was recommended during SEDAR 28. A discard mortality of 36% was recommended as a lower bound as was recommended during SEDAR 28.

Summary of Recommendations

Recreational discard mortality:
• 5 % model base run with 2% and 12% recommended for sensitivity model runs

Commercial discard mortality for gillnet:
• 55% model base run with 36% and 77% recommended for sensitivity model runs

Commercial discard mortality for vertical line:
• Use recreational discard mortality estimates: 5% for base run, 2% and 12% for sensitivity runs

6.1.3 Research recommendations

Recommendations based on the previous SEDAR 28 recommendations:

1. SEDAR 28-During discussion at the data workshop it was noted that the logbook categories for discards (all dead, majority dead, majority alive, all alive) are not useful for informing discard mortality. Consider simplified logbook language in regard to discards (e.g., list them as dead or alive).
    - New recommendation based on same concern: The group recommends that the SEDAR send a recommendation to the Southeast Fisheries Science Center (SEFSC) Fisheries Statistics Division Director clarifying the discard disposition. The group also noted that obtaining adequate discard data is best achieved by collaboration with stakeholder and state/federal partners.
2. SEDAR 28- Further research is needed on cobia release mortality.
    - The discard mortality ad-hoc group addressed this recommendation from SEDAR 28 and agree that additional research is still needed on cobia release mortality.

New SEDAR 58 recommendations:

1. The group recommends continuing electronic tagging to estimate release mortality and total mortality. Increases in spatial coverage (i.e. receiver arrays) and the number of tags both spatially and temporally to increase the precision of mortality estimates. Furthermore, elucidating the effect of temperature on discard mortality through the use of temperature tags.
2. The group recommends the use of conventional tagging. The tagging of telemetered fish informs the fates (i.e. harvest or catch and release of the telemetered fish). For all conventionally tagged fish, high value tags are need to estimate tag reporting rate and estimates of tag loss.

3. The group recommends a SEDAR/council/state or regional management (ASMFC) sponsored tagging workshop to codify methodologies.

Literature cited

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7 Ecosystem

7.1 Ecosystem Workgroup Participant list

Dan Crear, Bill Parker, Hank Liao, George Sedberry, Beth Wrege, Collins Doughtie, Kevin Weng, Karl Brenkert, Mike Denson

7.2 Overview

ToR #7: Identify and describe ecosystem, climate, species interactions, habitat considerations, and/or episodic events that would be reasonably expected to affect population dynamics.

The ad hoc work group determined that along the Atlantic coast of the US there is insufficient data to determine the habitats utilized by almost all life stages of cobia (larvae, juveniles 0-2, wintering adults) making it extremely difficult to evaluate the corresponding risk to the population from climate change, weather events or human pertubation.

Along the Atlantic coast (GA and north) adults migrate into nearshore waters based on temperature cues (>20 C) in the spring and form spawning aggregations and leave nearshore waters when sea surface temperatures exceed 32 C (SEDAR 58 Stock ID Workshop working paper). In some cases, cobia enter high salinity estuaries to spawn (Port Royal Sound, St. Helena Sound, and Chesapeake Bay, SEDAR 28, GSI data Table 2.3). Other than these two, the number and extent of spawning locations have not been enumerated nor documented. Some of these discrete segments of the stock spawn in smaller groups and do not spawn with the rest of the population and have been documented as genetically distinct population segments. Only two areas have been analyzed with sufficient sample sizes to identify these smaller reproductive pools (inshore southern South Carolina and Chesapeake Bay) (SEDAR 58 Stock ID Workshop S58-SID04).

Presumably eggs, larvae, and small juveniles occupy inshore and nearshore waters for a portion of their first year. Cobia eggs/larvae have been identified in ichthyoplankton surveys outside Chesapeake Bay and Southern SC estuaries, but other locations have not been reported.

In the fall, the population leaves nearshore waters, however it is currently unknown where cobia over winter. Because cobia seem sensitive to thermal cues, it is assumed they move into deeper offshore waters or closer to the Gulf stream suggesting a West-East migration. These movements have been confirmed by several pop-up satellite archival tags deployed in VA waters on adult cobia (SEDAR 58 Stock ID Workshop S58-SID02). However, this hypothesis needs to be tested further throughout the range. Very few records of small juveniles through age 2 fish have been collected and it is generally unknown what habitats they utilize.

Because of the paucity of information on cobia life history and the habitats they occupy throughout the year the work group believes that research should focus on documenting these basic questions prior to moving on to potential threats.

7.3 Research Recomendations

-Determine locations of all genetically distinct population segments

-Identify spawning aggregations and duration and timing of spawning

-Further charachterize spawning habitat: salinity, water temperature, day length, habitat type (i.e. structured, vegetated, sandy)

-Identify the habitat of 0-2 year olds juveniles and sub-adults

-Determine habitat use during the winter

-Document the distribution and mechanism for transport of eggs, larvae and post-larvae

-Evaluate the impacts of increased temperature, increased eutrophication of estuarine and nearshore waters, and decreased salinity on egg, larvae and juvenile survival

-Evaluate the impacts of increased temperature, increased eutrophication of estuarine and nearshore waters, and decreased salinity on the food web supporting larvae and juveniles

-Determine factors affecting changes in growth, maturity at age, egg production, and sex ratio as temperature increases forcing a change in habitat use

-Identify threats to different life stages by invasive species

-Better understand the relationship between prey species and co-occurring species (blue crab, calico crab, hardhead catfish, eels, cownose rays etc.)

-Identify levels of pollutants (mercury, microplastics, ethinyl-estradiol) affecting cobia and determine the impacts on growth, maturity at age, egg production, sex ratio and behavior

7.4 Ecosystem Group Reference List

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Modeling Approaches

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Young, J., M. Perkinson, K. Brenkert, E. Reyier, and J. Whittington. 2018. Cobia Telemetry Working Paper. SEDAR58-SID-08. SEDAR, North Charleston, SC. 15 pp.

Jensen, D. and J. Graves. 2018. Use of Pop-Up Satellite Archival Tags (PSATs) to Investigate the Movements, Habitat Utilization, and Post-Release Survival of Cobia (Rachycentron canadum) that Summer in Virginia Waters. SEDAR58-SID-02. SEDAR, North Charleston, SC. 13 pp.

8 Socio – economic

8.1 Overview

There is relatively limited socioeconomic information available for cobia fisheries and the human communities they support. What follows includes a brief summary of the social and economic dimensions of cobia fisheries as described primarily in relevant management documents. Additional context and content were added following a discussion by SEDAR 58 participants in the socio economic ad-hoc group.

ToR #8: Incorporate socioeconomic information into considerations of environmental events that affect stock status and related fishing effort and catch levels as practicable.

Atlantic Cobia support important recreational fisheries throughout the region. Recreational effort is highest in North Carolina and Virginia, which typically represent 70-90% of all directed trips targeting cobia. In South Carolina, high levels of inshore effort are thought to have produced reductions in local abundances, leading fishery managers to enact restrictive management measures beginning in 2015. Private vessels are the dominant fishing mode, though cobia is also an important target for charter vessels and fishing guides in South Carolina, North Carolina, and Virginia. Additionally, shore and pier fishing effort has been increasing in North Carolina recently and typically follows targeting by private vessels earlier in the season. Chumming and sight casting are the most common methods used by anglers to target cobia. Cobia may also occasionally be caught on recreational trips targeting other species outside directed effort during the spring and summer seasons. The South Atlantic Fisheries Management Council evaluated recreational engagement of South Atlantic fishing communities by assessing recreational fishing infrastructure, the number of charter permits, and other relevant data (SAFMC 2018). They found that several communities in North Carolina (Atlantic Beach, Hatteras, Manteo, and Morehead City) and South Carolina (Charleston, Hilton Head, Little River, and Murrells Inlet) exceeded their ranking threshold and were likely to have some dependence on recreational fishing, though this analysis was not specific to Atlantic cobia. It is noted that fishing communities in Virginia were not included in this analysis though cobia may be an important recreational resource to certain areas (e.g., Hampton and Virginia Beach). Economic activity dependent on recreational cobia fisheries is a function of recreational effort and related expenditures and may be substantial in some areas of North Carolina and Virginia. Additionally, a stated preference survey of cobia anglers in Virginia conducted in 2017 revealed a high willingness-to-pay for cobia trips, suggesting the species yields considerable economic value to the recreational sector (i.e., benefits in excess of fishing costs) (Scheld et al., manuscript under review).

Commercial landings of Atlantic cobia are small and typically represent less than $200,000 in ex-vessel revenues annually. Landing prices are generally between $2/lb and $3/lb. A substantial portion of commercial landings are as bycatch or incidental catch when targeting other species, and cobia was found to make up less than 1% of annual all-species revenues for commercial vessels landing cobia from Georgia, South Carolina, and North Carolina from 2012 through 2016 (SAFMC 2018). In Virginia, there is a small directed hook-and-line fishery (ASMFC 2017). Cobia is a state designated gamefish in South Carolina and may not be harvested in state waters for commercial sale; however, fish caught in federal waters can be landed commercially. Due to the small level of commercial landings, economic impacts and associated business activity are thought to be modest (SAFMC 2018).

Fishing mortality by the commercial sector is managed through state and federal limited entry programs as well as individual and vessel trip harvest limits. The recreational fishery is the dominant source of fishing mortality however (>95% of annual landings typically). Managing fishing mortality by the recreational sector is challenging due to difficulties in observing and quantifying catch, harvest, and effort. Furthermore, the recreational sector is composed of thousands of anglers with varying motivations and behaviors, making it difficult to accurately predict effort. Directed effort has generally been found to follow the species' north-south and inshore-offshore seasonal migratory behavior. Shifts in local inshore/offshore abundances or seasonal availability could lead to shifts in recreational effort and harvest. Anecdotal information and stated preference survey data suggest that recreational anglers are responsive to regulations, reducing trip-taking and fishing effort in response to restrictive regulations (Scheld et al., manuscript under review). Directed recreational effort may also depend on the availability and quality of opportunities to target alternative species, suggesting changes in abundances and fishery conditions of substitute species may influence fishing effort and harvests of Atlantic cobia (Scheld et al., manuscript under review).

Environmental factors that may affect fishing effort for Cobia are increasing water temperatures and eddies. The warmer temperatures can cause Cobia to move into fishing areas earlier in the year than expected or even truncate their availability, limiting catch to a period of time as short as two weeks. Cobia could also be moving further northward as mean water temperatures rise in mid and north Atlantic. Otherwise, socio-economic changes for the fishery are more likely related to anglers shifting fishing effort inshore due to high fuel prices or shifting offshore in recent years to protect inshore spawning aggregations.

8.2 Research Needs

- Obtain better data (e.g., more comprehensive and timely) to estimate the annual economic impacts, net benefits, and economic contributions of recreational and commercial Atlantic cobia fishing on coastal communities and regions.
- Obtain cost and expenditure data for recreational fishing trips targeting cobia by fishing mode, for different states, and for anglers returning to private sites, who would not be sampled by the MRIP.
- Estimate willingness-to-pay associated with recreational cobia angling.

8.3 Citations

Atlantic States Marine Fisheries Commission (ASMFC). 2017. Interstate Fishery Management Plan for Atlantic Migratory Group Cobia. NOAA award # NA15NMF4740069. Arlington, VA. 85 pp.

Scheld, A.M., W.M. Goldsmith, S. White, H. Small, and S. Musick. Quantifying the behavioral and economic effects of alternative regulatory measures in Virginia's recreational cobia fishery. Under review at the North American Journal of Fisheries Management.

South Atlantic Fishery Management Council (SAFMC). 2018. Amendment 31 to the Fishery Management Plan for Coastal Migratory Pelagics Resources in the Gulf of Mexico and Atlantic Region. NOAA award # FNA10NMF441001. Charleston, SC. 209 pp.

9 Analytical Approach

Based on the reports produced by the working groups of the Data Workshop, there are sufficient data to attempt to fit an age-structured statistical catch at age model. We also plan to attempt an age-structured production model, a production model, and the models contained in the DLM toolbox. The data provided includes catches, discards, a CPUE index, length and age compositions and life history information.

Southeast Data, Assessment, and Review

SEDAR 58

Atlantic Cobia

This information is distributed solely for the purpose of peer review. It does not represent and should not be construed to represent any agency determination or policy.

NOTE: Modifications to the model results reported in this report were made during the Review Workshop held November 19-21, 2019. For complete results reflecting those changes, please see the Addendum of the Stock Assessment Report (Section IV)

SECTION III: Assessment Workshop Report
November 2019

SEDAR
4055 Faber Place Drive, Suite
201 North Charleston, SC 29405

Document History

November 2019	Original release.

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1. Workshop Proceedings

1.1 Introduction

1.1.1 Workshop Time and Place

The SEDAR 58 Assessment Process was conducted through a series of webinars on the following dates: June 20th, July 17th, August 14th, September 13th, September 23rd, and October 10th, 2019.

1.1.2 Terms of Reference

1. Review any changes in data following the Data Workshop and any analyses suggested by the Data Workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data Workshop recommendations.
2. Develop population assessment models that are compatible with available data and document input data, model assumptions and configuration, and equations for each model considered.
    - Fully document and describe the impacts (on population parameters and management benchmarks) of any changes to the model structure, methods, application or fitting procedures made between this assessment and the prior assessment (SEDAR 28).
3. Provide estimates of stock population parameters, if feasible.
    - Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship (if applicable), and other parameters as necessary to describe the population.
    - Include appropriate and representative measures of precision for parameter estimates.
    - Compare and contrast population parameters and time series estimated in this assessment with values from the previous assessment (SEDAR 28), and comment on the impacts of changes in data, assumptions, or assessment methods on estimated population conditions.
4. Provide estimates of yield and productivity.
    - Include yield-per-recruit, spawner-per-recruit, and stock-recruitment models.
5. Provide estimates of population benchmarks or management criteria consistent with the available data, applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards. Include values for fishing mortality (including assumed discard mortality if appropriate), spawning stock biomass, fishery yield, SPR, and recruitment for potential population benchmarks.
    - Evaluate existing or proposed management criteria as specified in the management summary.
    - Recommend proxy values when necessary.
    - Compare and contrast reference values estimated in this assessment with values from the previous assessment (SEDAR 28), and comments on the impacts of changes in data, assumptions or assessment methods on reference point differences.
6. Characterize uncertainty in the assessment and estimated values.
    - Consider uncertainty in input data, modeling approach, and model configuration.

- Provide a continuity model consistent with the prior assessment configuration, if one exists, updated to include the most recent observations. Alternative approaches to a strict continuity run that distinguish between model, population, and input data influences on findings, may be considered.
- Consider other sources as appropriate for this assessment.
- Provide appropriate measures of model performance, reliability, and 'goodness of fit'.
- Provide measures of uncertainty for estimated parameters and model output.

7. Provide declarations of stock status relative to benchmarks, or alternative data poor approaches if necessary.
8. Perform probabilistic analysis of proposed reference points, stock status, and yield.
    - Provide the probability of overfishing at various harvest or exploitation levels.
    - Provide a probability density function for biological reference point estimates.
    - If the stock is overfished, provide the probability of rebuilding within mandated time periods as described in the management summary or applicable federal regulations.
9. Project future stock conditions (biomass, abundance, and exploitation) and develop rebuilding schedules if warranted; including estimated generation time. Stock projections shall be developed in accordance with the following:
    - If stock is overfished
      F=0, F=Fcurrent, F=Fmsy, F=Ftarget
      F=Frebuild (max that rebuild in allowed time)
    - If stock is not overfished
      F=Fcurrent, F=Fmsy, F=Ftarget
    - If data limitations preclude standard projections (i.e. bullets above), explore alternate models to provide management advice.
10. Provide recommendations for future research and data collection.
    - Be as specific as practicable in describing sampling design and sampling intensity.
    - Emphasize items which will improve future assessment capabilities and reliability.
    - Consider data, monitoring, and assessment needs.
11. Review, evaluate, and report on the status and progress of all research recommendations listed in the last assessment, peer review reports, and SSC report concerning this stock.
12. Complete the Assessment Workshop Report in accordance with project schedule deadlines (Section III of the SEDAR stock assessment report).

1.1.3 List of Participants

Assessment PANELISTS	
Katie Siegfried	SEFSC Beaufort – Lead Analyst
Rob Cheshire	SEFSC Beaufort
Jeff Buckel	SAFMC SSC
Mike Denson	SC DNR
Alex Aspinwall	VMRC
Cynthia Jones	ODU
Anne Lange	SAFMC SSC
Kyle Shertzer	SEFSC Beaufort
Erik Williams	SEFSC Beaufort
APPOINTED OBSERVERS	
Wes Blow	SAFMC Mack/Cobia AP
Collins Doughtie	SAFMC Mack/Cobia AP
Stephen Donalson	SAFMC Mack/Cobia AP
Bill Gorham	SAFMC Mack/Cobia AP
Bill Parker	Fisherman – SC
Lee Southard	Fisherman - GA
COUNCIL MEMBERS	
Anna Beckwith	SAFMC
Mel Bell	SAFMC
Steve Poland	SAFMC
Council and Agency STAFF	
Kathleen Howington	SEDAR
Cierra Graham	SAFMC
Christina Wiegand	SAFMC
Mike Errigo	SAFMC
Mike Larkin	SERO
Mike Schmidtke	ASMFC

1.1.4 List of Assessment Workshop Working Papers

Documents Prepared for the Assessment Workshop		
Final Assessment Reports		
SEDAR58-SAR1	Assessment of Atlantic Cobia	To be prepared by SEDAR 58
Reference Documents		
SEDAR58-RD01	SEDAR 28 South Atlantic Cobia Stock Assessment Report	SEDAR 28
SEDAR58-RD02	SEDAR 28 Gulf of Mexico Cobia Stock Assessment Report	SEDAR 28
SEDAR58-RD03	List of documents and working papers for SEDAR28 (South Atlantic Cobia and Spanish Mackerel) – all documents available on the SEDAR website.	SEDAR 28
SEDAR58-RD04	Managing A Marine Stock Portfolio: Stock Identification, Structure, and Management of 25 Fishery Species along the Atlantic Coast of the United States	McBride 2014
SEDAR58-RD05	Chapter 22: Interdisciplinary Evaluation of Spatial Population Structure for Definition of Fishery Management Units (excerpt from Stock Identification Methods – Second Edition)	Cadrin et al. 2014
SEDAR58-RD06	Mitochondrial DNA Analysis of Cobia *Rachycentron canadum* Population Structure Uisng Restriction Fragment Length Polymorphisms and Cytochrome B Sequence Variation	Hrincevich 1993
SEDAR58-RD07	Population Genetic Comparisons among Cobia from the Northern Gulf of Mexico, U.S. Western Atlantic, and Southeast Asia	Gold et al. 2013
SEDAR58-RD08	Population genetics of Cobia (*Rachycentron canadum*): implications for fishery management along the coast of the southeastern United States	Darden et al. 2014
SEDAR58-RD09	Growth, mortality, and movement of cobia (*Rachycentron canadum*)	Dippold et al. 2017

SEDAR58-RD10	Assessment of cobia, *Rachycentron canadum*, in the waters of the U.S. Gulf of Mexico	Williams, 2001
SEDAR58-RD11	Life history of Cobia, *Rachycentron canadum* (Osteichthyes: Rachycentridae), in North Carolina waters	Smith 1995
SEDAR58-RD12	A review of age, growth, and reproduction of cobia *Rachycentron canadum*, from US water of the Gulf of Mexico and Atlantic ocean	Franks and Brown-Peterson, 2002
SEDAR58-RD13	An assessment of cobia in Southeast US waters	Thompson 1995
SEDAR58-RD14	Reproductive biology of cobia, *Rachycentron canadum*, from coastal waters of the southern United States	Brown-Peterson et al. 2001
SEDAR58-RD15	Age and growth of cobia, *Rachycentron canadum*, from the northeastern Gulf of Mexico	Franks et al. 1999
SEDAR58-RD16	Synopsis of biological data on the cobia *Rachycentron canadum* (Pisces: Rachycentridae)	Shaffer and Nakamura 1989
SEDAR58-RD17	Age, growth, and reproductive biology of greater amberjack and cobia from Louisiana waters	Thompson et al.1991
SEDAR58-RD18	Cobia (*Rachycentron canadum*) stock assessment study in the Gulf of Mexico and in the South Atlantic	Burns et al. 1998
SEDAR58-RD19	Gonadal maturation in the cobia, *Rachycentron canadum*, from the northcentral Gulf of Mexico	Lotz et al. 1996
SEDAR58-RD20	Length-weight relationships, location and depth distributions for select Gulf of Mexico reef fish species	Pulver & Whatley 2016
SEDAR58-RD21	Inshore spawning of cobia (*Rachycentron canadum)* in South Carolina	Lefebvre & Denson 2012
SEDAR58-RD22	Determining the stock boundary between South Atlantic and Gulf of Mexico managed stocks of Cobia, *Rachycentron canadum*, through the use of telemetry and population genetics	Perkinson et al. 2018
SEDAR58-RD23	SAFMC Mackerel Cobia Advisory Panel and Cobia Sub-Panel Cobia Fishery Performance Report April 2017	SAFMC Mackerel Cobia AP & Cobia Sub-Panel 2017

SEDAR58-RD24	Spawning of the Cobia, *Rachycentron canadum*, in the Chesapeake Bay Area, with Observations of Juvenile Specimens	Joseph et al. 1964
SEDAR58-RD25	SEDAR28-DW02: South Carolina experimental stocking of Cobia *Rachycentrom canadum*	Denson 2012
SEDAR58-RD26	Applying network methods to acoustic telemetry data: Modeling the movements of tropical marine fishes	Finn et al. 2014
SEDAR58-RD27	Developing a deeper understanding of animal movements and spatial dynamics through novel application of network analyses	Jacoby et al. 2012
SEDAR58-RD28	Status of the South Carolina Fisheries for Cobia	Hammond 2001
SEDAR58-RD29	Dynamic ocean management increases the efficiency and efficacy of fisheries management	Dunn et.al. 2016
SEDAR58-RD30	Using Pop-off Satellite Archival Tags To Monitor and Track Dolphinfish and Cobia	Hammond 2008
SEDAR58-RD31	Cusk (Brosme brosme) and climate change: assessing the threat to a candidate marine fish species under the US Endangered Species Act	Hare et al 2012
SEDAR58-RD32	Dynamic habitat suitability modelling reveals rapid poleward distribution shift in a mobile apex predator	Hill et. al. 2016
SEDAR58-RD33	Seasonal forecasting of tuna habitat for dynamic spatial management	Hobday et. al. 2011
SEDAR58-RD34	Near real-time spatial management based on habitat predictions for a longline bycatch species	Hobday et. al. 2006
SEDAR58-RD35	Seasonal forecasting for decision support in marine fisheries and aquaculture	Hobday et. al. 2016
SEDAR58-RD36	Changing spatial distribution of fish stocks in relation to climate and population size on the Northeast United States continental shelf	Nye et.al. 2009

SEDAR58-RD37	Projecting changes in the distribution and productivity of living marine resources: A critical review of the suite of modelling approaches used in the large European project VECTORS	Peck et. al. 2016
SEDAR58-RD38	Climate Change Affects Marine Fishes Through the Oxygen Limitation of Thermal Tolerance	Portner and Knust 2007
SEDAR58-RD39	Effects of water temperature and fish size on growth and bioenergetics of cobia (Rachycentron canadum)	Sun and Chen 2014
SEDAR58-RD40	Effect of temperature on growth and energy budget of juvenile cobia (Rachycentron canadum)	Sun et. al. 2006
SEDAR58-RD41	Managing living marine resources in a dynamic environment: The role of seasonal to decadal climate forecasts	Tomoassi et. al. 2017
SEDAR58-RD42	Model-estimated conversion factors for calibrating Coastal Household Telephone Survey (CHTS) charterboat catch and effort estimates with For-Hire Survey (FHS) estimates in the Atlantic and Gulf of Mexico with application to red grouper and greater amberjack	Dettloff & Matter 2019
SEDAR58-RD43	Understanding the Virginia Cobia Stock Through Analysis of Trophy Fish	Weng et. al. 2019
SEDAR58-RD44	Technical Documentation of he Beaufort Assessment Model	Williams and Shertzer, 2015
SEDAR58-RD45	Evolutionary assembly rules for fish life histories	Charnov et.al. 2013

1.2 Statements Addressing Each Term of Reference

Note: Original ToRs are in normal font. Statements addressing ToRs are in italics.

1. “Review any changes in data following the Data Workshop and any analyses suggested by the Data Workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data Workshop recommendations.”

    Section 2 reviews the data and explains the deviations from Data Workshop recommendations.

2. “Develop population assessment models that are compatible with available data and document input data, model assumptions and configuration, and equations for each model considered.
    - Fully document and describe the impacts (on population parameters and management benchmarks) of any changes to the model structure, methods, application or fitting procedures made between this assessment and the prior assessment (SEDAR 28).”

    The data available supported the use of the Beaufort Assessment Model. The impacts of changing model structure or input data are shown through sensitivity analysis. The Panel agreed to conduct a continuity run in pieces, as a true continuity is often not possible to achieve. In particular, sensitivities S1-S3e, and S6 incorporate the previous assessment’s data and/or assumptions.

3. “Provide estimates of stock population parameters, if feasible.
    - Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship (if applicable), and other parameters as necessary to describe the population.
    - Include appropriate and representative measures of precision for parameter estimates.
    - Compare and contrast population parameters and time series estimated in this assessment with values from the previous assessment (SEDAR 28), and comment on the impacts of changes in data, assumptions, or assessment methods on estimated population conditions.”

    Requested values are in Tables 6-16 and measures of precision are shown in Figures 17, and 20-24. Comparison plots are provided in Figures 39 and 40 and a discussion is in section 4.9.2.

4. “Provide estimates of yield and productivity.
    - Include yield-per-recruit, spawner-per-recruit, and stock-recruitment models.”

    Figures 16 and 18-19 display requested relationships. The stock-recruit model is not meant to be a Beverton-Holt, rather, it is used with steepness fixed at 0.99 for computational convenience.

5. "Provide estimates of population benchmarks or management criteria consistent with the available data, applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards. Include values for fishing mortality (including assumed discard mortality if appropriate), spawning stock biomass, fishery yield, SPR, and recruitment for potential population benchmarks.
- Evaluate existing or proposed management criteria as specified in the management summary.
- Recommend proxy values when necessary.
- Compare and contrast reference values estimated in this assessment with values from the previous assessment (SEDAR 28), and comments on the impacts of changes in data, assumptions or assessment methods on reference point differences."

All requested values are provided in Tables 6-16. A proxy value was chosen by the Panel ($F_{40\%}$). Though $F_{40\%}$ and F_{msy} are not directly comparable, the comparison plots are provided (Figure 39)

6. "Characterize uncertainty in the assessment and estimated values.
- Consider uncertainty in input data, modeling approach, and model configuration.
- Provide a continuity model consistent with the prior assessment configuration, if one exists, updated to include the most recent observations. Alternative approaches to a strict continuity run that distinguish between model, population, and input data influences on findings, may be considered.
- Consider other sources as appropriate for this assessment.
- Provide appropriate measures of model performance, reliability, and 'goodness of fit'.
- Provide measures of uncertainty for estimated parameters and model output."

Uncertainty was characterized using an ensemble modeling approach. This approach entails creating a new data set by varying input data using either/both bootstrapping or/and monte carlo methods and running the assessment model for each new data set. The set of models is the ensemble from which we calculate statistics to provide uncertainty estimates. Section 3.7 describes the method, and Table 16 provides the medians and standard deviations of the ensemble model outputs.

7. "Provide declarations of stock status relative to benchmarks, or alternative data poor approaches if necessary."

Table 16 provides the needed quantities.

8. "Perform probabilistic analysis of proposed reference points, stock status, and yield.
- Provide the probability of overfishing at various harvest or exploitation levels.
- Provide a probability density function for biological reference point estimates."

Densities of reference points are provided in Figures 20-22. The stochastic projections are completed to provide probability of overfishing at various harvest levels (Figures 36-38).

9. "Project future stock conditions (biomass, abundance, and exploitation) and develop rebuilding schedules if warranted; including estimated generation time. Stock projections shall be developed in accordance with the following:

- If stock is not overfished
$F=F_{current}$, $F=F_{msy}$, $F=F_{target}$"

Section 3.8.3 describes the projection scenarios. The F_{target} chosen by the Panel was 75% of the $F_{40\%}$ value. Results are described in section 4.11 and shown in Tables 18-20 and Figures 36-38.

10. "Provide recommendations for future research and data collection.

- Be as specific as practicable in describing sampling design and sampling intensity.
- Emphasize items which will improve future assessment capabilities and reliability.
- Consider data, monitoring, and assessment needs."

The research recommendations were compiled from members of the Panel and reported in section 5.3 of the report.

11. "Review, evaluate, and report on the status and progress of all research recommendations listed in the last assessment, peer review reports, and SSC report concerning this stock."

The research recommendations in Section 5.3 are largely carried over from the previous assessment. There has not been a fishery independent sampling program developed. The age sampling program has expanded to Virginia, but is still a carcass collection program rather than a port sampling design. There is work underway to better characterize reproductive parameters, though the work is not complete (see the SEDAR 58 Stock ID workshop report). The telemetry work for this species is ongoing, and with continuing funding will help to provide better mortality estimates and may help to characterize the migratory dynamics.

12. "Complete the Assessment Workshop Report in accordance with project schedule deadlines (Section III of the SEDAR stock assessment report)."

Report submitted in a timely manner.

2 Data Review and Update

In this benchmark assessment, the start year is 1986 and the terminal year is 2017. The composition data and non-hindcasted landings data start in 1986, and the Assessment Panel decided to start the model in the year when the best data become available. The Panel's decision was also based on model runs that demonstrated the fact that including earlier years of hindcasted landings data did not affect model results. Data sources from SEDAR28 were also considered here; however, all data were re–examined and evaluated using current methodologies, including data prior to 2011 (the terminal year of SEDAR28). The input data for this assessment are described below, with focus on modifications from recommendations of the Data Workshop and those used in the last assessment:

2.1 Data Review

In this benchmark assessment, the Beaufort Assessment Model (BAM) was fitted to data sources similar to those used in the SEDAR28 benchmark with some modifications and additions.

- Landings: Commercial (all gears), and General recreational (headboat, charterboat, and private boat modes).
- Discards: Commercial (handline and nets), General recreational (all modes).
- Index of abundance: Headboat CPUE
- Length compositions of landings: Commercial handline
- Age compositions of landings: General recreational

In addition to data fitted by the model, this assessment utilized life-history information that was treated as input. Such inputs, some of which remained the same for this assessment as were used in the last assessment, were provided by the life history working group: natural mortality, female maturity at age, sex ratio, and somatic growth. The discard mortality rates were compiled by the discard mortality working group.

2.2 Data Update

The following is a summarization of the data differences between this benchmark assessment and the last (SEDAR28). Data available for this assessment are summarized in Tables 1–5.

- Discards and discard mortality: The discard mortality working group provide a gillnet discard mortality rate of 0.55, compared to 0.51 in SEDAR28. Commercial and recreational discards were updated through 2017. The estimates for commercial and recreational discards are either model- or ratio-based, therefore the entire time series of estimates were provided.
- Indices of abundance: As per the data workshop recommendations, neither the SCDNR index of abundance, nor the MRFSS index of abundance were used in this assessment, though they were in the SEDAR28 assessment. The headboat index is the sole index used in this benchmark assessment.
- Size/age compositions landings: Commercial and general recreational composition data were corrected and updated through 2017, the terminal year of the assessment, though general recreational length compositions and commercial age compositions were not used. All of the updated composition data are subject to the same minimum sample size used in SEDAR28 (n=30 trips for lengths and n=10 trips for ages) though sample sizes (i.e., trip numbers) were not available for several years and states. The number of fish sampled represented the sample size for general recreational compositions, as often a single fish is caught per trip.

- Growth curves: Additional growth curves were requested by the Assessment Panel, and the analyst and Life History Working Group chairperson conducted the analyses. The Panel requested a female–only and a landings–only growth curve. The landings–only growth curve is meant to represent the average size of the fish captured by the fleet, therefore the fitting procedure did not adjust for the size limit. The females–only growth curve is meant to be used to calculate the female biomass, and therefore needs to reflect the population. Size correction methodology was used for the female–only curve to account for fishery dependent observations (lengths) being truncated by the size limit.
- The iterative reweighting method used in SEDAR28 was not used for composition data, as the Dirichlet multinomial distribution was used. The Dirichlet multinomial is a self-weighting distribution, thus removing the need for weights on the composition data. The index was weighted using the iterative reweighting procedure.
- The Charnov et al. (2013) method was used to calculate natural mortality. The Charnov et al. method is a meta–analysis that includes data from multiple studies that generate methods to estimate natural mortality. The Lorenzen method (Lorenzen 1996) used in SEDAR28 is one method used in the Charnov et al. meta–analysis.

2.2.1 Discard Mortality

The discard mortalities for all the gears were revisited by the discard mortality working group. The group reviewed five data sources from state and federal government agencies. After discussion the observed immediate discard mortality for gillnet gears was 55%. The working group recommended an upper bound of 77% and a lower bound of 36% discard mortality as was recommended during SEDAR28. For lines, the group noted that the overall discard mortality of cobia was relatively low. Estimates of discard mortality ranged from 0% to 12.4%. The group determined that a 0% lower bound estimate was not realistic and therefore adopted the lower bound of 2% from SEDAR28. The group decided that 5% was a reasonable discard mortality estimate based on results from additional data sources and the discard mortality estimate from SEDAR28.

2.2.2 Recreational Landings and Discards

Estimates were available from the recalibrated MRIP data, and were used as input for the landings and discards for all recreational modes except headboat through 2017. Headboat landings were provided through 2017, and headboat discards were calculated using a model-based approach. Headboat and general recreational landings and discards were combined into one general recreational fleet, by applying the discard mortality rate to live discards and combining the result with the landings to create one time series of removals for the general recreational fleet.

2.2.3 Commercial Landings and Discards

The commercial discards were revised for the entire time series, as it is a model-based approach, and provided through 2017. Commercial landings were updated through 2017. Commercial landings and discards were combined into one time series, consistent with SEDAR28, by applying the discard mortality rate to live discards and combining the result with the landings for one time series of removals for the commercial fleet.

2.2.4 Indices of Abundance

The fishery-dependent index was considered in light of new management measures effected since the last assessment. Closures for the recreational season have been intermittent since 2015. The change in closures since SEDAR28 clearly affects catch per effort, and it likely invalidates catch per effort as a meaningful index of abundance. Thus, the headboat index was only updated through 2015 for this assessment. This index was the only index of abundance used in the assessment.

2.2.5 Length Compositions

Length compositions for both fleets were corrected and updated through 2017. The Assessment Panel considered several possible applications of length composition data. The Panel considered including general recreational length compositions in years with no age composition data, or when the age data were sparse. However, no growth curve is estimated internally, and the quality of the age compositions is such that the length compositions were not needed to supplement, and thus they were not used in the assessment. For the commercial fleet, length compositions were inadequate to produce annual length compositions. Therefore, the Assessment Panel agreed to pool the commercial length compositions across years into a single composition.

2.2.6 Age Compositions

The commercial age compositions were discussed by the Assessment Panel, in light of the fact that the samples for ageing were not randomly sampled. The Assessment Panel decided to not use the commercial age compositions, as they did not represent the fleet. The general recreational age compositions were discussed at both the data workshop and during the assessment process. The majority of the samples are from carcass collection programs in Virginia and South Carolina. The general recreational age samples from SEDAR28 were largely carcass samples as well, therefore the discussion focused on whether the samples were different from each state. In order to account for differences, the Assessment Panel decided to weight the age samples by landings in order to provide an age composition representative of the entire fleet across states.

3 Stock Assessment Methods

This assessment updates the primary model applied during the SEDAR28 benchmark for cobia. The methods are reviewed below, and any changes since the SEDAR28 benchmark are noted.

3.1 Overview

This assessment used the Beaufort Assessment Model (BAM, Williams and Shertzer 2015), which applies an integrated catch-age formulation, implemented with the AD Model Builder software (Fournier et al. 2012). In essence, the model simulates a population forward in time while including fishing processes (Quinn and Deriso 1999; Shertzer et al. 2014). Quantities to be estimated are systematically varied until characteristics of the simulated population match available data on the real population. The model is similar in structure to Stock Synthesis (Methot and Wetzel 2013). Versions of BAM have been used in previous SEDAR assessments of reef fishes in the U.S. South Atlantic such as red porgy, tilefish, blueline tilefish, gag, greater amberjack, snowy grouper, vermilion snapper, and red snapper.

3.2 Data Sources

The catch-age model included data from two fleets that caught cobia in southeastern U.S. waters north of the Georgia Florida border: commercial and general recreational. The model was fitted to data on annual removals (in units of 1000 lb whole weight for commercial and 1000 fish for general recreational), which comprised landings and dead discards. Dead discards were computed using the discard mortalities provided at the Data Workshop. The model was also fitted to pooled length compositions of commercial landings, annual age compositions of general recreational landings, and a fishery-dependent index (headboat). Data used in the model are tabulated in §2 of this report.

3.3 Model Configuration

Model structure and equations of the BAM are detailed in Williams and Shertzer (2015). The assessment time period was 1986–2017. A general description of the assessment model follows.

3.3.1 Stock dynamics

In the assessment model, new biomass was acquired through growth and recruitment, while abundance of existing cohorts experienced exponential decay from fishing and natural mortality. The population was assumed closed to immigration and emigration. The model included age classes $1 - 12^{+}$, where the oldest age class 12^{+} allowed for the accumulation of fish (i.e., plus group).

3.3.2 Initialization

Initial (1986) abundance at age was estimated in the model as follows. First, the equilibrium age structure was computed for ages 2–12 based on natural and initial fishing mortality (F_{init}), where F_{init} is an estimated parameter. Second, lognormal deviations around that equilibrium age structure were estimated. The deviations were lightly penalized, such that the initial abundance of each age could vary from equilibrium if suggested by early composition data, but remain estimable if data were uninformative. Given the initial abundance of ages 2–12, initial (1986) abundance of age-1 fish was computed using the same methods as for recruits in other years (described below).

3.3.3 Growth

Mean size at age of the population (total length, TL) was modeled with the von Bertalanffy equation (Figure 1), and weight at age (whole weight, WW) was modeled as a function of total length. Parameters of growth and conversions (TL-WW) were estimated by the Life History Working Group and were treated as input to the assessment model. The von Bertalanffy parameter estimates for the population from the DW were $L_{\infty} = 1262$, $K = 0.31$, and $t_0 = -0.53$. However, the Panel decided to use two modified growth curves instead; one to fit to landings (landings only with no size limit correction), and one to calculate spawning stock biomass (females only with a size limit correction) For the landings–only growth curve, $L_{\infty} = 1287$, $K = 0.26$, and $t_0 = -1.74$, and for the females–only growth curve, $L_{\infty} = 1334$, $K = 0.32$, and $t_0 = -0.49$. For fitting length composition data, the distribution of size at age was assumed normal with coefficient of variation (CV) estimated by the assessment model. A constant CV, rather than constant standard deviation, was suggested by the size at age data. Only the CV for the landings–only curve is estimated within the model.

3.3.4 Natural mortality rate

The natural mortality rate (M) was assumed constant over time, but decreasing with age. The form of M as a function of age was based on Charnov et al. (2013). The Charnov et al. (2013) approach relates the natural mortality at age to the von Bertalanffy growth equation parameters (of the whole population) and length at age: $\mathrm{M}_a = K \times [L_a/L_\infty]^{-1.5}$, where L_∞ and K are von Bertalanffy parameters and L_a is length at age.

3.3.5 Female maturity and Spawning stock

Female maturity was modeled with a logistic function; the age at 50% female maturity was estimated to be ~ 1 year. No new data on maturity were available for this assessment, therefore the values from SEDAR28 were applied. Spawning stock was modeled as biomass of mature females measured at the time of peak spawning. For cobia, peak spawning was considered to occur mid–June.

3.3.6 Recruitment

In this assessment, steepness was not estimable, even when applying a prior distribution to inform the estimation (Shertzer and Conn 2012). Likelihood profiles showed no minimum in the likelihood surface either, therefore the Panel concluded that the stock–recruit relationship is not well–defined. In the assessment, annual recruitment was estimated as deviations around an overall average. For coding convenience, this was achieved by using a Beverton–Holt recruitment model with steepness fixed at 0.99 to represent average recruitment. Expected recruitment of age-1 fish was predicted from the fixed average with annual variation in recruitment assumed to occur with lognormal deviations beginning in 1986.

3.3.7 Landings

The model included time series of landings from two fleets: commercial (all gear) and general recreational (headboat, charterboat, and private boats combined). Landings were modeled with the Baranov catch equation (Baranov 1918) and were fitted in units of weight (1000 lb whole weight for commercial and 1000 fish for recreational). Observed landings were provided back to the first assessment year (1986) for each fleet.

3.3.8 Discards

Live and dead commercial discards were provided from 1993 to 2017. Live commercial discards were reduced to dead discards using the gear-specific mortality rates, as suggested by the Panel described in §2.2.1, then the dead discards were combined with landings to produce one removal time series. Live discards from the general recreational fleet were available from 1986-2017, and the single removals time series was computed similarly to what was done for the commercial fleet.

3.3.9 Fishing

For each time series of landings, the assessment model estimated a separate full fishing mortality rate (F). Age-specific rates were then computed as the product of full F and selectivity at age. Apical F was computed as the maximum of F at age summed across fleets.

3.3.10 Selectivities

Selectivity curves were estimated using a parametric approach. This approach applies plausible structure on the shape of the selectivity curves, and achieves greater parsimony than occurs with unique parameters for each age. Selectivities of landings from all fleets were modeled as flat-topped, using a two-parameter logistic function. The selectivity of the fishery-dependent index was the same as that of the general recreational fleet.

Age and length composition data are critical for estimating selectivity parameters, and ideally, a model would have sufficient composition data from each fleet over time to estimate distinct selectivities in each time block assumed in the model. The commercial length compositions informed the commercial fleet selectivity, and only one time block was modeled due to lack of regulatory change in the fleet. The general recreational age compositions informed the general recreational fleet selectivities. Two time blocks were modeled due to reports from stakeholders and state scientists that fishing behaviors changed in 2007. The Panel requested multiple runs with different pivotal years for selectivity time blocks (2005–2009), and 2007 was the pivotal year that resulted in the best overall likelihood and best general age composition likelihood. The use of a second time block for the selectivity of the general recreational fleet is a departure from the assumption of time–invariant selectivity in SEDAR28.

3.3.11 Indices of abundance

The model was fit to a fishery–dependent index standardized from headboat logbooks (1991–2015). The predicted index is conditional on selectivity of the general recreational fleet and was computed from abundance at the midpoint of the year.

3.3.12 Catchability

In the BAM, catchability scales indices of relative abundance to estimated population abundance at large. Several options for time-varying catchability were implemented in the BAM following recommendations of the 2009 SEDAR procedural workshop on catchability (SEDAR Procedural Guidance 2009). In particular, the BAM allows for density dependence, linear trends, and random walk, as well as time-invariant catchability. For cobia, catchability of the index was assumed to be constant, as the Panel decided there was little reason to think catchability for cobia on headboats has changed since 1986.

3.3.13 Biological reference points

Biological reference points (benchmarks) were calculated based on the fishing rate that would allow a stock to attain 40% of the maximum spawning potential which would have been obtained in the absence of fishing mortality. Computed benchmarks included $L_{\mathrm{F40\%}}$, fishing mortality rate at $L_{\mathrm{F40\%}}$ ($F_{40\%}$), and spawning stock at $L_{\mathrm{F40\%}}$ ($\mathrm{SSB}_{\mathrm{F40\%}}$)(Gabriel and Mace 1999). In this assessment, spawning stock measures biomass of mature females. These benchmarks are conditional on the estimated selectivity functions and the relative contributions of each fleet's fishing mortality. The selectivity pattern used here was the effort-weighted selectivities at age, with effort from each fishery estimated as the full F averaged over the last three years of the assessment.

3.3.14 Fitting criterion

The fitting criterion was a penalized likelihood approach in which observed landings were fit closely, and observed composition data and the abundance index were fit to the degree that they were compatible. Landings and index data were fitted using lognormal likelihoods. Length and age composition data were fitted using the Dirichlet-multinomial distribution, with sample size represented by the annual number of fish, adjusted by an estimated variance inflation factor.

The SEDAR28 benchmark fit composition data using the multinomial distribution, and many SEDAR assessments since then have applied a robust version of the multinomial likelihood, as recommended by Francis (2011). More recent work has questioned use of the multinomial distribution in stock assessment models (Francis 2014), and of the alternative distributions, two appear most promising, the Dirichlet-multinomial and logistic-normal (Francis 2017; Thorson et al. 2017). Both are self-weighting and therefore iterative re-weighting (e.g., Francis (2011)) is unnecessary, and both better account for intra-haul correlations (i.e., fish caught in the same set are more alike in length or age than fish caught in a different set). The Dirichlet-multinomial allows for observed zeros (the logistic-normal does not), and has recently been implemented in Stock Synthesis (Methot and Wetzel 2013). This assessment used the Dirichlet-multinomial distribution in the base run.

The model includes the capability for each component of the likelihood to be weighted by user-supplied values. When applied to landings and indices, these weights modified the effect of the input CVs. In this application to cobia, CVs of landings (in arithmetic space) were assumed equal to 0.05 to achieve a close fit to these data while allowing some imprecision. In practice, the small CVs are a matter of computational convenience, as they help achieve a close fit to the landings, while avoiding having to solve the Baranov equation iteratively (which is complex when there are multiple fisheries). Weights on the index were adjusted iteratively, starting from initial weights in an attempt to achieve standard deviations of normalized residuals (SDNRs) near 1.0.

The compound objective function also included several penalties or prior distributions, applied to CV of growth (based on the empirical estimate), $F_{\text{initratio}}$ (prior of 1.0), and selectivity parameters. Penalties or priors were applied to maintain parameter estimates near reasonable values, and to prevent the optimization routine from drifting into parameter space with negligible gradient in the likelihood.

3.3.15 Configuration of base run

The base run was configured as described above. However, the base run configuration was not considered to represent all uncertainty. Sensitivities, retrospective analyses, and ensemble modeling was conducted to better characterize the uncertainty in base run point estimates.

3.3.16 Sensitivity analyses

Sensitivity runs were chosen to investigate issues that arose specifically with this benchmark assessment. They were intended to demonstrate directionality of results with changes in inputs or simply to explore model behavior, and not all were considered equally plausible. Sensitivity runs vary from the base run as follows.

- S1: Start model in 1950 to match SEDAR28 start year.
- S2: Include length compositions for the general recreational fleet.
- S3: Use the life history values from SEDAR28. Runs 3a–3e incrementally and additively incorporate each value: length–weight relationship, time of spawn, sex ratio, growth curve, and natural mortality.

- S4: Remove the headboat index.
- S5: Smooth the peak in general recreational removals in 1996 (used the geometric mean of 2 years before and after peak).
- S6: Shift general recreational landings down 3 fold.
- S7: Used the bounds of ensemble parameters that would reach upper bound of status. Runs 7a–c are each parameter, or set of parameters, separately: Landings and discards +1SD, and the upper bound of discard mortality; the lower bound of M using the von Bertalanffy parameters bounds; and the index +1SD.
- S8: Used the bounds of ensemble parameters that would reach lower bound of status. Runs 8a–c are each parameter, or set of parameters, separately: Landings and discards -1SD, and the lower bound of discard mortality; the upper bound of M using the von Bertalanffy parameters bounds; and the index -1SD.
- S9: Runs a–e are the 5 retrospective peels. Retrospective analyses, or peels, were run by incrementally dropping one year at a time for five iterations making the terminal years 2016, 2015, 2014, 2013, and 2012.
- S10: Shift general recreational landings up 3 fold.

3.4 Parameters Estimated

The model estimated annual fishing mortality rates of each fleet (66 parameters), selectivity parameters (6 parameters), Dirichlet-multinomial variance inflation factors (2 parameters), a catchability coefficient associated with the index (1 parameter), initial mean recruitment (1 parameter), initial fishing mortality (1 parameter), variance of the recruitment deviations (1 parameter), annual recruitment deviations (31 parameters), deviations in the initial age structure (15 parameters), and CV of size at age for the landings growth curve (1 parameter).

3.5 Per Recruit and Equilibrium Analyses

Yield per recruit and spawning potential ratio were computed as functions of F, as were equilibrium landings and spawning biomass. Equilibrium landings were also computed as functions of biomass B, which itself is a function of F. As in computation of MSY proxy-related benchmarks (described in §3.6), per recruit and equilibrium analyses applied the most recent selectivity patterns averaged across fleets, weighted by each fleet's F from the last three years of the assessment (2015–2017).

3.6 Benchmark/Reference Point Methods

In this assessment of cobia, the quantities $F_{40\%}$, $\mathrm{SSB}_{\mathrm{F}40\%}$, $B_{\mathrm{F}40\%}$, and $L_{\mathrm{F}40\%}$ were estimated as proxies for MSY–based reference points. Steepness was not reliably estimable, so the stock-recruit relationship was not used to identify a maximum yield. Instead, steepness was fixed at 0.99 in order to assume an average level of recruitment while estimating deviations around the mean. $F_{40\%}$ was used by consensus of the Panel to generate fishing benchmarks. However, because the stock-recruitment relationship was not estimated, assumptions about recruitment are required to generate biomass benchmarks. Here, equilibrium recruitment was assumed equal to expected recruitment (arithmetic average). On average, expected recruitment is higher than that estimated directly from the spawner-recruit curve, because of lognormal deviation in recruitment. Thus, in this assessment, the method of benchmark estimation accounted for lognormal deviation by including a bias correction in equilibrium recruitment. The bias correction

(ς) was computed from the variance (σ_R^2) of recruitment deviation in log space: $\varsigma = \exp(\sigma_R^2/2)$. Then, equilibrium recruitment (R_{eq}) associated with any F is,

$$R_{eq} = \frac{R_0 \left[\varsigma 0.8h\Phi_F - 0.2(1-h)\right]}{(h-0.2)\Phi_F} \tag{1}$$

where R_0 is virgin recruitment, h is steepness which is fixed in this assessment, and $\Phi_F = \phi_F/\phi_0$ is spawning potential ratio given growth, maturity, and total mortality at age (including natural and fishing mortality rates). Because steepness is fixed at 0.99, R_{eq} as a function of F is approximately a straight horizontal line. The R_{eq} and mortality schedule imply an equilibrium age structure and an average sustainable yield (ASY). The estimate of $F_{40\%}$ is the F giving the highest ASY, and the estimate of $L_{\mathrm{F40\%}}$ is that ASY. The value of $F_{40\%}$ is the F giving 40% spawning potential ratio. The estimates of $L_{\mathrm{F40\%}}$ and $\mathrm{SSB_{F40\%}}$ follow from the corresponding equilibrium age structure and recruitment.

Estimates of $L_{\mathrm{F40\%}}$ and related benchmarks are conditional on selectivity pattern. The selectivity pattern used here was an average of terminal-year selectivities from each fleet, where each fleet-specific selectivity was weighted in proportion to its corresponding estimate of F averaged over the last three years (2015–2017). If the selectivities or relative fishing mortalities among fleets were to change, so would the estimates of $L_{\mathrm{F40\%}}$ and related benchmarks.

The maximum fishing mortality threshold (MFMT) is proposed to be set to $F_{40\%}$, and the minimum stock size threshold (MSST) as $\mathrm{MSST} = 75\%\mathrm{SSB_{F40\%}}$. Overfishing is defined as $F >$ MFMT and overfished as SSB $<$ MSST. Current status of the stock is represented by SSB in the latest assessment year (2017), and current status of the fishery is represented by the geometric mean of F from the latest three years (2015–2017).

3.7 Uncertainty and Measures of Precision

For the base run of the catch-age model (BAM), uncertainty in results and precision of estimates was computed thoroughly through an ensemble modeling approach (Scott et al. 2016) using a mixed Monte Carlo and bootstrap framework (Efron and Tibshirani 1993; Manly 1997). Monte Carlo and bootstrap methods are often used to characterize uncertainty in ecological studies, and the mixed approach has been applied successfully in stock assessment (Restrepo et al. 1992; Legault et al. 2001; SEDAR 2004; 2009; 2010). The approach is among those recommended for use in SEDAR assessments (SEDAR Procedural Guidance 2010).

The approach translates uncertainty in model input into uncertainty in model output, by fitting the assessment model many times with different values of "observed" data and key input parameters. A chief advantage of the ensemble modeling approach is that the resulting ensemble model describes a range of possible outcomes, so that uncertainty is characterized more thoroughly than it could be by any single fit or handful of sensitivity runs. A minor disadvantage of the approach is that computational demands are relatively high, though parallel computing can somewhat mitigate those demands.

In this assessment, the BAM was successively re-fit in $n = 4000$ trials that differed from the original inputs by bootstrapping on data sources, and by Monte Carlo sampling of several key input parameters. The value of $n = 4000$ was chosen because at least 3000 runs were desired, and it was anticipated that not all runs would be valid. Of the 4000 trials, approximately 0.975% were discarded, based on a 0.5% trim on $R0$ or because the model did not properly converge. This left $n = 3961$ trials used to characterize uncertainty, which was sufficient for convergence of standard errors in management quantities.

The ensemble model should be interpreted as providing an approximation to the uncertainty associated with each output. The results are approximate as all runs are given equal weight in the results, yet some might provide better fits to data than others.

3.7.1 Bootstrap of observed data

To include uncertainty in time series of observed landings, discards, and the index of abundance, multiplicative lognormal errors were applied through a parametric bootstrap. To implement this approach in the ensemble modeling, random variables ($x_{s,y}$) were drawn for each year y of time series s from a normal distribution with mean 0 and variance $\sigma^2_{s,y}$ [that is, $x_{s,y} \sim N(0, \sigma^2_{s,y})$]. Annual observations were then perturbed from their original values ($\hat{O}_{s,y}$),

$$O_{s,y} = \hat{O}_{s,y}[\exp(x_{s,y} - \sigma^2_{s,y}/2)] \tag{2}$$

The term $\sigma^2_{s,y}/2$ is a bias correction that centers the multiplicative error on the value of 1.0. Standard deviations in log space were computed from CVs in arithmetic space, $\sigma_{s,y} = \sqrt{\log(1.0 + CV^2_{s,y})}$. As used for fitting the base run, CVs of commercial landings in most years were assumed to be 0.05. The CVs for recreational landings and both commercial and recreational discards were those provided by the data providers(see Table 3). The CVs of indices of abundance were those provided by the data providers (see Table 4).

Uncertainty in age and length compositions were included by drawing new distributions for each year of each data source, following a multinomial sampling process. Ages (or lengths) of individual fish were drawn at random with replacement using the cell probabilities of the original data. For each year of each data source, the number of individuals sampled was the same as in the original data (number of fish), and the effective sample sizes used for fitting (number of trips) was unmodified.

3.7.2 Monte Carlo sampling

In each successive fit of the model, several parameters were fixed (i.e., not estimated) at values drawn at random from distributions described below.

Natural mortality A point estimate of natural mortality at age was provided by the Life History Working Group, though no uncertainty was provided. Because natural mortality is inherently uncertain, the Panel attempted to vary M in the ensemble modeling approach in a way consistent with Charnov et al. (2013). The model in Charnov et al. (2013) is based on a linear regression in log space of the relationship between M and von Bertalanffy growth parameters. Charnov et al. (2013) provides estimates of the standard error of the slope and intercept of that regression. In this step of the ensemble modeling, we used those estimates of uncertainty to regenerate a new slope and intercept, assuming normal distributions, from which we calculated a new natural mortality vector at age for each of the 4000 models.

Discard mortalities Similarly, discard mortalities (δ) were subjected to Monte Carlo variation as follows. The discard mortality working group provided point estimates and an upper and lower bound for each gear type. A new value for commercial and recreational lines discard mortality was drawn for each model from a uniform distribution (range [0.02, 0.12]) with center equal to the point estimate ($\delta = 0.05$). Similarly, a new value for commercial gillnet discard mortality was drawn for each model from a uniform distribution (range [0.36, 0.77]) with center equal to the point estimate ($\delta = 0.55$).

Recreational Landings and Discards CVs The recreational landings and all discards were allowed to vary based on the CVs provided. Once the landings and discards time series were drawn for each fleet and gear, the discards were decremented by the selected value for discard mortality relevant to the gear, and the result was added to the landings for each fleet.

3.8 Projections—Probabilistic Analysis

Projections were run to predict stock status in years after the assessment, 2018–2024, as requested in the TORs.

The structure of the projection model was the same as that of the assessment model, and parameter estimates were those from the assessment. Any time-varying quantities, such as selectivity, were fixed to the most recent values of the assessment period. A single selectivity curve was applied to calculate landings computed by averaging selectivities across fleets using geometric mean Fs from the last three years of the assessment period, similar to computation of MSY benchmarks (§3.6).

Expected values of SSB (time of peak spawning), F, recruits, and landings were represented by deterministic projections using parameter estimates from the base run. These projections were built on the estimated spawner-recruit relationship with bias correction, and were thus consistent with estimated benchmarks in the sense that long-term fishing at $F_{40\%}$ would yield $L_{\mathrm{F}40\%}$ from a stock size at $\mathrm{SSB}_{\mathrm{F}40\%}$. Uncertainty in future time series was quantified through stochastic projections that extended the ensemble model fits of the stock assessment model.

3.8.1 Initialization of projections

Although the terminal year of the assessment is 2017, the assessment model computes abundance at age (N_a) at the start of 2018. For projections, those estimates were used to initialize N_a. However, the assessment has no information to inform the strength of 2018 recruitment, and thus it computes 2018 recruits (N_1) as the expected value, that is, without deviation from the estimate of mean recruitment, and corrected to be unbiased in arithmetic space. In the stochastic projections, lognormal stochasticity was applied to these abundances after adjusting them to be unbiased in log space, with variability based on the estimate of σ_R. Thus, the initial abundance in year one (2018) of projections included this variability in N_1. The deterministic projections were not adjusted in this manner, because deterministic recruitment follows mean recruitment.

Fishing rates that define the projections were assumed to start in 2020. Because the assessment period ended in 2017, the projections required an initialization period (2018 and 2019). F_{current} was assumed during the interim period.

3.8.2 Uncertainty of projections

To characterize uncertainty in future stock dynamics, stochasticity was included in replicate projections, each an extension of a single assessment fit from the ensemble. Thus, projections carried forward uncertainties in natural mortality and discard mortality, as well as in estimated quantities such as spawner-recruit parameters (R_0 and σ_R, selectivity curves, and in initial (start of 2018) abundance at age.

Initial and subsequent recruitment values were generated with stochasticity using a Monte Carlo procedure, in which the estimated recruitment of each model within the ensemble is used to compute mean annual recruitment values ($\bar{R}_y$). Variability is added to the mean values by choosing multiplicative deviations at random from a lognormal distribution,

$$R_y = \bar{R}_y \exp(\epsilon_y). \qquad (3)$$

Here ϵ_y is drawn from a normal distribution with mean 0 and standard deviation σ_R, where σ_R is the standard deviation from the relevant ensemble model component.

The procedure generated 20,000 replicate projections of models within the ensemble drawn at random (with replacement). In cases where the same model run was drawn, projections would still differ as a result of stochasticity in projected recruitment streams. Central tendencies were represented by the deterministic projections of the base run, as well as by medians of the stochastic projections. Precision of projections was represented graphically by the 5^{th} and 95^{th} percentiles of the replicate projections.

3.8.3 Projection scenarios

The TORs for this assessment described three projections scenarios: $F = F_{40\%}$, $F = 75\%F_{40\%}$, and $F = F_{\text{current}}$. In each, the landings in the interim period (2018–2019) were calculated based on F_{current}.

- Scenario 1: $F = F_{\text{current}}$, with F_{current} also assumed for the interim period.
- Scenario 2: $F = F_{40\%}$, with F_{current} assumed for the interim period.
- Scenario 3: $F = 75\%F_{40\%}$, with L_{current} assumed for the interim period.

4 Stock Assessment Results

4.1 Measures of Overall Model Fit

The Beaufort Assessment Model (BAM) fit well to the available data. Predicted length compositions from the commercial fishery were reasonably close to observed data, as were predicted age compositions (Figure 2). The model was configured to fit observed commercial and recreational landings closely (Figures 3–4). The fit to the index of abundance generally captured the observed trend but not all annual fluctuations (Figure 5).

4.2 Parameter Estimates

Estimates of all parameters from the catch-age model are shown in Appendix B. Estimates of management quantities and some key parameters, such as those of the spawner-recruit model, are reported in sections below.

4.3 Stock Abundance and Recruitment

Estimated abundance at age shows little trend, though the last few years are some of the lowest in the time series (Figure 6; Table 6). Total estimated abundance at the end of the assessment period showed a sharp decline since 2013. Annual number of recruits is shown in Table 6 (age-1 column) and in Figure 7. In the most recent decade, a notably strong year class (age-1 fish) was predicted to have occurred in 2010, but the most recent four years had lower than average recruitment.

4.4 Total and Spawning Biomass

Estimated biomass at age, as well as total biomass and spawning biomass followed a similar pattern as abundance at age (Figures 8 and 9 ; Tables 7 and 8).

4.5 Selectivity

Selectivities of landings from commercial and recreational fleets are shown in Figures 10–11. In the general recreational fleet, the selectivity shifted toward younger ages with the reported change in fisher behavior. In the most recent years, full selection occurred near age-4 for both fleets.

Average selectivities of landings were computed from F-weighted selectivities in the most recent period of regulations (Figure 12). These average selectivities were used to compute benchmarks. All selectivities from the most recent period, including average selectivities, are tabulated in Table 9.

4.6 Fishing Mortality and Landings

The estimated fishing mortality rates (F) generally increased through the assessment time period, with a previous peak in 1996 (Figure 13). The general recreational fleet has been the largest contributor to total F (Table 10). Estimates of total F at age are shown in Table 11. Table 12 shows total landings at age in numbers, and Table 13 in weight. In general, the majority of estimated landings were from the general recreational fleet (Figures 14, 15; Tables 14, 15).

4.7 Spawner-Recruitment Parameters

The spawner-recruit relationship with fixed steepness, from which we estimate deviations from the average recruitment, is shown in Figure 16 depicted graphically by recruits per spawner as a function of spawners. Values of recruitment-related parameters were as follows: unfished age-1 recruitment $\widehat{R_0} = 1,336,484$, and standard deviation of recruitment residuals in log space $\widehat{\sigma_R} = 0.53$. Uncertainty in these quantities was estimated through the ensemble modeling (Figure 17).

4.8 Per Recruit and Equilibrium Analyses

Yield per recruit and spawning potential ratio were computed as functions of F (Figure 18). Per recruit analyses applied the most recent selectivity patterns averaged across fleets, weighted by F from the last three years (2015–2017).

As in per recruit analyses, equilibrium landings and spawning biomass were computed as functions of F (Figure 19). By definition, the F that provides 40% SPR is $F_{40\%}$, and the corresponding landings and spawning biomass are $L_{\mathrm{F40\%}}$ and $\mathrm{SSB}_{\mathrm{F40\%}}$.

4.9 Benchmarks / Reference Points

As described in §3.6, biological reference points (benchmarks) were derived analytically assuming equilibrium dynamics, corresponding to the expected recruitment (Figure16). Reference points estimated were $F_{40\%}$, $L_{\mathrm{F40\%}}$, $B_{\mathrm{F40\%}}$ and $\mathrm{SSB}_{\mathrm{F40\%}}$. Standard deviations of benchmarks were approximated as those from ensemble model (§3.7).

Estimates of benchmarks are summarized in Table 16. Point estimates of $L_{\mathrm{F40\%}}$-related quantities were $F_{40\%} = 0.69$ (y^{-1}), $L_{\mathrm{F40\%}} = 3923.780$ (klb), $B_{\mathrm{F40\%}} = 0.29$ (mt), and $\mathrm{SSB}_{\mathrm{F40\%}} = 2980.975$ (mt). Distributions of these benchmarks from the ensemble model are shown in Figure 20.

4.9.1 Status of the Stock and Fishery

The estimated time series of spawning stock biomass showed little overall trend, though the terminal year is the lowest in the time series (Figure 9). Current stock status was estimated in the base run to be $\mathrm{SSB}_{2017}/\mathrm{MSST} = 1.88$ and $\mathrm{SSB}_{2017}/\mathrm{SSB}_{\mathrm{F40\%}} = 1.41$ (Table 16 and Figure 21), indicating that the stock is not overfished. Uncertainty from the ensemble modeling suggested that the estimate of SSB relative to both $\mathrm{SSB}_{\mathrm{F40\%}}$ and SSB/MSST is robust (Figures 22, 23). More specifically, about 99.8% of ensemble modeling runs indicate the stock is above MSST, while only 0.2% of the models in the ensemble indicated an overfished status. Age structure estimated by the base run showed slightly fewer younger fish in the last decade than the (equilibrium) age structure expected at $L_{\mathrm{F40\%}}$ (Figure 24), however the rest of the age structure is above expected values in the terminal year (2017).

The estimated time series of fishing mortality rate has a slightly increasing trend, though the peak year was 1996 (Figure 13). Current fishery status in the terminal year, with current F represented by the geometric mean from 2015–2017, was estimated by the base run to be $F_{2015-2017}/F_{40\%} = 0.29$ (Table 16 and Figures 22 and 23). The results of the ensemble model are consistent with those results, as only 0.5% of models within the ensemble estimate the stock is undergoing overfishing.

4.9.2 Comparison to previous assessment

When estimates from this assessment are compared to estimates from the SEDAR28 assessment for cobia, a notable difference is the magnitude of the biomass and spawning stock biomass estimates (Figure 40). In this assessment, updated and recalibrated MRIP estimates of general recreational landings and discards were used. Those estimates are several times higher per year than the estimates used in SEDAR28, and are the result of an improvement in the estimation of recreational effort (for details of how the MRIP is an improvement of MRFSS, see https://www.fisheries.noaa.gov/recreational-fishing-data/how-marine-recreational-information-program-has-improved). Regardless of the magnitude of biomass and SSB, the status benchmarks remain on similar scales (Figure 39). The time trends in abundance, recruitment, and relative status are very similar between this assessment and the last as well (e.g. Figures 39 and 40). Natural mortality estimates provided by the Data Workshop were higher than used for SEDAR28. The higher natural mortality (0.97–0.31 in this assessment compared to 0.56–0.24 in SEDAR28) leads the model to estimate a more productive stock. Length and age composition data are fit better using the Dirichlet-multinomial distribution in this assessment (Figures 2 in both reports), as is the headboat index of abundance using the iterative reweighting process.

4.10 Sensitivity and Retrospective Analyses

Sensitivity runs, described in §3.3, were used for exploring data or model issues that arose during the assessment process, for evaluating implications of assumptions in the base assessment model, and for interpreting ensemble model results in terms of expected effects of input parameters (Figures 25–33). Sensitivity runs are a tool for better understanding model behavior, and therefore should not be used as the basis for management. All runs are not considered equally plausible in the sense of alternative states of nature. Time series of $F/F_{40\%}$ and $\mathrm{SSB}/\mathrm{SSB}_{\mathrm{F40\%}}$ demonstrate sensitivity to natural mortality (Figure 31) and the SEDAR28 life history inputs (Figure 27). The majority of the runs agreed with the status indicated by the base run (Figure 33, Table 17). Results appeared to be most sensitive to natural mortality.

Retrospective analyses did not suggest any patterns of substantial over- or underestimation in terminal-year estimates starting in 2017 (Figures 34 and 35).

4.11 Projections

Projections based on $F = F_{40\%}$, which is higher than F_{current} drove the stock towards $L_{\text{F40\%}}$ values (Figures 36 and 37, Tables 18 and 19). The 75%$F_{40\%}$ projection was similar to the $F = F_{40\%}$ scenario (Figure 38, Table 20).

5 Discussion

5.1 Comments on the Assessment

Estimated benchmarks played a central role in this assessment; Values of $\text{SSB}_{\text{F40\%}}$ and $F_{40\%}$ were used to gauge the status of the stock and fishery. Computation of benchmarks was conditional on selectivity, and if selectivity patterns change again in the future, for example as a result of new size limits or different relative catch allocations among sectors, estimates of benchmarks would likely change as well.

The base run of the BAM indicated that the stock is not overfished ($\text{SSB}_{2017}/\text{MSST} = 1.88$), and that overfishing is not occurring ($F_{2015-2017}/F_{40\%} = 0.29$). The ensemble model indicated that the stock status is most likely above MSST with 99.8% of the runs indicating the stock is not overfished. Only about 0.4% of the ensemble model runs indicate that the stock is experiencing overfishing. The decreasing trend for biomass is dependent on what appears to be below average recruitment in the last four years of the assessment. The stock has been declining over the last few years of the assessment, and this decline will likely continue if recruitment remains low.

The recent low recruitment in 2014 did not continue into the terminal year of the assessment. No mechanism for the recent low recruitment has been identified, and periodic low recruitment events are estimated throughout the time series. Input from the stakeholders suggests the recent low recruitment was short lived, which is consistent with modeling results. Multiple years of low recruitment would likely negatively affect the stock status, however monitoring the age compositions into the future will provide the data needed to make that determination.

In addition to more years of data, this benchmark assessment included several modifications to previous data. First, MRIP recalibrated data were used. Next, the SCDNR and MRFSS indices were excluded after the value of all three indices was re-evaluated. All composition data were updated and any needed corrections were made, including the exclusion of commercial age compositions due to non-random sampling.

In general, fishery dependent indices of abundance may not track actual abundance well, because of factors such as hyperstability. Furthermore, this issue can be exacerbated by management measures. In this assessment, fishery dependent indices were not extended beyond 2015, because of the seasonal closures. Such regulations change fisher behavior, thus altering the portion of the population or habitat represented by the logbook data that would be used to create an index of abundance. As such management measures become more common in the southeast U.S., the continued utility of fishery dependent indices in SEDAR stock assessments will be questionable. This situation amplifies the importance of fishery independent sampling.

5.2 Comments on the Projections

As usual, projections should be interpreted in light of the model assumptions and key aspects of the data. Some major considerations are the following:

- In general, projections of fish stocks are highly uncertain, particularly in the long term (e.g., beyond 5 years).

- Although projections included many major sources of uncertainty, they did not include structural (model) uncertainty. That is, projection results are conditional on one set of functional forms used to describe population dynamics, selectivity, recruitment, etc.
- Fisheries were assumed to continue fishing at their estimated current proportions of total effort, using the estimated current selectivity patterns. New management regulations that alter those proportions or selectivities would likely affect projection results.
- The projections assumed that the estimated level of recruitment applies in the future and that past residuals represent future uncertainty in recruitment. If future recruitment is characterized by runs of large or small year classes, possibly due to environmental or ecological conditions, stock trajectories may be affected. In this assessment, the lowest recruitment occurred in the terminal four years, and if this is not reversed, the stock projections are overly optimistic.
- Projections apply the Baranov catch equation to relate F and landings using a one-year time step, as in the assessment. The catch equation implicitly assumes that mortality occurs throughout the year. This assumption is violated when seasonal closures are in effect, introducing additional and unquantified uncertainty into the projection results.

5.3 Research Recommendations

- Develop a fishery independent sampling program for abundance of cobia and other coastal migratory species. Fishery dependent abundance indices used in this assessment were uncertain in part due to the lack of an effective sampling methodology.
- Implement a systematic age sampling program for the general recreational sector. Age samples were important in this assessment for identifying strong year classes but sample sizes were relatively small and disparate in time and space.
- Better characterize reproductive parameters including age at maturity, batch fecundity, spawning seasonality, and spawning frequency.
- Age-dependent natural mortality was estimated by indirect methods for this assessment of cobia. Telemetry- and conventional-tag programs for cobia should be maintained as they may prove useful for estimating mortality.
- Better characterize the migratory dynamics of the stock and the degree of fidelity to spawning areas.

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7 Tables

Table 1. Life-history characteristics at age, including average body length and weight (mid-year), proportion females mature, and natural mortality at age. The CV of length was estimated by the assessment model; other values were treated as input.

Age	Total length (mm)	Total length (in)	CV length	Whole wgt (kg)	Whole wgt (lb)	Fem. mat.	prop. fem.	M
1	589.4	23.2	0.12	2.02	4.44	0.0	0.58	0.97
2	768.7	30.3	0.12	4.82	10.62	0.5	0.58	0.65
3	900.2	35.4	0.12	8.09	17.82	1.0	0.58	0.51
4	996.6	39.2	0.12	11.29	24.89	1.0	0.58	0.44
5	1067.4	42.0	0.12	14.14	31.17	1.0	0.58	0.40
6	1119.2	44.1	0.12	16.52	36.42	1.0	0.58	0.37
7	1157.3	45.6	0.12	18.43	40.64	1.0	0.58	0.35
8	1185.2	46.7	0.12	19.93	43.94	1.0	0.58	0.34
9	1205.7	47.5	0.12	21.08	46.48	1.0	0.58	0.33
10	1220.7	48.1	0.12	21.96	48.40	1.0	0.58	0.33
11	1231.7	48.5	0.12	22.61	49.85	1.0	0.58	0.32
12	1239.8	48.8	0.12	23.10	50.93	1.0	0.58	0.32
13	1245.7	49.0	0.12	23.47	51.73	1.0	0.58	0.32
14	1250.0	49.2	0.12	23.74	52.33	1.0	0.58	0.31
15	1253.2	49.3	0.12	23.93	52.77	1.0	0.58	0.31
16	1255.6	49.4	0.12	24.08	53.09	1.0	0.58	0.31

Table 2. Observed time series of landings (L) and dead discards (D) combined for the commercial (comm) and general recreational (GR) fleets. Landings are in units of 1000 lb whole weight for commercial landings and discards, and in units of 1000 fish for general recreational landings and discards.

Year	LD.comm	LD.GR
1986	25.734	33.608
1987	40.740	24.930
1988	28.588	12.236
1989	33.453	22.420
1990	44.357	18.605
1991	43.816	23.670
1992	35.933	23.900
1993	39.606	15.991
1994	47.118	13.865
1995	67.648	28.148
1996	62.684	94.424
1997	63.618	20.741
1998	43.700	12.650
1999	27.541	27.283
2000	43.652	14.963
2001	42.593	13.445
2002	45.518	18.645
2003	39.367	55.201
2004	37.783	33.440
2005	29.256	59.899
2006	34.953	53.614
2007	32.733	38.877
2008	35.021	30.785
2009	48.003	57.067
2010	58.689	54.608
2011	36.050	36.904
2012	46.204	50.826
2013	54.060	70.214
2014	70.952	59.131
2015	87.942	115.314
2016	92.754	83.032
2017	68.402	50.597

Table 3. Landings (L), Discards (D, l-D represents live discards and d-D represents dead discards), and CVs used in the ensemble model for the commercial (Comm) and general recreational (GR) fleets. Landings and discards from commercial handline (HL) and commercial gillnet (GN) gear are combined into one commercial removals time series.

Year	GR L	Comm L	Comm HL D	Comm GN d-D	Comm GN l-D	GR D	GR L CVs	Comm L CVs	GR D CVs	Comm D CVs
1986	33.152	25.734	0.000	0.000	0.000	9.1120	0.120	0.10	0.00	0.000
1987	24.893	40.740	0.000	0.000	0.000	0.7360	0.010	0.10	0.46	0.000
1988	11.923	28.588	0.000	0.000	0.000	6.2730	0.100	0.10	0.23	0.000
1989	21.732	33.453	0.000	0.000	0.000	13.767	0.210	0.10	0.12	0.000
1990	18.057	44.357	0.000	0.000	0.000	10.958	0.070	0.10	0.16	0.000
1991	21.504	43.816	0.000	0.000	0.000	43.331	0.110	0.10	0.22	0.000
1992	23.164	35.933	0.000	0.000	0.000	14.733	0.190	0.10	0.19	0.000
1993	15.766	39.526	1.605	0.000	0.000	4.4930	0.160	0.05	0.45	15.13
1994	12.256	47.020	1.959	0.000	0.000	32.179	0.170	0.05	0.05	15.13
1995	27.713	67.557	1.814	0.000	0.000	8.7060	0.340	0.05	0.28	15.13
1996	94.123	62.591	1.856	0.000	0.000	6.0250	0.030	0.05	0.34	15.13
1997	18.938	63.522	1.911	0.000	0.000	36.062	0.050	0.05	0.04	15.13
1998	11.241	43.622	1.563	0.000	0.000	28.186	0.340	0.05	0.18	15.13
1999	23.794	27.474	1.346	0.000	0.000	69.798	0.460	0.05	0.19	15.13
2000	13.665	43.580	1.449	0.000	0.000	25.953	0.280	0.05	0.21	15.13
2001	11.672	42.513	1.592	0.000	0.000	35.464	0.340	0.05	0.16	15.13
2002	16.864	44.375	1.417	0.000	1.950	35.623	0.170	0.05	0.11	12.47
2003	51.969	39.310	1.130	0.000	0.000	64.647	0.500	0.05	0.11	11.18
2004	31.635	32.916	1.040	4.815	0.000	36.095	0.110	0.05	0.17	18.75
2005	57.370	28.884	1.051	0.195	0.226	50.579	0.220	0.05	0.09	18.07
2006	50.908	34.708	1.175	0.186	0.000	54.111	0.230	0.05	0.10	19.61
2007	36.360	31.663	1.194	0.000	1.837	50.351	0.070	0.05	0.08	20.54
2008	28.859	33.876	1.186	0.584	0.913	38.513	0.030	0.05	0.05	14.19
2009	52.657	42.423	1.216	2.911	4.742	88.200	0.170	0.05	0.15	30.43
2010	50.607	56.661	1.040	0.999	1.776	80.012	0.140	0.05	0.09	18.27
2011	31.487	34.222	0.882	0.745	1.889	108.35	0.230	0.05	0.09	25.80
2012	46.387	42.811	0.797	0.999	4.280	88.767	0.020	0.05	0.19	23.77
2013	66.204	53.605	0.869	0.000	0.749	80.211	0.230	0.05	0.28	14.73
2014	52.472	70.064	0.839	0.846	0.000	133.19	0.220	0.05	0.10	13.88
2015	110.42	84.901	0.763	0.000	5.460	97.899	0.120	0.05	0.11	14.19
2016	75.779	92.535	0.776	0.000	0.328	145.07	0.040	0.05	0.10	21.59
2017	39.661	68.365	0.738	0.000	0.000	218.73	0.160	0.05	0.23	22.14

Table 4. Observed index of abundance and CVs from headboats (HB).

Year	HB	HB CV
1991	1.02	0.26
1992	0.95	0.25
1993	0.83	0.20
1994	0.72	0.18
1995	1.14	0.20
1996	0.46	0.17
1997	0.64	0.27
1998	0.78	0.21
1999	0.82	0.18
2000	0.77	0.22
2001	0.70	0.26
2002	1.17	0.24
2003	0.88	0.21
2004	0.89	0.21
2005	1.09	0.20
2006	0.86	0.23
2007	1.59	0.30
2008	1.37	0.16
2009	1.08	0.19
2010	1.00	0.30
2011	0.83	0.24
2012	1.09	0.22
2013	2.04	0.23
2014	1.23	0.19
2015	1.04	0.20
2016	.	.
2017	.	.

Table 5. Sample sizes (number of fish) of length compositions (len) or age compositions (age) by fleet. Data sources are commercial lines (comm) and general recreational (GR). The commercial fleet is a pooled composition over 1986–2017, rather than a single year of data..

Year	len.comm	age.GR
1986	.	22
1987	.	18
1988	.	.
1989	.	62
1990	.	80
1991	.	13
1992	.	12
1993	.	.
1994	.	.
1995	.	10
1996	.	31
1997	.	13
1998	.	.
1999	1449	124
2000	.	111
2001	.	52
2002	.	26
2003	.	.
2004	.	.
2005	.	57
2006	.	63
2007	.	203
2008	.	225
2009	.	265
2010	.	293
2011	.	246
2012	.	269
2013	.	445
2014	.	487
2015	.	484
2016	.	386
2017	.	273

Table 6. Estimated total abundance at age (1000 fish) at start of year.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1986	1246.74	286.12	184.80	91.72	132.31	103.47	25.58	28.16	22.48	10.27	8.08	6.32	4.88	3.73	2.84	6.42	2163.92
1987	1531.51	472.42	148.98	109.39	56.09	81.08	64.58	16.25	18.07	14.57	6.66	5.29	4.14	3.20	2.46	6.12	2540.79
1988	2605.51	580.34	246.01	88.29	67.31	34.78	51.29	41.60	10.57	11.87	9.57	4.42	3.51	2.75	2.14	5.76	3765.72
1989	1172.31	987.48	302.54	146.68	55.50	43.30	22.93	34.48	28.24	7.25	8.14	6.63	3.06	2.43	1.92	5.52	2828.42
1990	1558.48	444.24	514.37	179.54	90.61	34.64	27.59	14.88	22.59	18.69	4.80	5.44	4.43	2.04	1.64	5.03	2929.02
1991	2076.37	590.62	231.50	306.02	112.03	57.56	22.52	18.28	9.96	15.27	12.63	3.27	3.71	3.02	1.41	4.60	3468.77
1992	841.48	786.87	307.74	137.63	190.38	70.79	37.20	14.83	12.15	6.69	10.25	8.57	2.22	2.52	2.07	4.11	2435.49
1993	639.45	318.90	410.04	183.03	85.72	120.49	45.83	24.53	9.87	8.17	4.50	6.97	5.82	1.51	1.73	4.25	1870.82
1994	1972.55	242.35	166.26	244.54	115.18	55.25	79.64	30.87	16.69	6.79	5.62	3.12	4.83	4.04	1.06	4.19	2952.97
1995	824.14	747.60	126.36	99.21	154.30	74.61	36.72	53.96	21.13	11.54	4.69	3.92	2.18	3.38	2.85	3.70	2170.29
1996	2112.54	312.29	389.29	74.90	61.17	96.09	47.44	23.78	35.28	13.95	7.62	3.13	2.62	1.45	2.27	4.41	3188.23
1997	648.64	799.77	161.69	223.33	40.86	30.74	47.93	23.98	12.13	18.17	7.19	3.96	1.63	1.36	0.76	3.51	2025.64
1998	1184.47	245.79	416.47	95.87	137.93	25.52	19.61	31.15	15.73	8.04	12.04	4.81	2.65	1.09	0.92	2.89	2204.99
1999	2747.22	448.90	128.12	248.22	60.26	88.75	16.84	13.19	21.15	10.79	5.51	8.34	3.33	1.84	0.76	2.67	3805.90
2000	1958.28	1041.03	233.79	75.95	152.69	37.32	56.06	10.83	8.57	13.88	7.08	3.65	5.53	2.21	1.23	2.30	3610.39
2001	1136.47	742.16	542.59	139.26	47.62	97.83	24.50	37.51	7.32	5.85	9.47	4.88	2.52	3.81	1.54	2.45	2805.78
2002	1277.68	430.72	386.91	323.59	87.66	30.72	64.71	16.52	25.54	5.03	4.02	6.58	3.39	1.75	2.67	2.80	2670.30
2003	2362.70	484.23	224.51	230.51	202.90	56.16	20.16	43.28	11.16	17.43	3.43	2.77	4.53	2.34	1.22	3.81	3671.13
2004	419.81	895.15	251.88	132.19	138.25	120.23	33.74	12.32	26.71	6.95	10.86	2.16	1.74	2.85	1.49	3.20	2059.54
2005	2569.76	159.08	466.16	149.27	81.22	85.46	75.79	21.66	7.99	17.49	4.55	7.18	1.43	1.15	1.91	3.13	3653.23
2006	1627.50	973.48	82.69	273.30	88.06	46.75	49.69	44.79	12.92	4.81	10.54	2.77	4.37	0.87	0.71	3.09	3226.35
2007	1127.96	616.56	506.15	48.56	162.28	51.27	27.54	29.76	27.08	7.89	2.94	6.50	1.71	2.70	0.54	2.37	2621.80
2008	1846.98	427.55	321.28	292.78	28.85	100.10	32.59	17.86	19.49	17.92	5.22	1.96	4.34	1.14	1.82	1.96	3121.84
2009	1105.90	700.10	222.88	187.79	177.93	18.21	65.13	21.63	11.97	13.20	12.13	3.57	1.34	2.97	0.79	2.61	2548.16
2010	1125.86	419.17	364.51	126.81	107.65	105.79	11.16	40.70	13.65	7.63	8.41	7.81	2.30	0.86	1.93	2.21	2346.48
2011	3482.49	426.73	218.22	207.40	72.72	64.03	64.83	6.98	25.70	8.71	4.87	5.42	5.03	1.48	0.56	2.70	4597.87
2012	1613.09	1320.02	222.34	126.18	123.12	44.82	40.66	42.00	4.56	16.99	5.76	3.25	3.62	3.36	1.00	2.20	3572.95
2013	1909.07	611.41	687.21	126.27	72.04	72.89	27.34	25.30	26.40	2.90	10.79	3.69	2.08	2.32	2.18	2.07	3583.97
2014	309.95	723.59	318.24	388.46	71.37	42.21	44.01	16.84	15.74	16.59	1.82	6.85	2.34	1.32	1.49	2.72	1963.55
2015	1108.21	117.48	376.80	182.33	226.16	43.11	26.27	27.95	10.80	10.20	10.75	1.19	4.48	1.53	0.87	2.78	2150.92
2016	962.04	420.00	61.03	204.89	94.78	121.57	23.88	14.84	15.95	6.23	5.88	6.26	0.69	2.61	0.90	2.15	1943.69
2017	1335.20	364.59	218.16	33.26	107.08	51.22	67.69	13.56	8.52	9.24	3.61	3.44	3.66	0.41	1.54	1.80	2222.98
2018	1334.59	506.03	189.57	121.50	18.22	60.74	29.94	40.36	8.17	5.18	5.62	2.22	2.11	2.25	0.25	2.08	2328.83

Table 7. Estimated biomass at age (1000 lb) at start of year

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1986	5540.4	3038.2	3293.9	2282.9	4123.5	3767.9	1039.3	1237.2	1044.8	497.1	402.6	322.1	252.6	194.9	149.9	340.8	27528.7
1987	6805.9	5016.4	2655.5	2722.5	1748.0	2952.7	2624.4	714.1	839.7	705.0	331.8	269.2	214.1	167.3	130.1	325.0	28221.4
1988	11578.5	6162.4	4385.0	2197.6	2097.7	1266.3	2084.3	1828.1	491.4	574.5	477.1	224.9	181.4	143.7	113.1	305.6	34111.7
1989	5209.5	10485.6	5392.7	3650.6	1729.7	1577.0	931.9	1514.8	1312.6	350.8	405.7	337.5	158.3	127.2	101.4	293.2	33578.8
1990	6925.6	4717.2	9168.4	4468.3	2823.9	1261.3	1121.1	653.9	1050.1	904.8	239.2	277.1	229.3	106.9	86.6	267.0	34300.6
1991	9227.0	6271.7	4126.4	7616.5	3491.7	2096.2	915.1	803.1	462.8	739.0	629.6	166.7	192.0	158.3	74.3	244.1	37214.3
1992	3739.5	8355.5	5485.3	3425.3	5933.5	2577.6	1511.5	651.5	564.8	323.6	511.0	436.3	114.9	131.8	109.3	218.5	34089.6
1993	2841.5	3386.3	7308.8	4555.4	2671.3	4387.9	1862.2	1078.1	459.0	395.7	224.2	354.7	301.2	78.9	91.3	225.3	30222.1
1994	8765.8	2573.5	2963.5	6086.3	3589.8	2011.9	3236.2	1356.5	775.8	328.5	280.0	159.0	250.0	211.4	55.8	222.4	32866.1
1995	3662.3	7938.6	2252.2	2469.2	4808.9	2717.2	1492.3	2371.1	981.9	558.4	233.9	199.7	112.7	176.6	150.4	196.4	30321.7
1996	9387.7	3316.2	6938.8	1864.0	1906.6	3499.2	1927.7	1044.8	1640.0	675.3	379.9	159.4	135.4	76.1	119.9	234.1	33305.0
1997	2882.5	8492.4	2881.9	5558.3	1273.4	1119.5	1947.6	1053.6	563.7	879.6	358.3	201.9	84.2	71.2	40.3	186.5	27594.6
1998	5263.5	2609.8	7423.2	2386.1	4298.8	929.2	797.0	1368.6	731.3	389.1	600.3	244.9	137.3	57.1	48.5	153.4	27438.7
1999	12208.3	4766.6	2283.5	6177.8	1877.9	3232.0	684.1	579.6	983.0	522.3	274.9	425.1	172.4	96.1	40.1	141.5	34465.8
2000	8702.3	11054.2	4167.2	1890.2	4758.9	1358.9	2278.0	475.8	398.2	671.5	353.0	186.1	285.9	115.5	64.8	121.9	36882.9
2001	5050.4	7880.6	9671.5	3465.9	1484.2	3562.7	995.6	1648.2	340.2	283.1	472.0	248.5	130.3	199.5	81.1	130.3	35643.9
2002	5677.8	4573.7	6896.5	8053.7	2732.2	1118.6	2629.7	725.8	1187.2	243.6	200.4	335.1	175.5	91.5	141.1	148.6	34930.5
2003	10499.5	5141.8	4001.8	5737.1	6323.7	2045.0	819.2	1901.9	518.5	843.5	171.1	141.1	234.6	122.1	64.2	202.4	38767.4
2004	1865.6	9505.2	4489.7	3290.0	4308.7	4378.4	1371.3	541.5	1241.4	336.6	541.5	110.0	90.2	149.3	78.5	169.8	32467.5
2005	11419.7	1689.2	8309.0	3715.0	2531.3	3112.3	3079.9	951.7	371.3	846.4	226.9	365.7	73.9	60.4	100.5	166.0	37019.4
2006	7232.5	10337.0	1474.0	6802.1	2744.5	1702.4	2019.0	1968.1	600.5	233.0	525.1	141.1	226.2	45.4	37.5	164.2	36252.6
2007	5012.4	6547.1	9021.8	1208.6	5057.6	1867.1	1119.1	1307.6	1258.8	382.1	146.6	330.9	88.4	141.1	28.7	125.9	33643.2
2008	8207.6	4540.0	5726.5	7286.9	899.0	3645.3	1324.1	784.6	905.9	867.3	260.1	100.1	224.7	59.7	95.9	104.3	35032.3
2009	4914.5	7434.0	3972.7	4673.8	5545.5	663.4	2646.4	950.4	556.4	638.9	604.7	181.9	69.4	155.4	41.7	138.7	33187.7
2010	5003.2	4451.1	6497.2	3156.1	3355.0	3852.6	453.5	1788.4	634.5	369.5	419.5	397.9	119.0	45.2	101.9	117.5	30762.0
2011	15475.8	4531.2	3889.6	5161.9	2266.6	2331.6	2634.3	306.4	1194.5	421.5	242.7	276.0	260.4	77.6	29.8	143.3	39243.0
2012	7168.3	14016.8	3963.3	3140.3	3836.9	1632.1	1652.1	1845.5	212.1	822.3	286.8	165.6	187.2	175.9	52.7	116.6	39274.7
2013	8483.6	6492.4	12249.1	3142.7	2245.2	2654.6	1111.1	1111.8	1227.1	140.2	537.7	188.1	107.8	121.5	114.9	110.0	40037.5
2014	1377.4	7683.6	5672.5	9668.2	2224.2	1537.3	1788.4	740.1	731.7	803.1	90.8	348.6	121.3	69.2	78.5	144.6	33079.0
2015	4924.7	1247.4	6716.2	4538.0	7048.6	1569.9	1067.7	1228.0	502.0	493.6	535.7	60.6	231.7	80.2	46.1	147.7	30438.3
2016	4275.2	4460.0	1087.8	5099.3	2953.8	4427.1	970.3	652.1	741.2	301.4	293.0	318.6	35.9	136.5	47.6	114.2	25913.8
2017	5933.5	3871.5	3888.5	827.8	3337.1	1865.3	2750.7	595.9	396.0	447.3	179.9	175.3	189.4	21.2	81.4	95.7	24656.3
2018	5930.7	5373.3	3379.0	3023.9	567.7	2212.1	1216.5	1773.6	379.6	250.7	280.2	112.9	109.3	117.7	13.2	110.2	24851.2

Table 8. Estimated time series and status indicators. Fishing mortality rate is apical F. Total biomass (B, mt) is at the start of the year, and spawning biomass (SSB mature female biomass, and SSBknum in 1000s of mature females) at the time of peak spawning (end of March). The $MSST_{\mathrm{F40}}$ is defined by $\mathrm{MSST} = 0.75SSB_{\mathrm{F40}}$. *Prop.fem is proportion of age-2^+ population that is female.*

Year	F	F/F_{40}	B	B/B_{unfished}	SSB	SSBknum	$SSB/SSBB_{\mathrm{F40}}$	$SSB/MSST_{\mathrm{F40}}$	Prop.fem
1986	0.1039	0.1500	12487	0.826	5474	363	1.84	2.45	0.58
1987	0.0901	0.1301	12801	0.847	4902	352	1.64	2.19	0.58
1988	0.0474	0.0685	15473	1.024	5086	397	1.71	2.27	0.58
1989	0.0827	0.1195	15231	1.008	5957	522	2.00	2.66	0.58
1990	0.0620	0.0896	15559	1.029	6517	525	2.19	2.92	0.58
1991	0.0683	0.0986	16880	1.117	6472	501	2.17	2.89	0.58
1992	0.0664	0.0959	15463	1.023	6800	545	2.28	3.04	0.58
1993	0.0452	0.0653	13708	0.907	6753	495	2.27	3.02	0.58
1994	0.0393	0.0568	14908	0.986	6037	401	2.03	2.70	0.58
1995	0.0849	0.1227	13754	0.910	5874	440	1.97	2.63	0.58
1996	0.3336	0.4819	15107	0.999	5407	401	1.81	2.42	0.58
1997	0.0813	0.1174	12517	0.828	5286	441	1.77	2.36	0.58
1998	0.0471	0.0680	12446	0.823	5474	414	1.84	2.45	0.58
1999	0.0916	0.1324	15633	1.034	5152	380	1.73	2.30	0.58
2000	0.0520	0.0751	16730	1.107	5874	510	1.97	2.63	0.58
2001	0.0444	0.0641	16168	1.070	6945	591	2.33	3.11	0.58
2002	0.0523	0.0756	15844	1.048	7061	541	2.37	3.16	0.58
2003	0.1428	0.2063	17585	1.163	6567	481	2.20	2.94	0.58
2004	0.0937	0.1353	14727	0.974	6662	538	2.23	2.98	0.58
2005	0.1766	0.2552	16792	1.111	6293	454	2.11	2.81	0.58
2006	0.1632	0.2357	16444	1.088	6032	494	2.02	2.70	0.58
2007	0.0832	0.1202	15260	1.010	6521	535	2.19	2.92	0.58
2008	0.0599	0.0865	15890	1.051	6382	484	2.14	2.85	0.58
2009	0.1201	0.1734	15054	0.996	6239	488	2.09	2.79	0.58
2010	0.1197	0.1730	13953	0.923	5995	454	2.01	2.68	0.58
2011	0.0841	0.1215	17800	1.178	5548	409	1.86	2.48	0.58
2012	0.1242	0.1795	17815	1.179	6335	574	2.13	2.83	0.58
2013	0.1346	0.1945	18161	1.201	7157	610	2.40	3.20	0.58
2014	0.1042	0.1505	15004	0.993	7100	578	2.38	3.18	0.58
2015	0.2210	0.3193	13807	0.913	6113	430	2.05	2.73	0.58
2016	0.2156	0.3114	11754	0.778	4764	336	1.60	2.13	0.58
2017	0.1671	0.2414	11184	0.740	4212	313	1.41	1.88	0.58
2018	.	.	11272	0.746	.	.	.	.	0.58

Table 9. Selectivity at age for the commercial fleet (comm), general recreational fleet (GR), and landings averaged across fisheries (L.avg). TL is total length. For time-varying selectivities, values shown are from the terminal assessment year.

Age	TL(mm)	TL(in)	comm	GR	L.avg
1	589.4	23.2	0.029	0.000	0.001
2	768.7	30.3	0.168	0.019	0.023
3	900.2	35.4	0.580	0.446	0.450
4	996.6	39.2	0.904	0.971	0.969
5	1067.4	42.0	0.985	0.999	0.999
6	1119.2	44.1	0.998	1.000	1.000
7	1157.3	45.6	1.000	1.000	1.000
8	1185.2	46.7	1.000	1.000	1.000
9	1205.7	47.5	1.000	1.000	1.000
10	1220.7	48.1	1.000	1.000	1.000
11	1231.7	48.5	1.000	1.000	1.000
12	1239.8	48.8	1.000	1.000	1.000
13	1245.7	49.0	1.000	1.000	1.000
14	1250.0	49.2	1.000	1.000	1.000
15	1253.2	49.3	1.000	1.000	1.000
16	1255.6	49.4	1.000	1.000	1.000

Table 10. Estimated time series of fully selected fishing mortality rates for the commercial fleet (F.comm) and the general recreational fleet (F.GR). Also shown is apical F, the maximum F at age summed across fleets.

Year	F.comm	F.GR	Apical F
1986	0.002	0.102	0.104
1987	0.003	0.087	0.090
1988	0.002	0.045	0.047
1989	0.002	0.081	0.083
1990	0.003	0.059	0.062
1991	0.002	0.066	0.068
1992	0.002	0.064	0.066
1993	0.002	0.043	0.045
1994	0.003	0.037	0.039
1995	0.004	0.081	0.085
1996	0.004	0.329	0.334
1997	0.004	0.077	0.081
1998	0.003	0.044	0.047
1999	0.002	0.090	0.092
2000	0.003	0.049	0.052
2001	0.002	0.042	0.044
2002	0.002	0.050	0.052
2003	0.002	0.141	0.143
2004	0.002	0.092	0.094
2005	0.002	0.175	0.177
2006	0.002	0.161	0.163
2007	0.002	0.081	0.083
2008	0.002	0.058	0.060
2009	0.003	0.117	0.120
2010	0.004	0.116	0.120
2011	0.002	0.082	0.084
2012	0.003	0.121	0.124
2013	0.003	0.132	0.135
2014	0.004	0.101	0.104
2015	0.005	0.216	0.221
2016	0.007	0.209	0.216
2017	0.006	0.161	0.167
2018	.	.	.

Table 11. Estimated instantaneous fishing mortality rate (per yr) at age

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1986	0.000	0.003	0.014	0.052	0.090	0.101	0.103	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104
1987	0.000	0.002	0.013	0.046	0.078	0.088	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
1988	0.000	0.001	0.007	0.024	0.041	0.046	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
1989	0.000	0.002	0.012	0.042	0.072	0.081	0.082	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
1990	0.000	0.002	0.009	0.032	0.054	0.061	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
1991	0.000	0.002	0.010	0.035	0.059	0.067	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
1992	0.000	0.002	0.010	0.033	0.057	0.065	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
1993	0.000	0.001	0.007	0.023	0.039	0.044	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
1994	0.000	0.001	0.006	0.020	0.034	0.038	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
1995	0.000	0.003	0.013	0.044	0.074	0.083	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085
1996	0.001	0.008	0.046	0.166	0.288	0.326	0.332	0.333	0.334	0.334	0.334	0.334	0.334	0.334	0.334	0.334
1997	0.000	0.003	0.013	0.042	0.071	0.079	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081
1998	0.000	0.002	0.007	0.024	0.041	0.046	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
1999	0.000	0.002	0.013	0.046	0.079	0.089	0.091	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092
2000	0.000	0.002	0.008	0.027	0.045	0.051	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
2001	0.000	0.001	0.007	0.023	0.039	0.043	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
2002	0.000	0.002	0.008	0.027	0.045	0.051	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
2003	0.001	0.004	0.020	0.071	0.123	0.139	0.142	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143
2004	0.000	0.002	0.013	0.047	0.081	0.091	0.093	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094
2005	0.001	0.004	0.024	0.088	0.152	0.172	0.176	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177
2006	0.001	0.004	0.022	0.081	0.141	0.159	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163	0.163
2007	0.000	0.002	0.037	0.081	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
2008	0.000	0.001	0.027	0.058	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
2009	0.000	0.003	0.054	0.116	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
2010	0.000	0.003	0.054	0.116	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
2011	0.000	0.002	0.038	0.082	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084
2012	0.000	0.003	0.056	0.120	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124
2013	0.000	0.003	0.060	0.131	0.134	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135
2014	0.000	0.003	0.047	0.101	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104
2015	0.000	0.005	0.099	0.214	0.221	0.221	0.221	0.221	0.221	0.221	0.221	0.221	0.221	0.221	0.221	0.221
2016	0.000	0.005	0.097	0.209	0.215	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216
2017	0.000	0.004	0.075	0.162	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167

Table 12. Estimated total landings at age in numbers (1000 fish)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1986	0.34	0.55	2.07	3.76	9.39	8.36	2.13	2.36	1.89	0.87	0.68	0.54	0.41	0.32	0.24	0.55
1987	0.39	0.86	1.52	3.95	3.48	5.72	4.69	1.19	1.33	1.07	0.49	0.39	0.31	0.24	0.18	0.45
1988	0.37	0.59	1.37	1.71	2.24	1.32	2.00	1.64	0.42	0.47	0.38	0.18	0.14	0.11	0.09	0.23
1989	0.27	1.61	2.79	4.85	3.17	2.82	1.53	2.32	1.91	0.49	0.55	0.45	0.21	0.17	0.13	0.38
1990	0.29	0.59	3.72	4.52	3.91	1.70	1.40	0.76	1.16	0.96	0.25	0.28	0.23	0.11	0.08	0.26
1991	0.41	0.83	1.81	8.44	5.31	3.11	1.25	1.02	0.56	0.86	0.71	0.19	0.21	0.17	0.08	0.26
1992	0.16	1.05	2.30	3.67	8.78	3.72	2.01	0.81	0.67	0.37	0.56	0.47	0.12	0.14	0.11	0.23
1993	0.09	0.32	2.20	3.39	2.72	4.36	1.71	0.92	0.37	0.31	0.17	0.26	0.22	0.06	0.07	0.16
1994	0.26	0.23	0.82	4.01	3.20	1.74	2.59	1.01	0.55	0.22	0.19	0.10	0.16	0.13	0.04	0.14
1995	0.22	1.40	1.28	3.42	9.06	4.98	2.52	3.73	1.47	0.80	0.33	0.27	0.15	0.24	0.20	0.26
1996	1.79	1.89	13.65	9.33	12.74	22.54	11.43	5.77	8.60	3.40	1.87	0.77	0.64	0.36	0.56	1.09
1997	0.17	1.48	1.60	7.42	2.30	1.97	3.15	1.59	0.81	1.21	0.48	0.27	0.11	0.09	0.05	0.24
1998	0.19	0.27	2.43	1.87	4.56	0.96	0.76	1.21	0.62	0.32	0.47	0.19	0.10	0.04	0.04	0.11
1999	0.67	0.78	1.28	9.02	3.79	6.36	1.24	0.98	1.58	0.81	0.41	0.63	0.25	0.14	0.06	0.20
2000	0.33	1.23	1.48	1.63	5.57	1.55	2.39	0.47	0.37	0.60	0.31	0.16	0.24	0.10	0.05	0.10
2001	0.16	0.74	2.92	2.54	1.49	3.47	0.89	1.38	0.27	0.22	0.35	0.18	0.09	0.14	0.06	0.09
2002	0.20	0.49	2.39	6.91	3.21	1.28	2.78	0.71	1.11	0.22	0.18	0.29	0.15	0.08	0.12	0.12
2003	0.87	1.27	3.43	12.85	19.48	6.13	2.26	4.90	1.27	1.98	0.39	0.32	0.52	0.27	0.14	0.44
2004	0.11	1.62	2.60	4.92	8.89	8.81	2.54	0.94	2.04	0.53	0.83	0.17	0.13	0.22	0.11	0.25
2005	1.13	0.50	8.65	10.17	9.51	11.37	10.37	2.99	1.11	2.42	0.63	1.00	0.20	0.16	0.27	0.44
2006	0.68	2.90	1.43	17.31	9.58	5.78	6.32	5.74	1.66	0.62	1.36	0.36	0.57	0.11	0.09	0.40
2007	0.07	0.84	14.57	3.06	10.70	3.43	1.86	2.02	1.85	0.54	0.20	0.45	0.12	0.19	0.04	0.16
2008	0.10	0.45	6.71	13.38	1.38	4.87	1.60	0.88	0.97	0.89	0.26	0.10	0.22	0.06	0.09	0.10
2009	0.09	1.37	9.19	16.77	16.64	1.73	6.24	2.08	1.16	1.28	1.18	0.35	0.13	0.29	0.08	0.26
2010	0.11	0.86	15.02	11.29	10.04	10.01	1.07	3.91	1.32	0.74	0.82	0.76	0.22	0.08	0.19	0.22
2011	0.23	0.60	6.35	13.18	4.84	4.33	4.42	0.48	1.77	0.60	0.34	0.37	0.35	0.10	0.04	0.19
2012	0.14	2.67	9.48	11.64	11.89	4.39	4.02	4.17	0.46	1.70	0.58	0.33	0.36	0.34	0.10	0.22
2013	0.18	1.33	31.66	12.56	7.50	7.70	2.92	2.71	2.84	0.31	1.17	0.40	0.23	0.25	0.24	0.23
2014	0.03	1.33	11.46	30.29	5.83	3.50	3.69	1.42	1.33	1.40	0.15	0.58	0.20	0.11	0.13	0.23
2015	0.17	0.42	28.01	28.68	37.20	7.19	4.42	4.73	1.84	1.73	1.83	0.20	0.76	0.26	0.15	0.48
2016	0.18	1.55	4.44	31.49	15.24	19.83	3.93	2.45	2.65	1.03	0.98	1.04	0.12	0.44	0.15	0.36
2017	0.20	1.07	12.44	4.05	13.64	6.62	8.83	1.78	1.12	1.22	0.48	0.46	0.48	0.05	0.20	0.24

Table 13. Estimated total landings at age in whole weight (1000 lb)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1986	3.05	8.47	45.14	105.14	314.38	319.71	89.74	107.20	90.96	43.37	35.39	28.39	22.35	17.38	13.40	30.55
1987	3.57	13.25	33.23	110.49	116.44	218.66	197.73	53.99	63.79	53.67	25.45	20.72	16.53	13.02	10.14	25.42
1988	3.39	9.05	29.92	47.84	74.98	50.37	84.37	74.26	20.06	23.50	19.66	9.30	7.53	6.01	4.74	12.84
1989	2.43	24.65	60.90	135.70	106.09	107.62	64.73	105.58	91.93	24.62	28.68	23.94	11.26	9.12	7.29	21.15
1990	2.63	8.97	81.26	126.55	131.12	65.13	58.91	34.48	55.64	48.03	12.79	14.87	12.34	5.81	4.71	14.56
1991	3.73	12.74	39.54	236.07	177.95	118.86	52.80	46.50	26.93	43.07	36.98	9.83	11.36	9.43	4.44	14.62
1992	1.42	16.01	50.21	102.77	293.94	142.19	84.85	36.70	31.97	18.35	29.20	25.01	6.61	7.64	6.36	12.73
1993	0.81	4.83	48.07	94.86	91.13	166.52	71.92	41.78	17.87	15.44	8.82	13.99	11.92	3.15	3.65	9.04
1994	2.39	3.50	17.95	112.16	107.10	66.64	109.05	45.87	26.36	11.18	9.61	5.47	8.64	7.36	1.95	7.78
1995	1.97	21.41	27.87	95.79	303.32	190.22	106.27	169.42	70.50	40.17	16.95	14.52	8.23	12.99	11.08	14.52
1996	16.23	29.02	297.78	261.06	426.65	861.66	481.92	261.98	413.07	170.43	96.56	40.64	34.63	19.62	31.03	60.71
1997	1.54	22.65	34.83	207.71	77.06	75.16	132.99	72.18	38.80	60.67	24.89	14.08	5.89	5.02	2.85	13.22
1998	1.68	4.16	53.08	52.32	152.86	36.70	32.02	55.17	29.62	15.79	24.55	10.05	5.65	2.37	2.02	6.40
1999	6.07	11.98	27.98	252.50	126.97	243.26	52.40	44.54	75.92	40.42	21.43	33.24	13.53	7.61	3.19	11.26
2000	2.96	18.78	32.20	45.48	186.46	59.16	100.91	21.15	17.78	30.05	15.91	8.42	12.98	5.29	2.98	5.60
2001	1.46	11.40	63.68	71.22	49.74	132.73	37.74	62.70	13.00	10.84	18.22	9.62	5.06	7.81	3.18	5.13
2002	1.85	7.46	52.13	193.48	107.56	48.98	117.19	32.46	53.34	10.97	9.09	15.25	8.01	4.21	6.51	6.88
2003	7.87	19.53	74.87	359.65	652.58	234.42	95.53	222.52	60.96	99.34	20.31	16.80	28.01	14.72	7.76	24.48
2004	0.96	24.77	56.68	137.70	297.73	336.65	107.29	42.51	97.94	26.61	43.12	8.80	7.23	12.06	6.35	13.79
2005	10.24	7.70	188.70	284.71	318.66	434.68	437.44	135.62	53.15	121.42	32.80	53.03	10.76	8.85	14.78	24.47
2006	6.13	44.41	31.30	484.40	321.00	220.99	266.56	260.70	79.93	31.06	70.56	19.02	30.58	6.20	5.11	22.50
2007	0.60	12.85	318.04	85.50	358.43	131.16	78.46	91.72	88.68	26.96	10.42	23.61	6.33	10.18	2.07	9.12
2008	0.88	6.83	146.33	374.47	46.32	186.21	67.51	40.02	46.41	44.51	13.46	5.19	11.69	3.13	5.05	5.50
2009	0.85	21.05	200.51	469.27	557.40	66.08	263.12	94.52	55.57	63.93	60.98	18.39	7.05	15.89	4.27	14.27
2010	1.01	13.12	327.69	315.97	336.37	382.85	44.97	177.43	63.23	36.88	42.19	40.15	12.04	4.62	10.43	12.05
2011	2.05	9.20	138.66	368.74	162.21	165.42	186.53	21.71	84.98	30.04	17.43	19.89	18.82	5.65	2.17	10.49
2012	1.28	40.98	206.79	325.69	398.35	167.95	169.67	189.57	21.89	84.98	29.88	17.29	19.63	18.57	5.58	12.39
2013	1.60	20.44	690.83	351.54	251.35	294.53	123.03	123.16	136.51	15.63	60.37	21.18	12.19	13.83	13.12	12.59
2014	0.27	20.43	250.13	847.60	195.39	133.87	155.43	64.34	63.89	70.25	8.00	30.83	10.75	6.19	7.04	12.99
2015	1.56	6.48	611.23	802.57	1245.92	274.98	186.59	214.65	88.13	86.82	94.93	10.79	41.33	14.42	8.31	26.69
2016	1.59	23.81	96.89	881.30	510.47	758.18	165.80	111.49	127.23	51.82	50.77	55.39	6.26	23.98	8.38	20.17
2017	1.86	16.43	271.41	113.21	456.84	253.10	372.46	80.72	53.84	60.96	24.69	24.14	26.19	2.96	11.36	13.41

Table 14. Estimated time series of landings in numbers (1000 fish) for the commercial fleet (L.comm) and general recreational (L.GR))

Year	L.comm	L.GR	Total
1986	0.81	33.64	34.45
1987	1.32	24.95	26.26
1988	1.00	12.24	13.24
1989	1.22	22.44	23.65
1990	1.61	18.61	20.22
1991	1.55	23.69	25.23
1992	1.24	23.92	25.16
1993	1.32	16.00	17.32
1994	1.52	13.86	15.39
1995	2.18	28.14	30.32
1996	2.15	94.25	96.40
1997	2.22	20.70	22.93
1998	1.51	12.64	14.15
1999	0.96	27.25	28.21
2000	1.59	14.96	16.55
2001	1.56	13.45	15.01
2002	1.59	18.64	20.24
2003	1.35	55.18	56.53
2004	1.28	33.42	34.70
2005	1.01	59.91	60.92
2006	1.22	53.69	54.92
2007	1.17	38.91	40.08
2008	1.22	30.82	32.04
2009	1.64	57.18	58.82
2010	2.00	54.64	56.64
2011	1.27	36.91	38.18
2012	1.70	50.79	52.49
2013	2.04	70.19	72.22
2014	2.51	59.18	61.69
2015	2.95	115.13	118.08
2016	3.00	82.89	85.89
2017	2.29	50.59	52.88
.	.	.	.

Table 15. Estimated time series of landings in whole weight (1000 lb) for the commercial fleet (L.comm) and general recreational (L.rec).

Year	L.comm	L.GR	Total
1986	25.74	1248.89	1274.63
1987	40.75	935.35	976.09
1988	28.59	449.23	477.82
1989	33.46	792.23	825.68
1990	44.36	633.45	677.81
1991	43.82	801.03	844.85
1992	35.94	830.03	865.97
1993	39.61	564.19	603.80
1994	47.12	495.88	543.00
1995	67.65	1037.58	1105.23
1996	62.68	3440.30	3502.98
1997	63.61	725.94	789.55
1998	43.70	440.75	484.44
1999	27.54	944.76	972.30
2000	43.65	522.47	566.12
2001	42.59	460.94	503.53
2002	45.52	629.85	675.37
2003	39.37	1899.97	1939.34
2004	37.78	1182.40	1220.18
2005	29.26	2107.76	2137.01
2006	34.95	1865.50	1900.45
2007	32.73	1221.39	1254.13
2008	35.02	968.48	1003.51
2009	48.01	1865.16	1913.16
2010	58.69	1762.32	1821.01
2011	36.05	1207.93	1243.98
2012	46.20	1664.30	1710.50
2013	54.06	2087.83	2141.89
2014	70.95	1806.47	1877.42
2015	87.94	3627.45	3715.39
2016	92.75	2800.79	2893.54
2017	68.40	1715.18	1783.58
.	.	.	.

Table 16. Estimated status indicators, benchmarks, and related quantities from the base run of the Beaufort Assessment Model, conditional on estimated current selectivities averaged across fleets. Median values and standard deviations (SD) approximated from the ensemble model are also provided. Rate estimates (F) are in units of y^{-1}*; status indicators are dimensionless; and biomass estimates are whole weight in units of metric tons or pounds, as indicated. Spawning stock biomass (SSB) is measured as mature female biomass.*

Quantity	Units	Estimate	Median	SD
$F_{40\%}$	y^{-1}	0.69	0.69	0.14
$B_{\mathrm{F40\%}}$	mt	10643	10776	5597
$\mathrm{SSB}_{\mathrm{F40\%}}$	mt	2980.975	3012	1097
MSST	mt	2236	2266	1007
$L_{\mathrm{F40\%}}$	1000 lb	3923.780	3945	2098
$Lknum_{\mathrm{F40\%}}$	1000 fish	149.958	151	87
$R_{\mathrm{F40\%}}$	1000 age-1 fish	1513761	1537431	1054
$F_{2015-2017}/F_{40\%}$	—	0.29	0.30	0.17
$\mathrm{SSB}_{2017}/\mathrm{MSST}$	—	1.88	1.90	0.33
$\mathrm{SSB}_{2017}/\mathrm{SSB}_{\mathrm{F40\%}}$	—	1.41	1.42	0.25

Table 17. Results from sensitivity runs of the Beaufort catch-age model. Current F represented by geometric mean of last three assessment years.

Run	Description	$F_{40\%}$	$\mathrm{SSB}_{\mathrm{F}40\%}$ (mt)	$L_{\mathrm{F}40\%}$ (1000 lb)	$L_{\mathrm{F}40\%}$ (1000s)	$\mathrm{F}_{\mathrm{current}}/F_{40\%}$	$\mathrm{SSB}_{2017}/\mathrm{SSB}_{\mathrm{F}40\%}$	R0(1000)
Base	—	0.692	2980.97	3924	150	0.29	1.41	1336
S1	early start year	0.696	2996.49	3945	151	0.28	1.47	1310
S2	Include length comps	0.714	2562.88	3375	129	0.36	1.28	1079
S3	S28 LH values all	0.319	1749.02	1863	58	1.27	0.86	310
S3a	S28 l-w	0.693	3595.82	4733	149	0.29	1.41	1330
S3b	S28 + time of spawn	0.722	3658.11	4790	152	0.28	1.42	1330
S3c	S28 and sex ratio	0.722	3153.54	4790	152	0.28	1.42	1330
S3d	S28 and growth	0.627	2554.97	3813	143	0.32	1.43	1357
S3e	S28 and M	0.341	1799.72	1897	60	1.19	0.88	310
S4	Remove index	0.707	3339.82	4397	168	0.23	1.63	1491
S5	no MRIP peak	0.693	2795.09	3680	141	0.31	1.37	1245
S6	lower GR landings	0.681	1047.92	1381	53	0.3	1.41	470
S7	Upper values of ensemble parms	0.906	4851.73	7392	294	0.13	1.66	3070
S7a	Upper Ensemble L/D/DiscM	0.691	3317.5	4367	167	0.26	1.45	1487
S7b	Upper Ensemble Index	0.501	2303.66	2498	90	0.6	1.13	667
S7c	Lower Ensemble M	0.693	2979.09	3921	150	0.29	1.41	1335
S8	Lower values of ensemble parms	0.501	1809.41	1962	71	0.62	1.11	524
S8a	Lower Ensemble L/D/DiscM	0.692	2982.45	3926	150	0.29	1.41	1337
S8b	Lower Ensemble Index	0.691	2343.18	3085	118	0.29	1.4	1051
S8c	Upper Ensemble M	0.909	4353.64	6633	264	0.14	1.64	2755
S10	upper GR landings	0.696	8781.05	11553	440	0.29	1.42	3937

Table 18. Projection results with fishing mortality rate fixed at $F = F_{\text{current}}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb*). The extension* b *indicates expected values (deterministic) from the base run; the extension* med *indicates median values from the stochastic projections.*

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1335	1360	0.27	0.31	4058	3954	83	89	2798	2885
2019	1334	1359	0.33	0.34	3649	3758	87	94	2798	2885
2020	1334	1359	0.17	0.21	3750	3828	46	59	1394	1738
2021	1334	1359	0.17	0.21	4004	4002	52	63	1535	1855
2022	1334	1359	0.17	0.21	4184	4115	55	65	1634	1935
2023	1335	1360	0.17	0.21	4307	4189	57	67	1700	1983
2024	1335	1360	0.17	0.21	4389	4236	58	67	1743	2013

Table 19. Projection results with fishing mortality rate fixed at $F = F_{40\%}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb*). The extension* b *indicates expected values (deterministic) from the base run; the extension* med *indicates median values from the stochastic projections.*

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1335	1360	0.27	0.31	4058	3954	83	89	2798	2885
2019	1334	1359	0.33	0.34	3649	3758	87	94	2798	2885
2020	1334	1359	0.69	0.69	3217	3321	160	170	4770	4970
2021	1333	1358	0.69	0.69	2850	2920	142	146	3958	4079
2022	1332	1357	0.69	0.69	2710	2763	136	138	3646	3709
2023	1332	1357	0.69	0.69	2656	2701	133	135	3527	3572
2024	1332	1356	0.69	0.69	2635	2677	133	134	3481	3515

Table 20. Projection results with fishing mortality rate fixed at $F = 75\%F_{40\%}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb*). The extension* b *indicates expected values (deterministic) from the base run; the extension* med *indicates median values from the stochastic projections.*

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1335	1360	0.27	0.31	4058	3954	83	89	2798	2885
2019	1334	1359	0.33	0.34	3649	3758	87	94	2798	2885
2020	1334	1359	0.52	0.52	3381	3490	127	135	3802	3969
2021	1333	1358	0.52	0.52	3157	3233	121	124	3439	3546
2022	1333	1358	0.52	0.52	3060	3124	118	120	3278	3342
2023	1333	1358	0.52	0.52	3017	3071	117	118	3207	3254
2024	1333	1357	0.52	0.52	2998	3044	116	118	3175	3215

8 Figures

Figure 1. Mean length at age (mm) and estimated upper and lower 95% confidence intervals of the population.

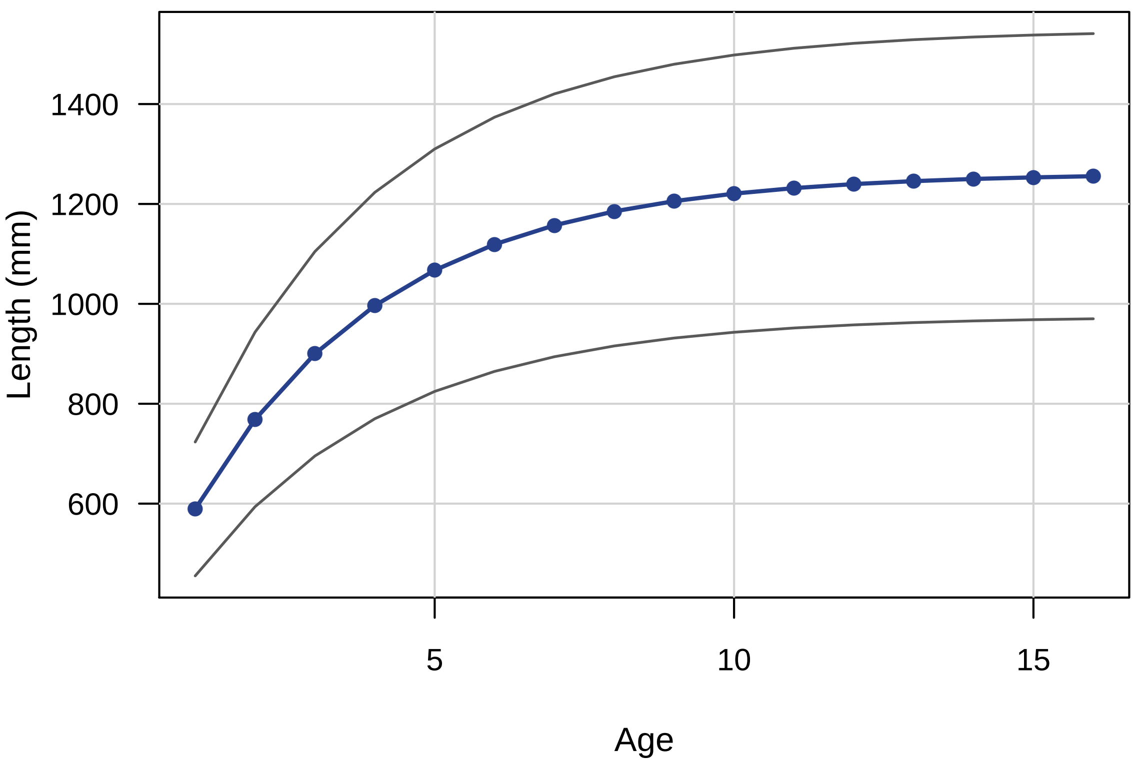


Figure 2. Observed (open circles) and estimated (solid line) annual length and age compositions by fleet from the base run. In panels indicating the data set, lcomp refers to length compositions, acomp to age compositions, comm to the commercial fleet, and GR to the general recreational fleet. N indicates the number of fish samples taken. For the commercial fleet, length compositions from 1986–2017 were pooled.

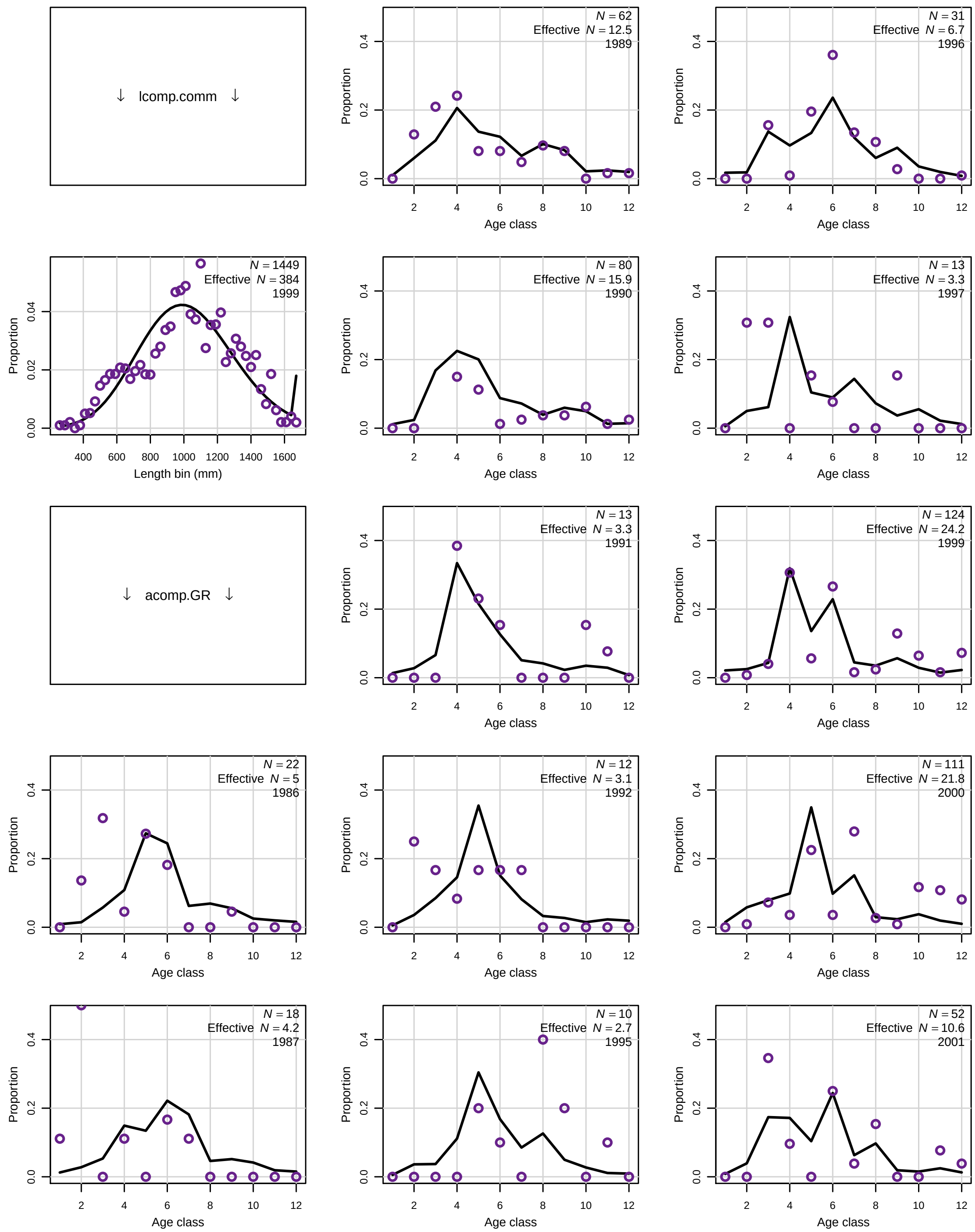


Figure 2. (cont.) Observed (open circles) and estimated (solid line) annual length and age compositions by fleet or survey from the base run.

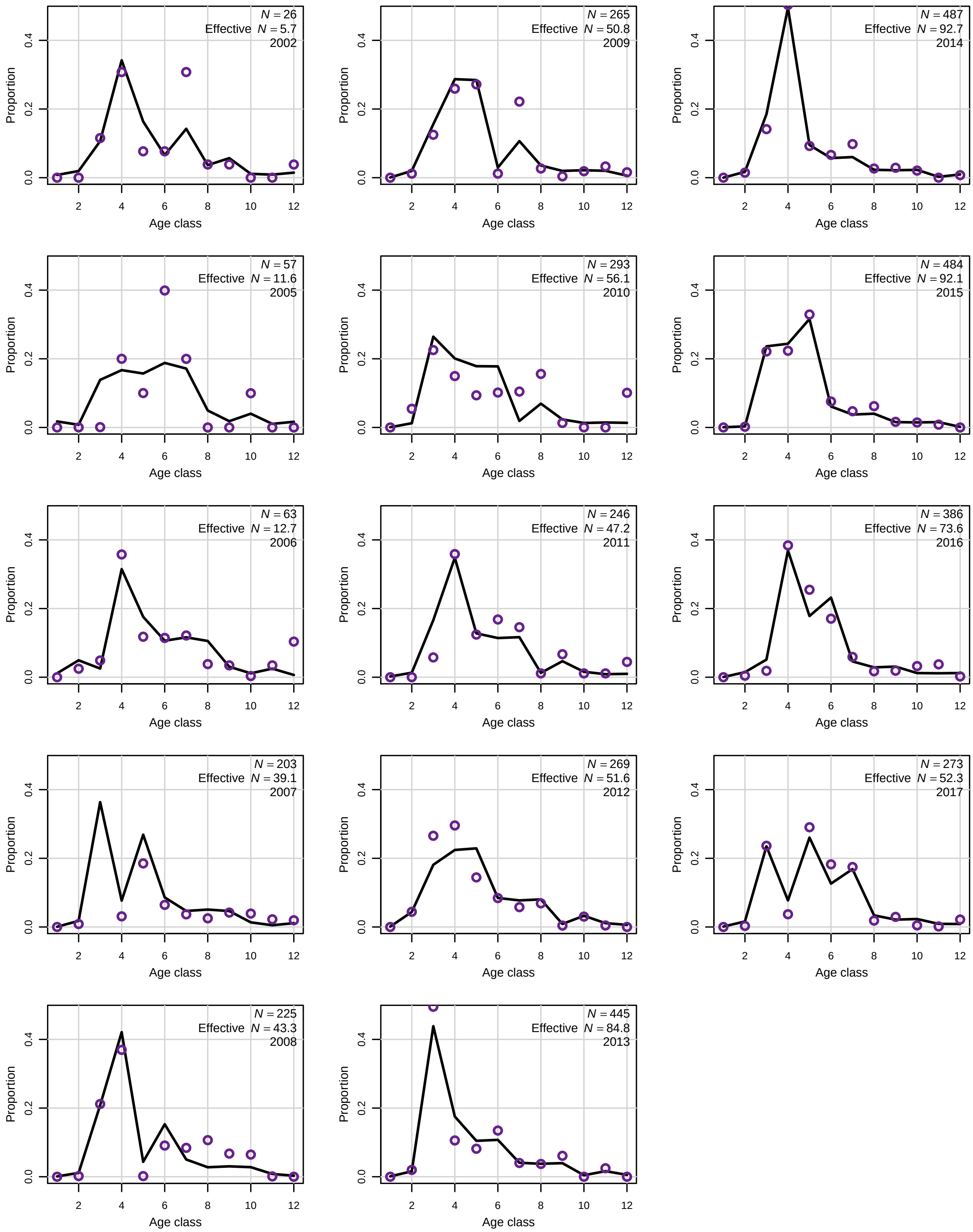


Figure 3. Observed (open circles) and estimated (line, solid circles) commercial landings (1000 lb whole weight).

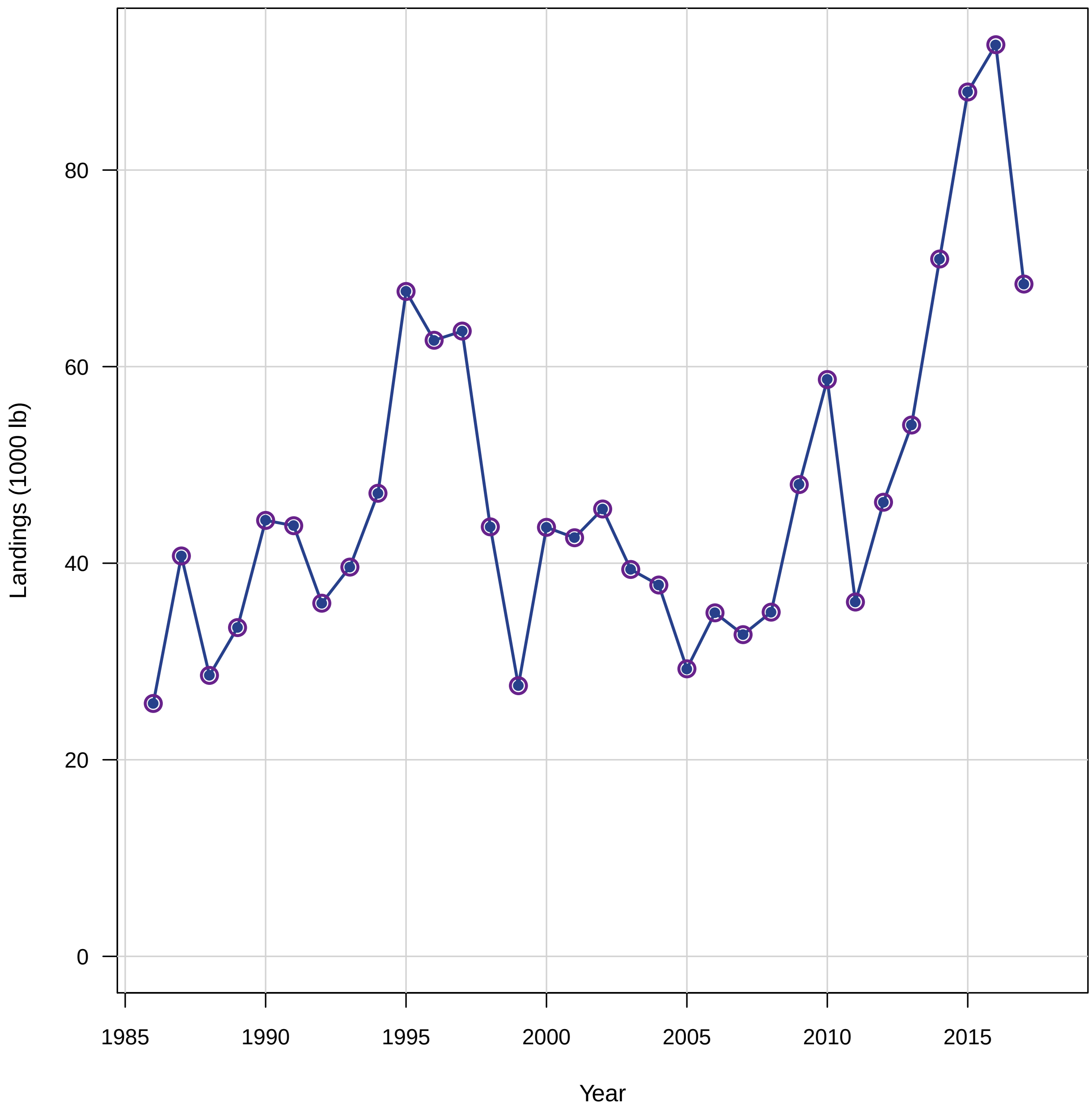


Figure 4. Observed (open circles) and estimated (line, solid circles) general recreational landings (1000 fish).

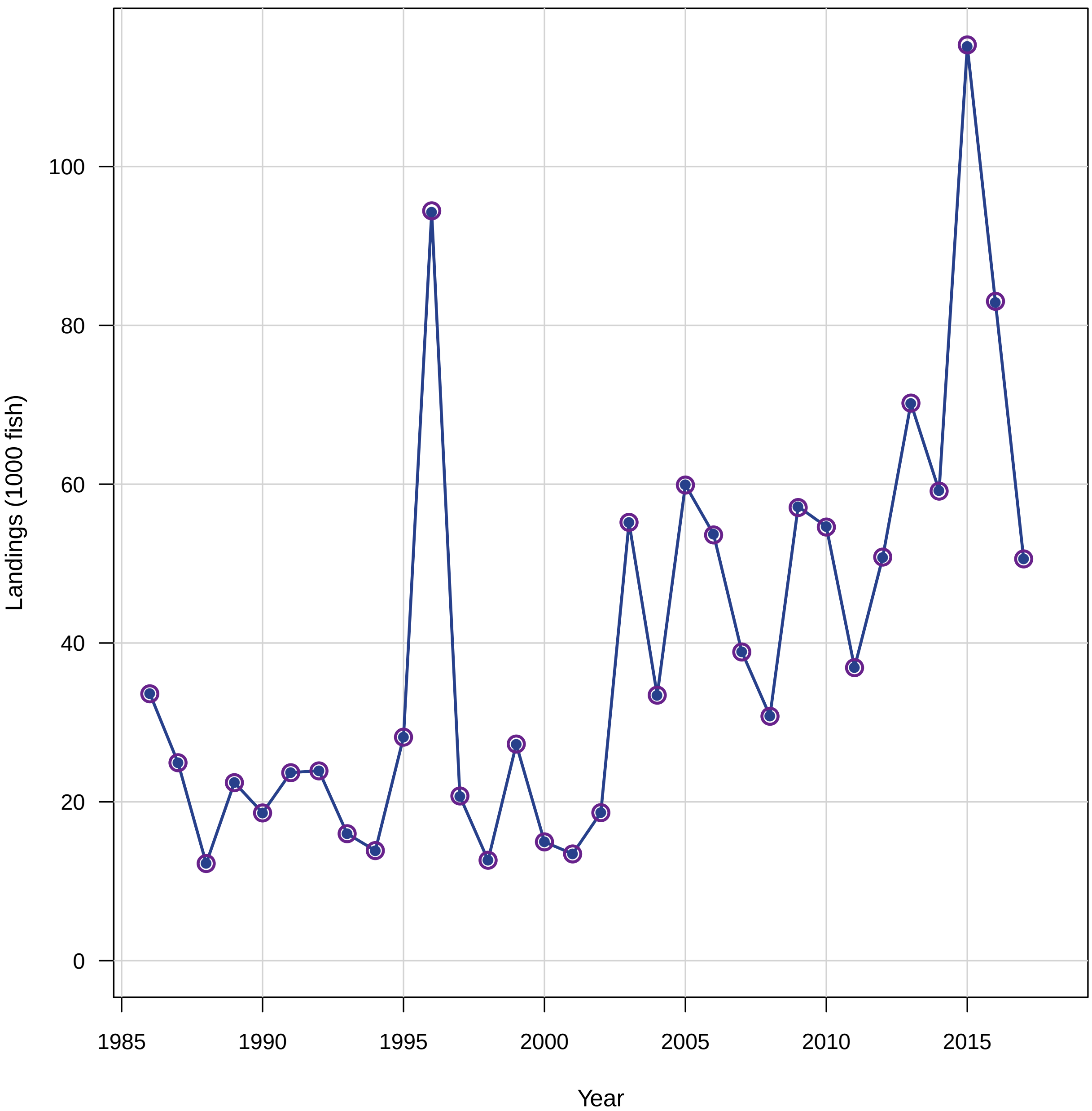


Figure 5. Observed (open circles) and estimated (line, solid circles) index of abundance from the headboat fleet.

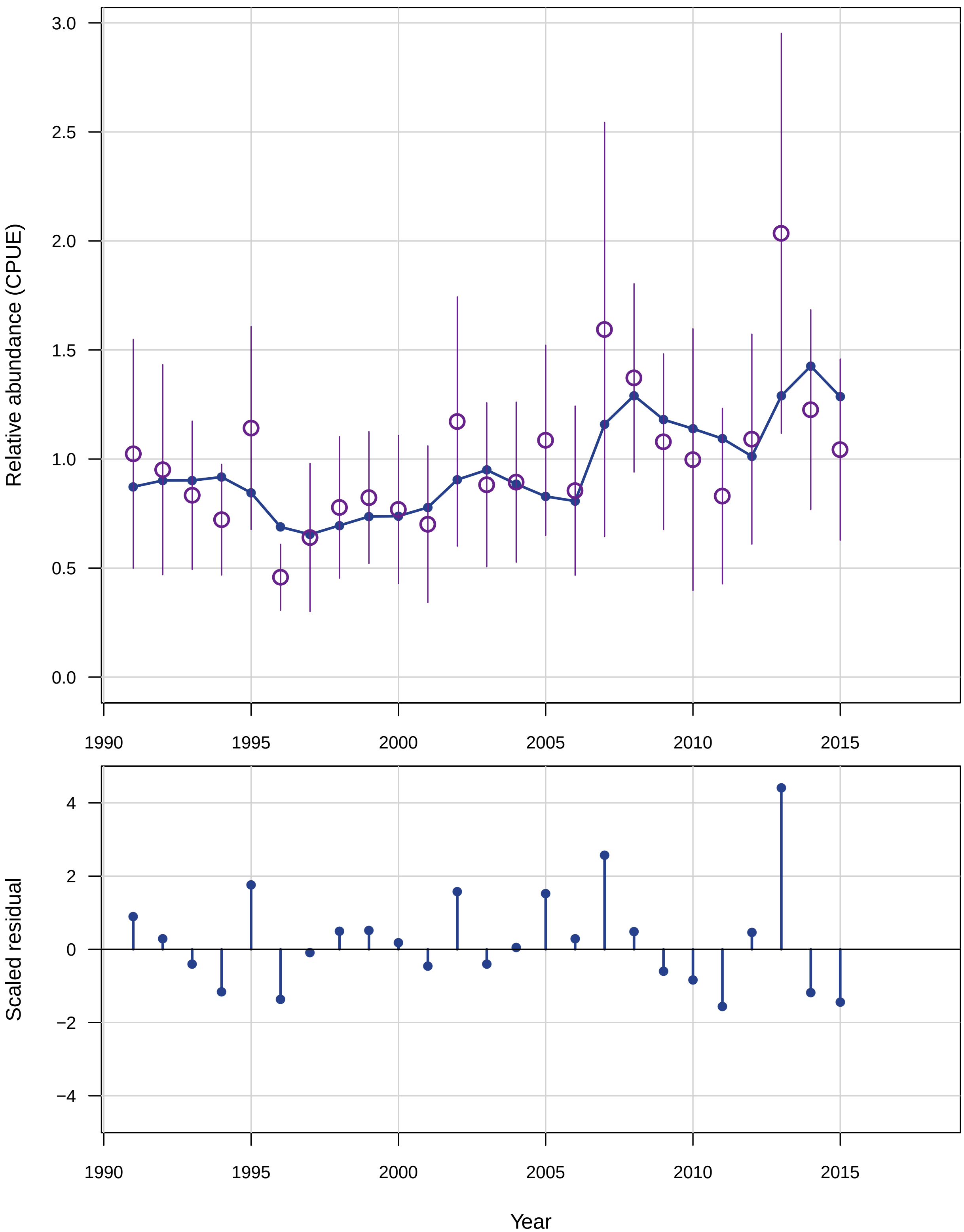


Figure 6. Estimated abundance at age at start of year.

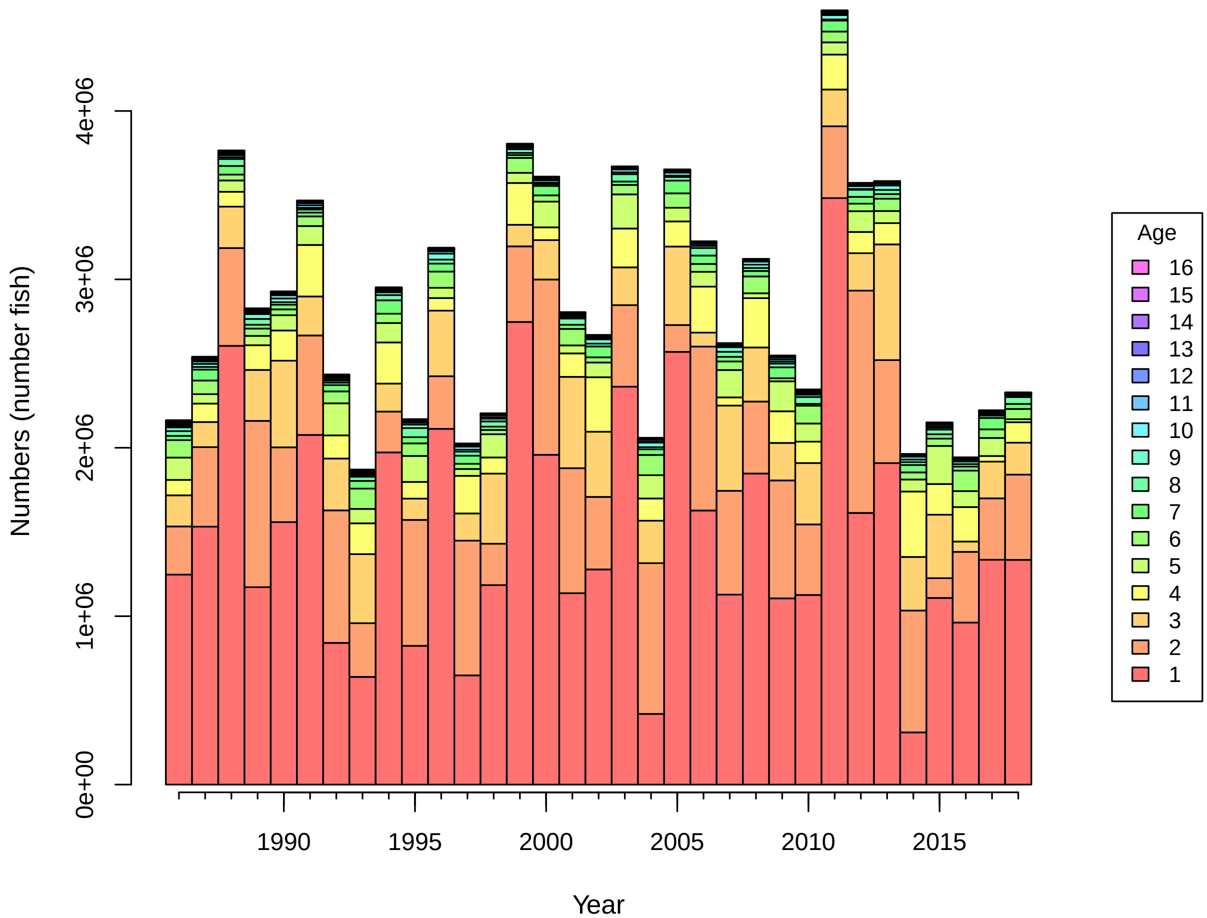


Figure 7. Top panel: Estimated recruitment of age-1 fish. Horizontal dashed line indicates $R_{F40\%}$. Bottom panel: log recruitment residuals.

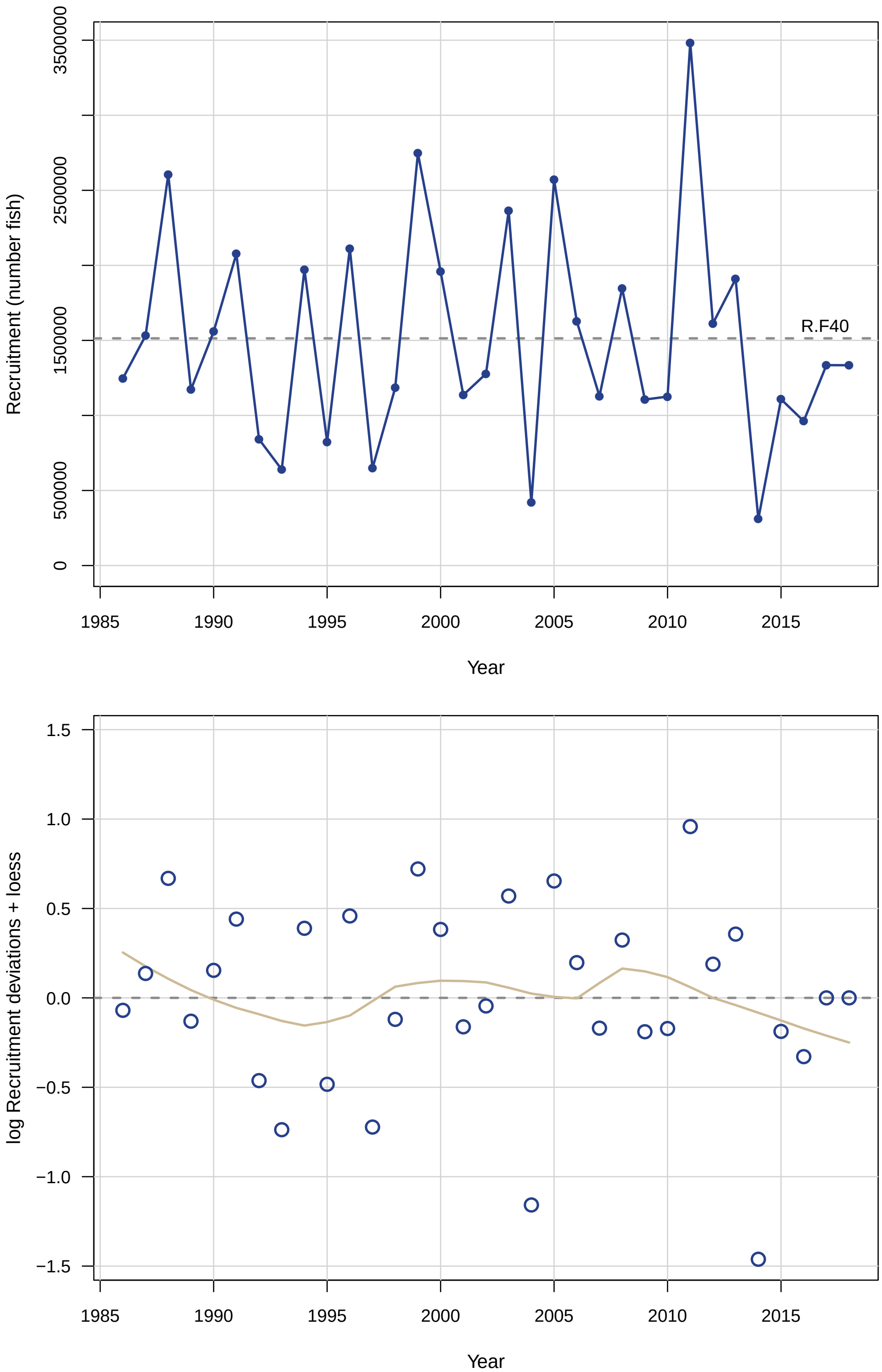


Figure 8. Estimated biomass at age at start of year.

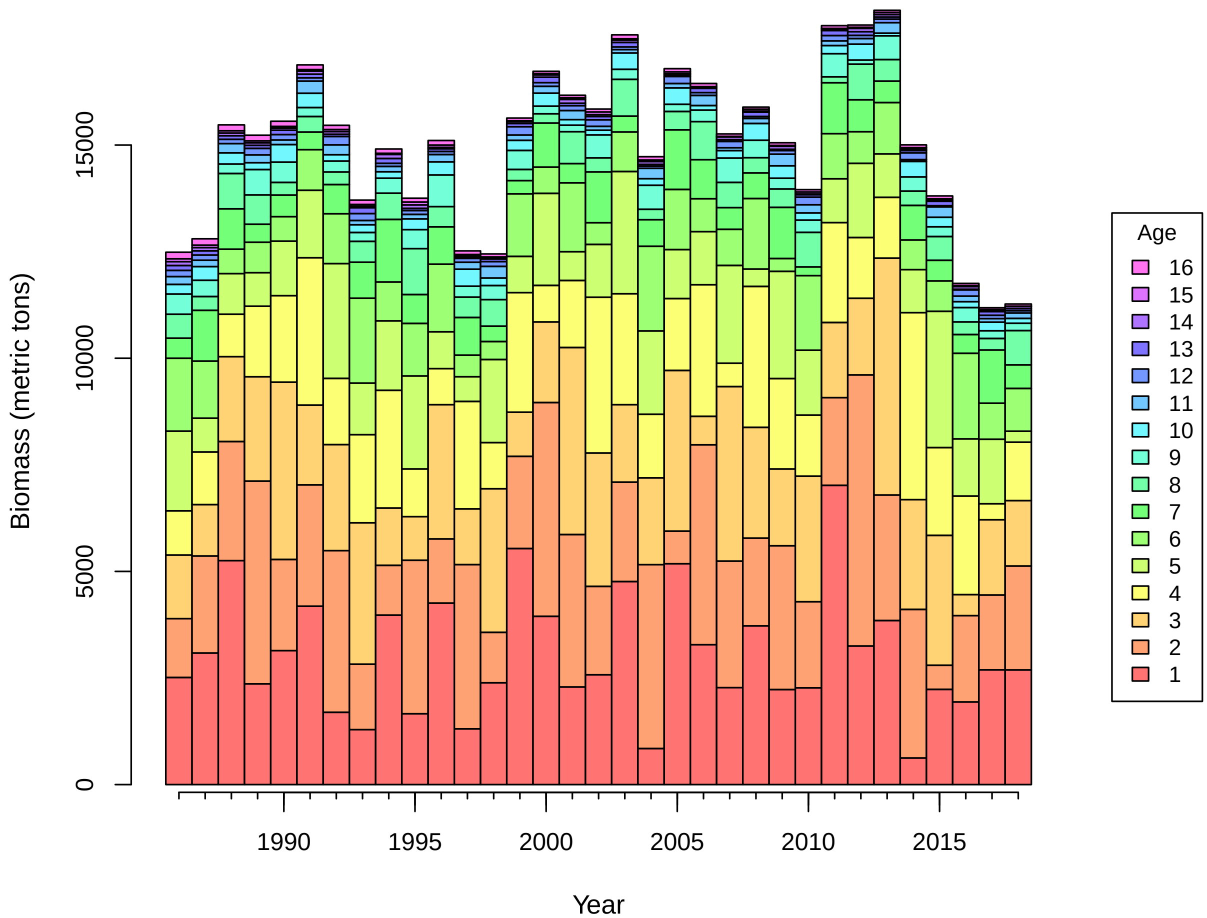
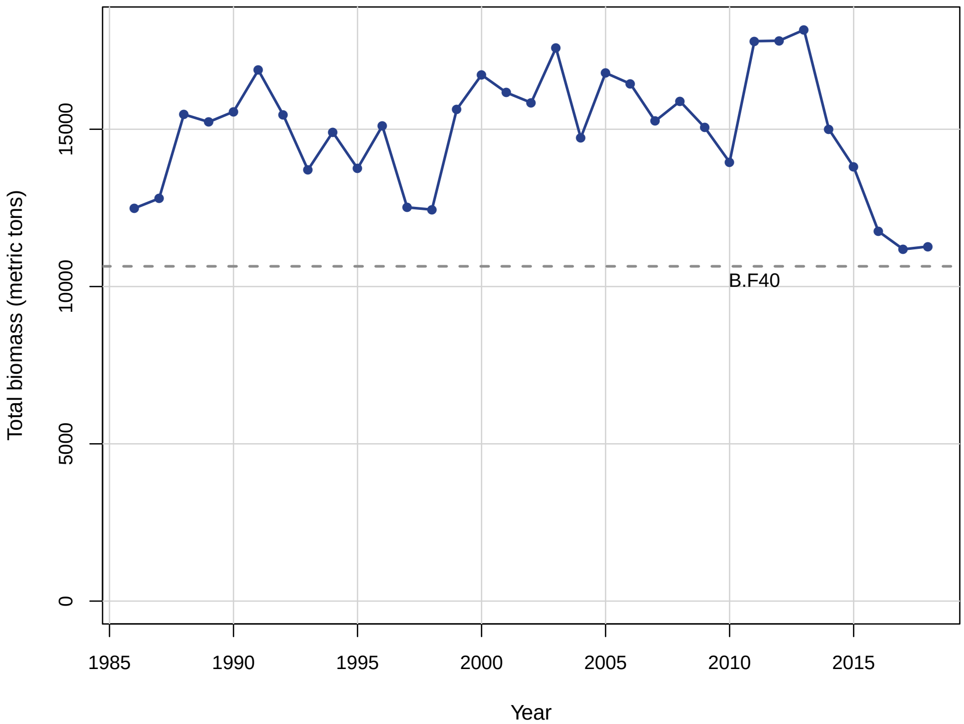


Figure 9. Top panel: Estimated total biomass (metric tons) at start of year. Horizontal dashed line indicates $B_{F40\%}$. Bottom panel: Estimated spawning stock (mature female biomass) at time of peak spawning.



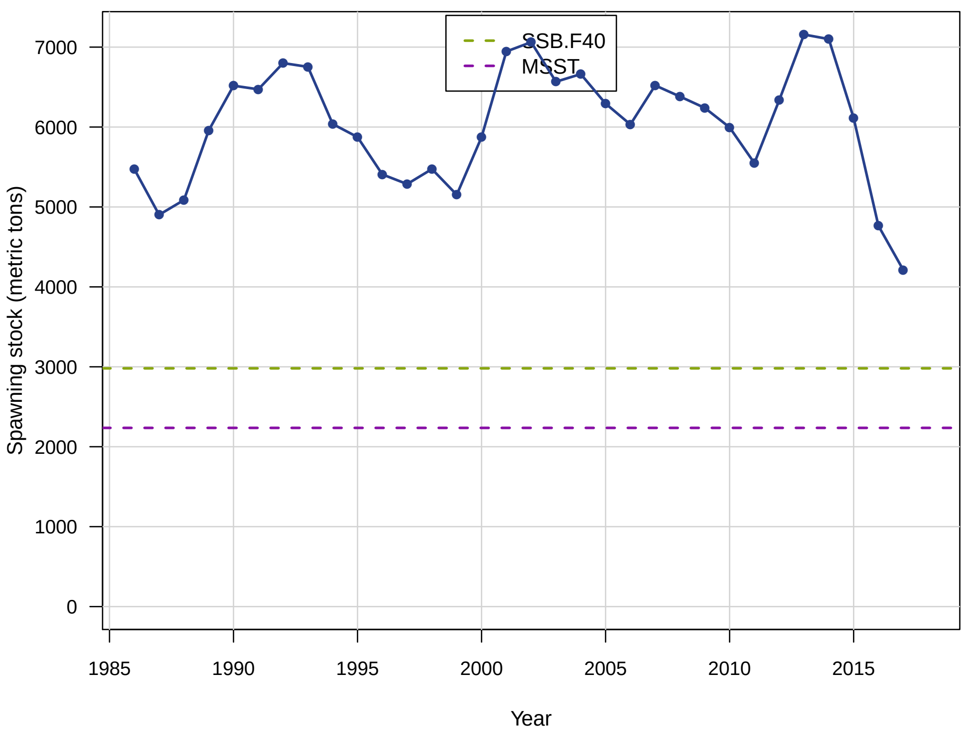


Figure 10. Estimated selectivity of the commercial fleet. Years indicated on plot signify the first year of a time block.

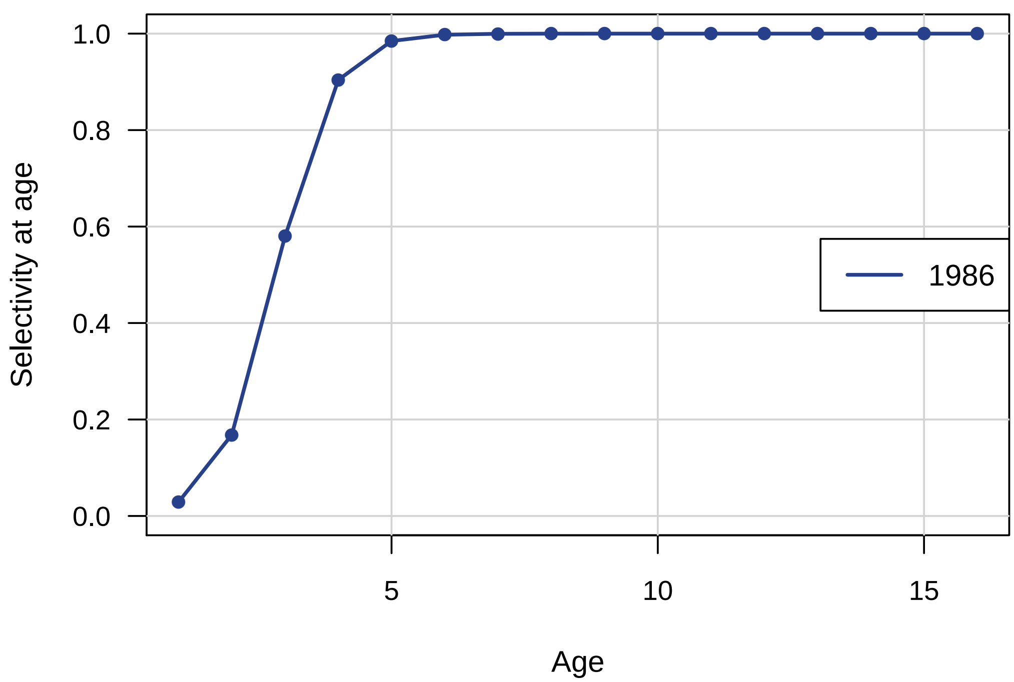


Figure 11. Estimated selectivities of the general recreational fleet. Years indicated on plot signify the first year of a time block.

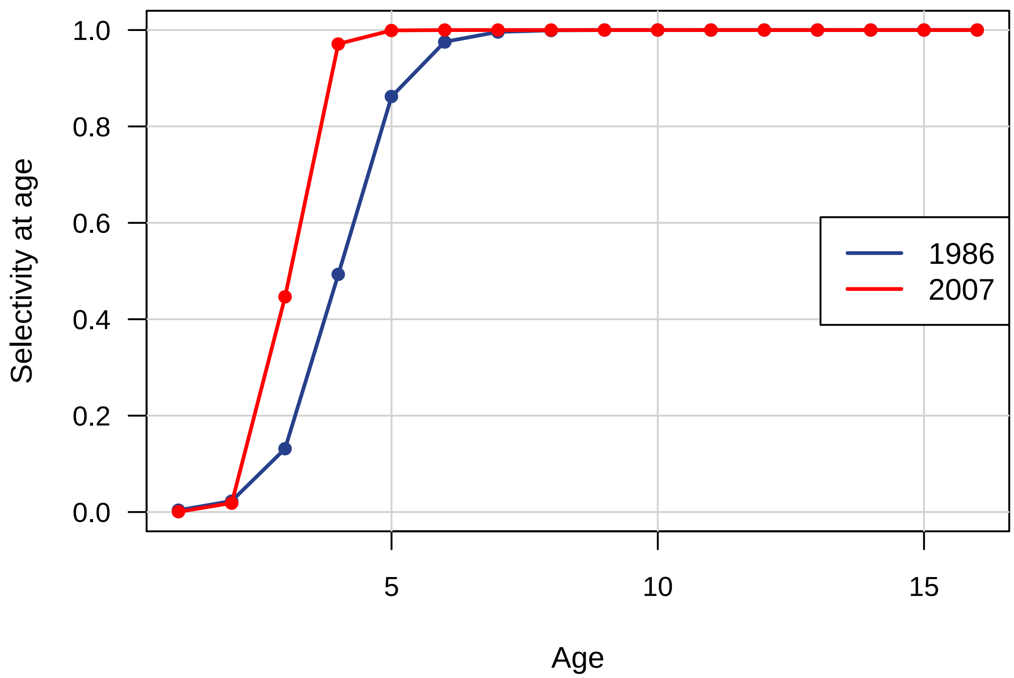


Figure 12. Average selectivity from the terminal assessment years, weighted by geometric mean Fs from the last three assessment years, and used in computation of benchmarks and projections.

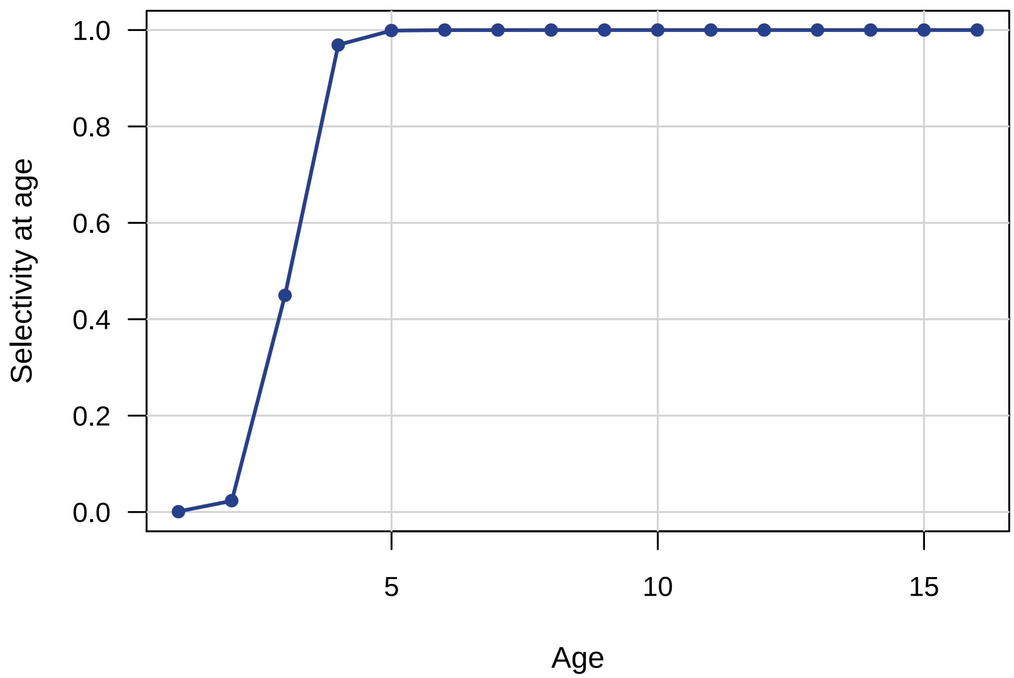


Figure 13. Estimated fully selected fishing mortality rate (per year) by fishery. comm refers to the commercial fleet, and GR to the general recreational fleet.

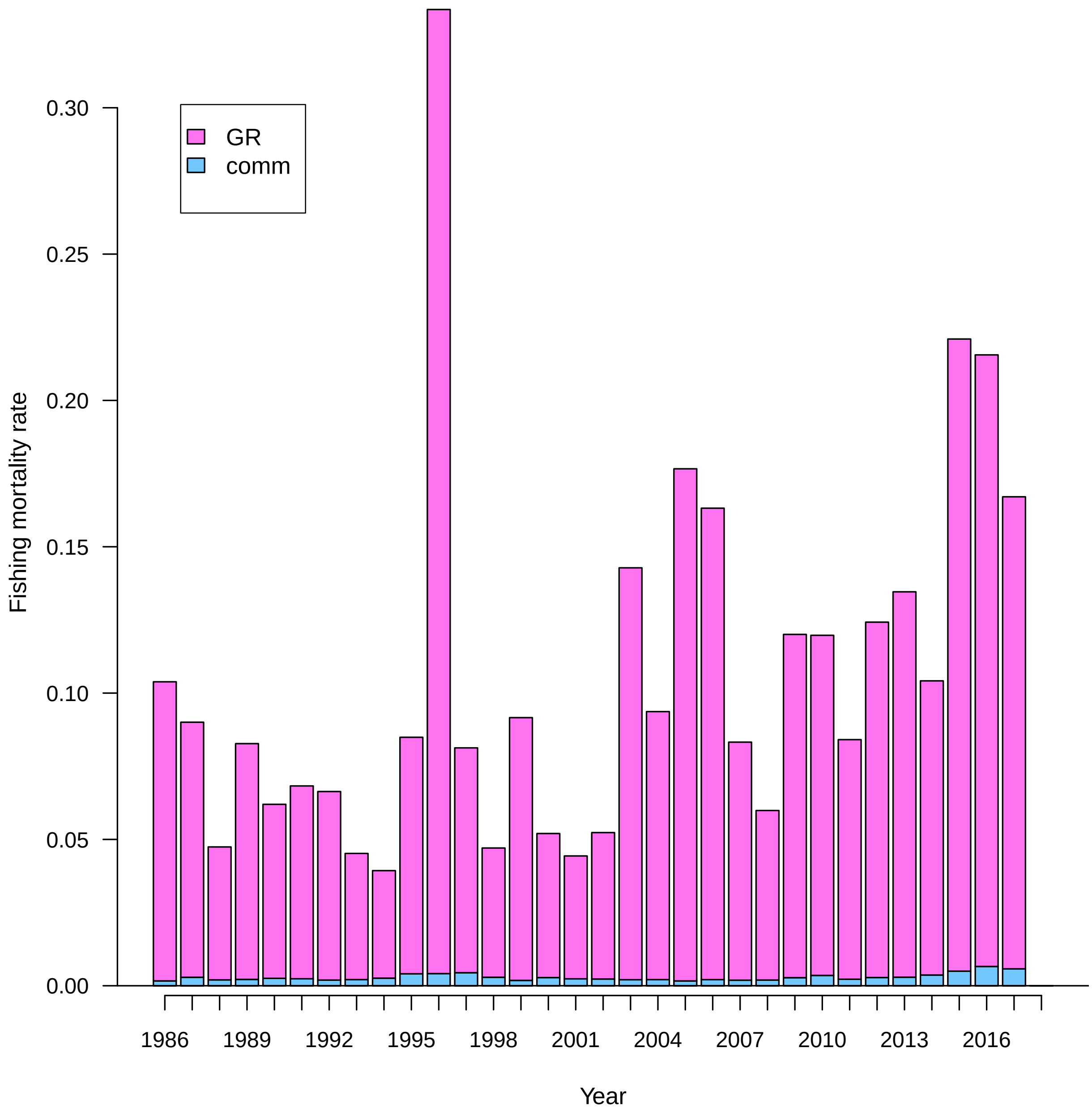


Figure 14. Estimated landings in numbers by fishery from the catch-age model. comm refers to the commercial fleet, and GR to the general recreational fleet.

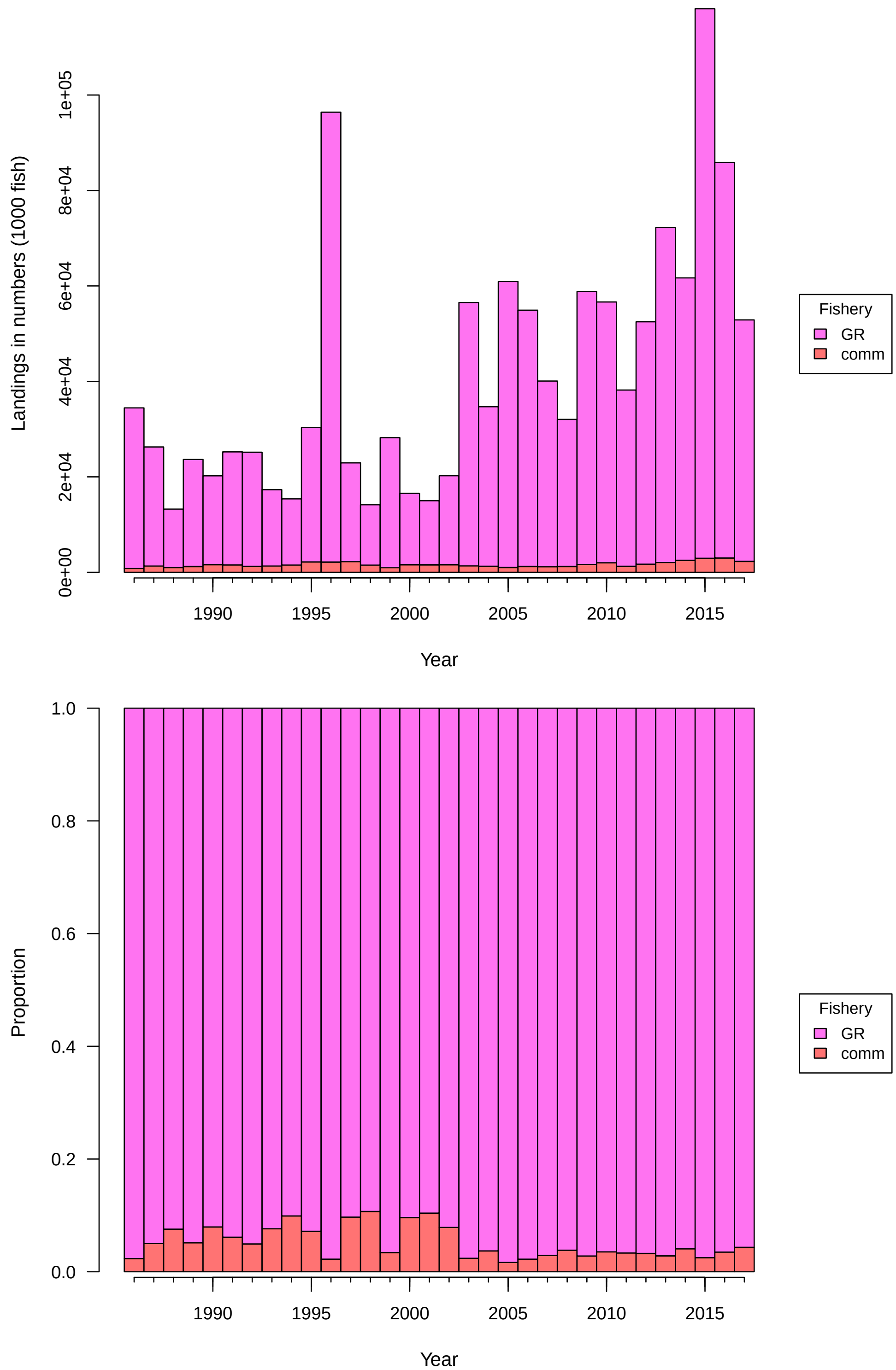
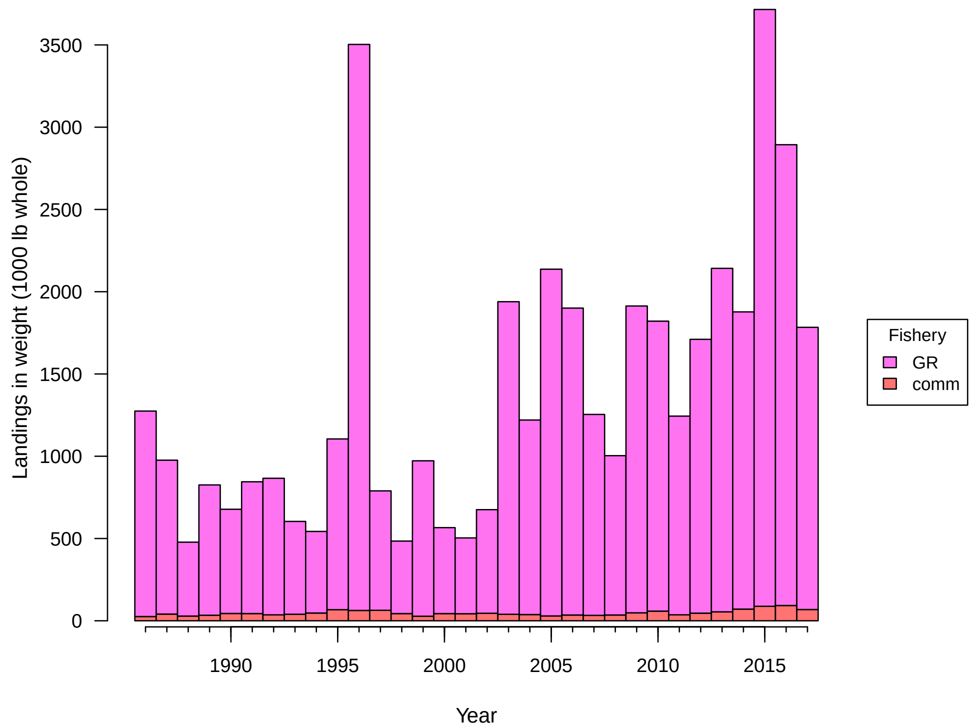


Figure 15. Estimated landings in whole weight by fishery from the catch-age model. comm refers to the commercial fleet, and GR to the general recreational fleet.



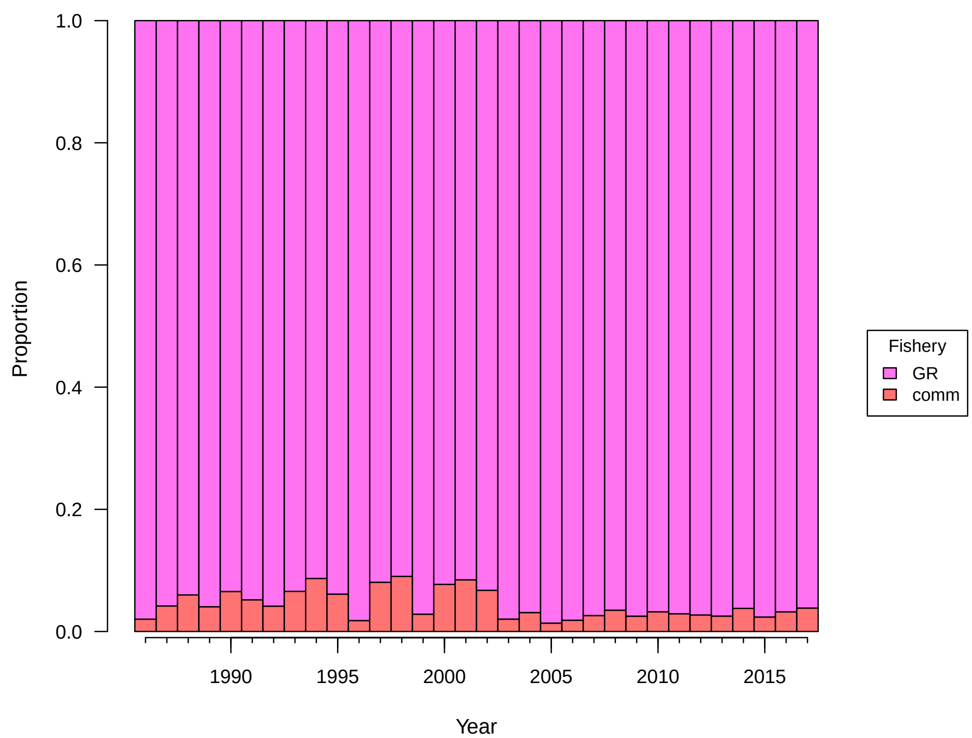


Figure 16. Top panel: Spawner-recruit relationship. The expected curve was used for computing management benchmarks. Years within panel indicate year of recruitment generated from spawning biomass. Bottom panel: log of recruits (number age-1 fish) per spawner as a function of spawners.

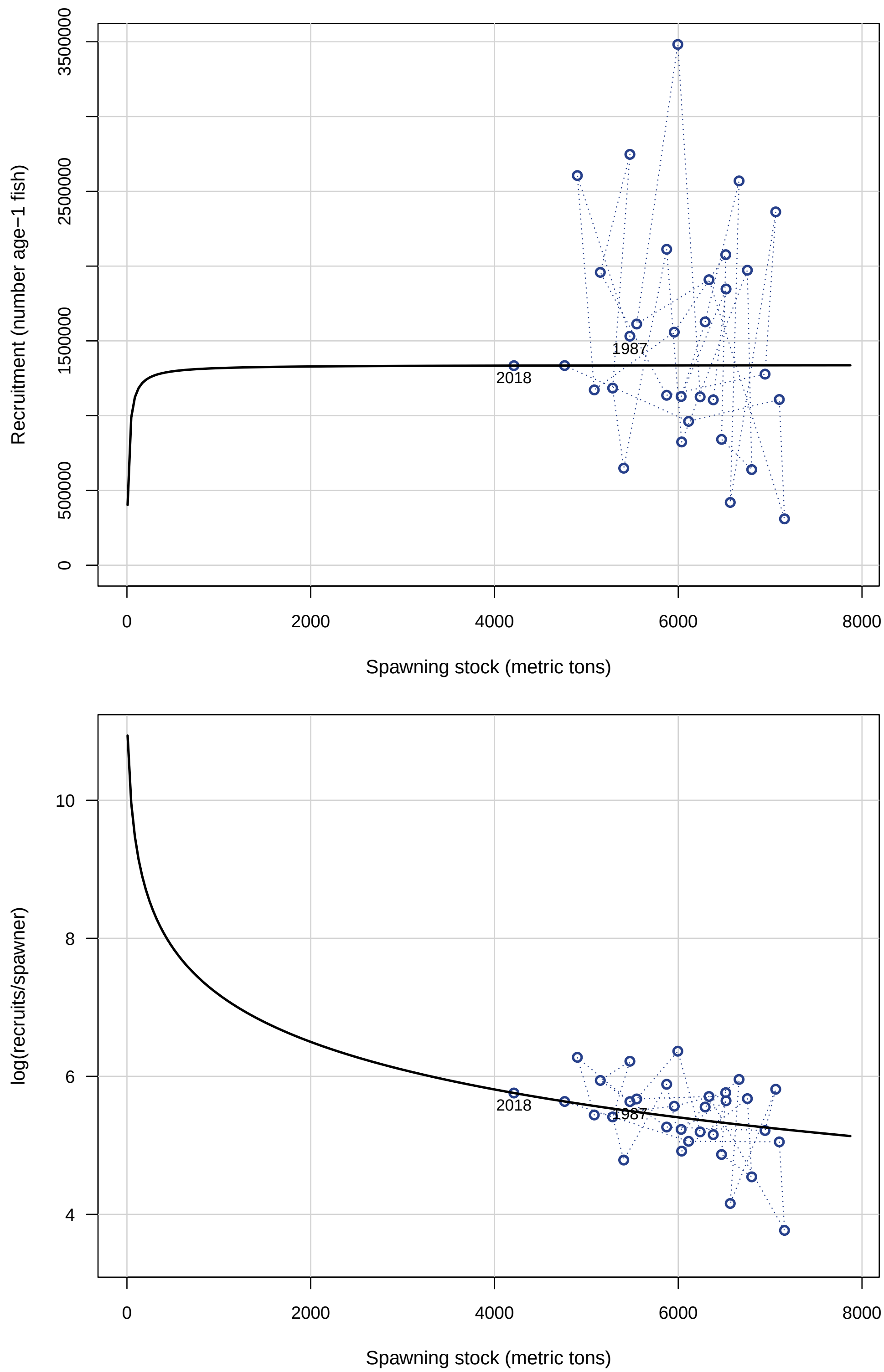


Figure 17. Probability densities of spawner-recruit quantities R0 (unfished recruitment of age-1 fish), the SD of recruitment residuals, and unfished spawners per recruit. Vertical lines represent point estimates or values from the base run of the Beaufort Assessment Model.

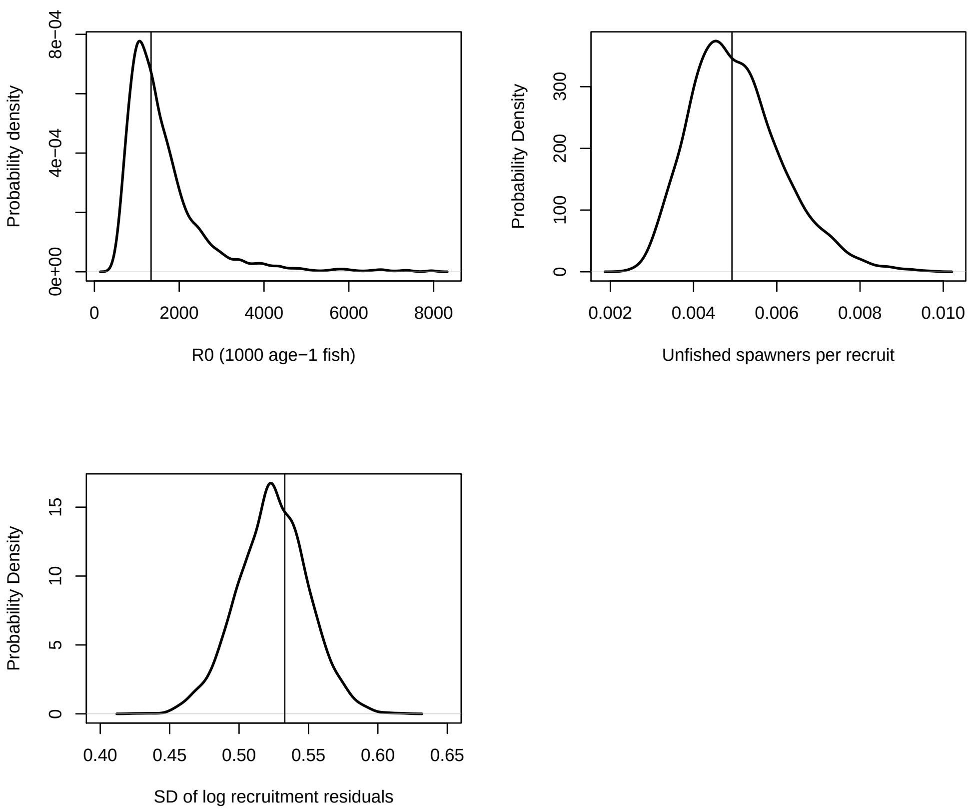


Figure 18. Top panel: yield per recruit (kg). Bottom panel: spawning potential ratio (spawning biomass per recruit relative to that at the unfished level), from which the X% level of SPR provides $F_{X\%}$. Both curves are based on average selectivity from the end of the assessment period.

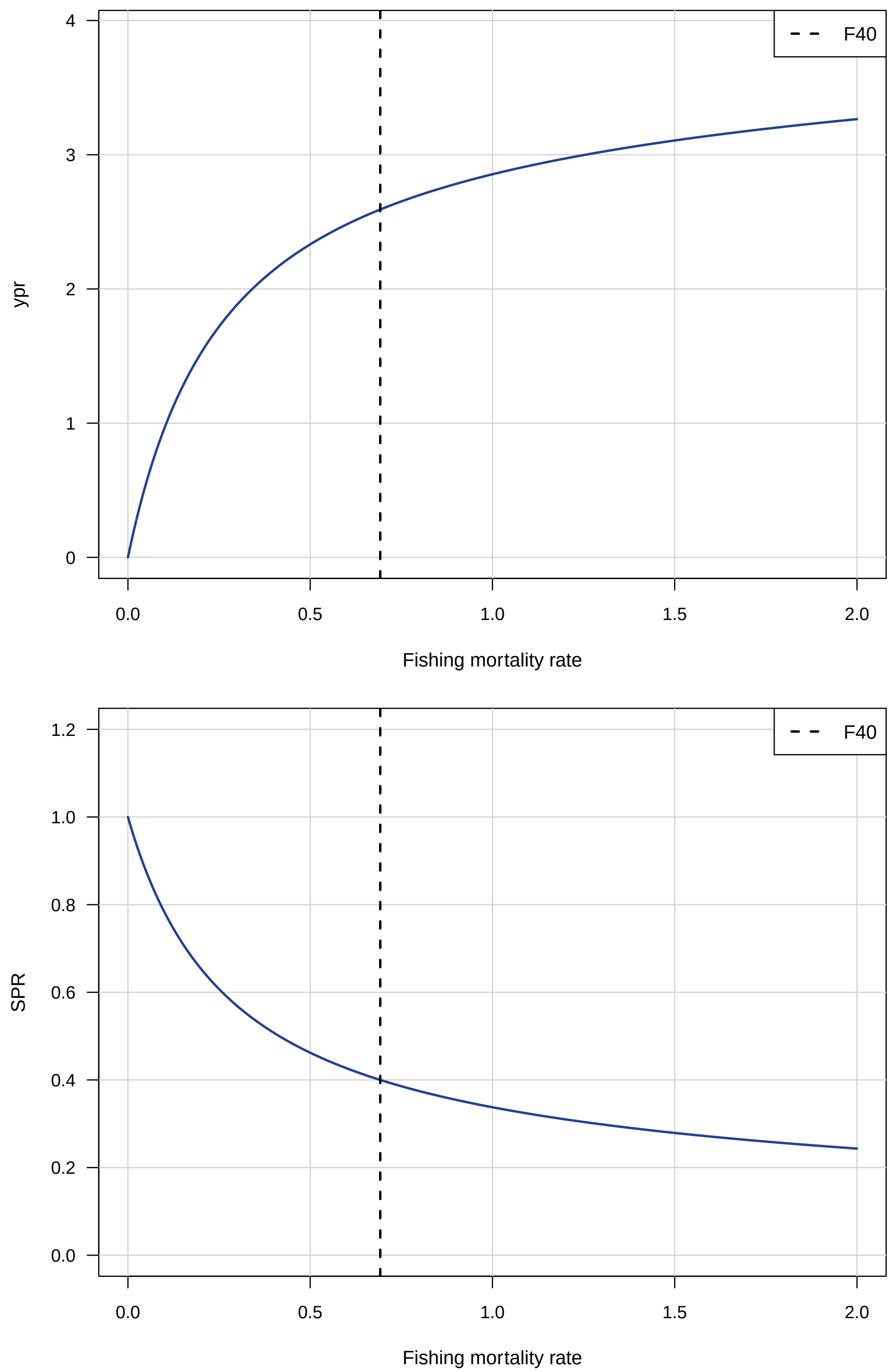


Figure 19. Top panel: equilibrium landings. The vertical dashed line occurs where fishing rate is $F_{40\%} = 0.69$ *and equilibrium landings are* $L_{\mathrm{F}40\%}$ *(1000 lb). Bottom panel: equilibrium spawning biomass. Both curves are based on average selectivity from the end of the assessment period.*

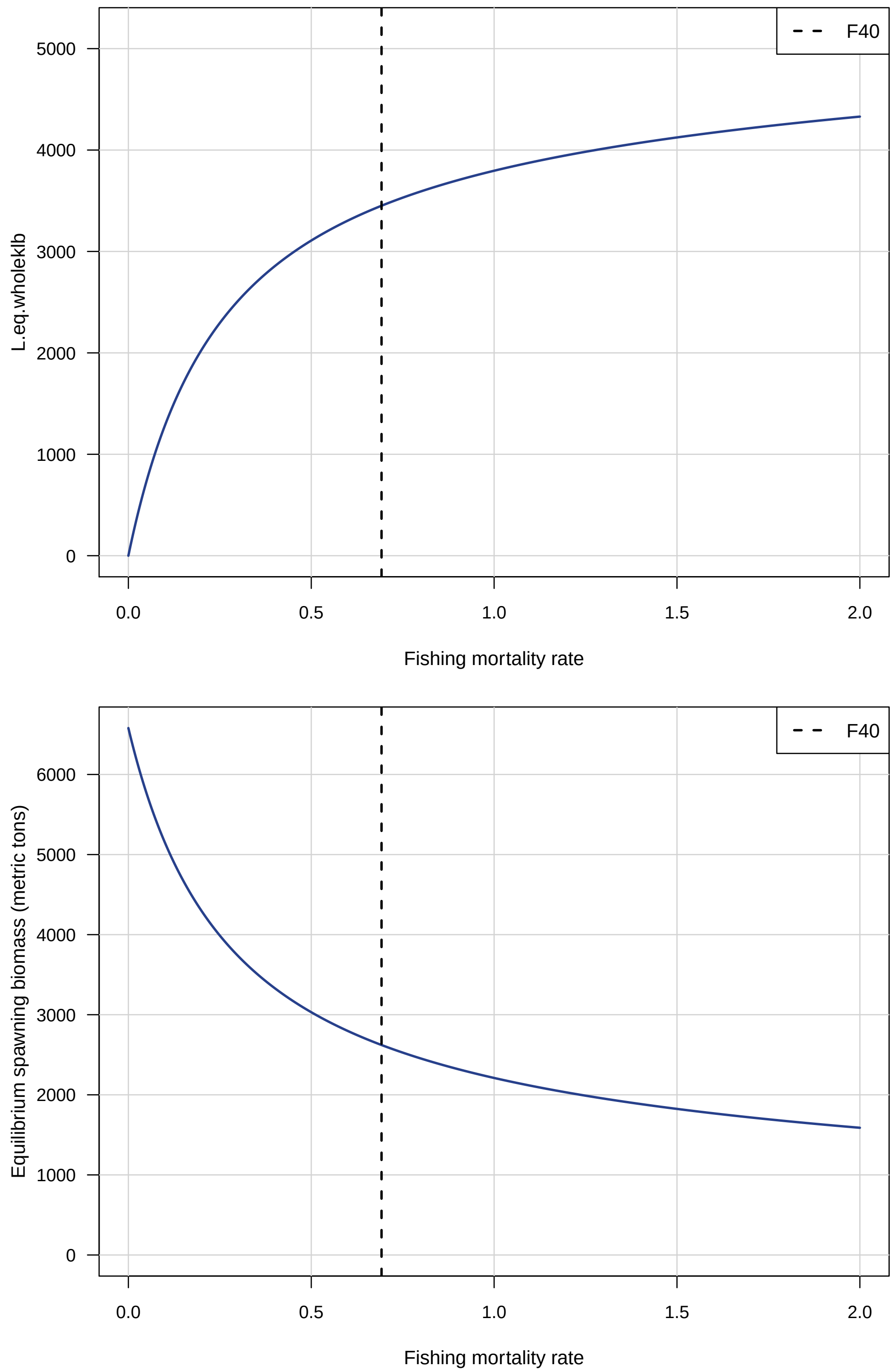


Figure 20. Probability densities of $F_{40\%}$-related benchmarks from the ensemble model of the Beaufort Assessment Model. Vertical lines represent point estimates from the base run.

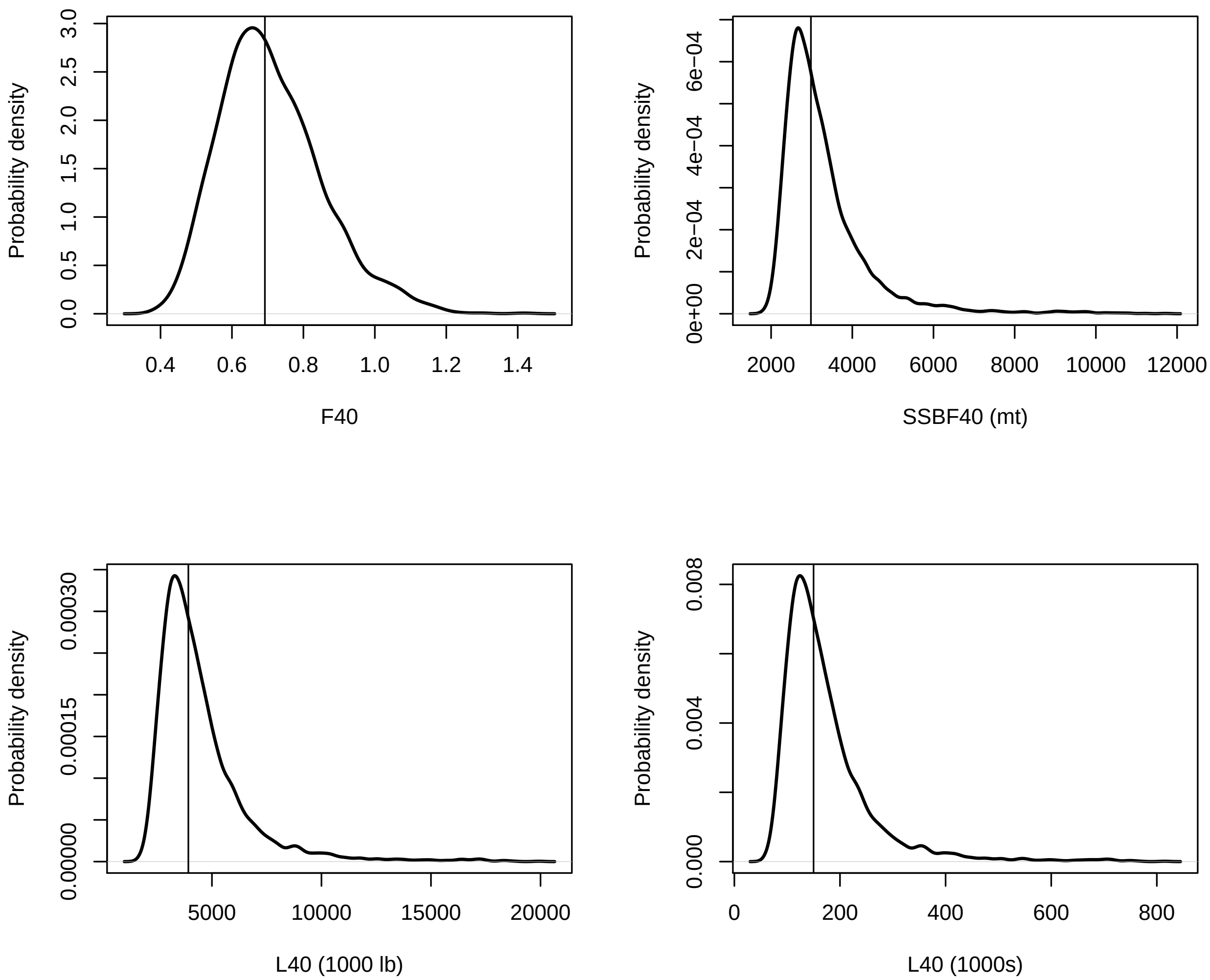


Figure 21. Estimated time series relative to benchmarks. Solid line indicates estimates from base run of the Beaufort Assessment Model; gray error bands indicate 5^{th} *and* 95^{th} *percentiles of the ensemble modeling. Top panel: spawning biomass relative to the minimum stock size threshold (*MSST*). Middle panel: spawning biomass relative to* $\mathrm{SSB_{F40\%}}$. *Bottom panel: F relative to* $F_{40\%}$.

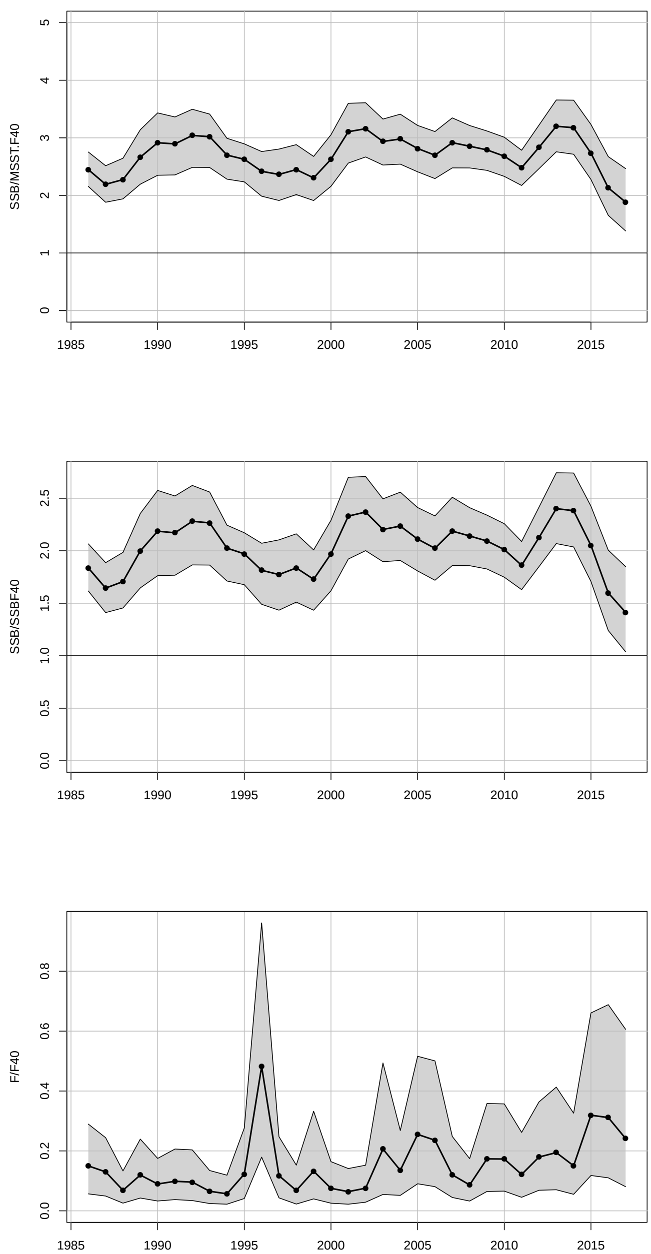


Figure 22. Probability densities of terminal status estimates from ensemble model of the Beaufort Assessment Model. Vertical lines represent point estimates from the base run.

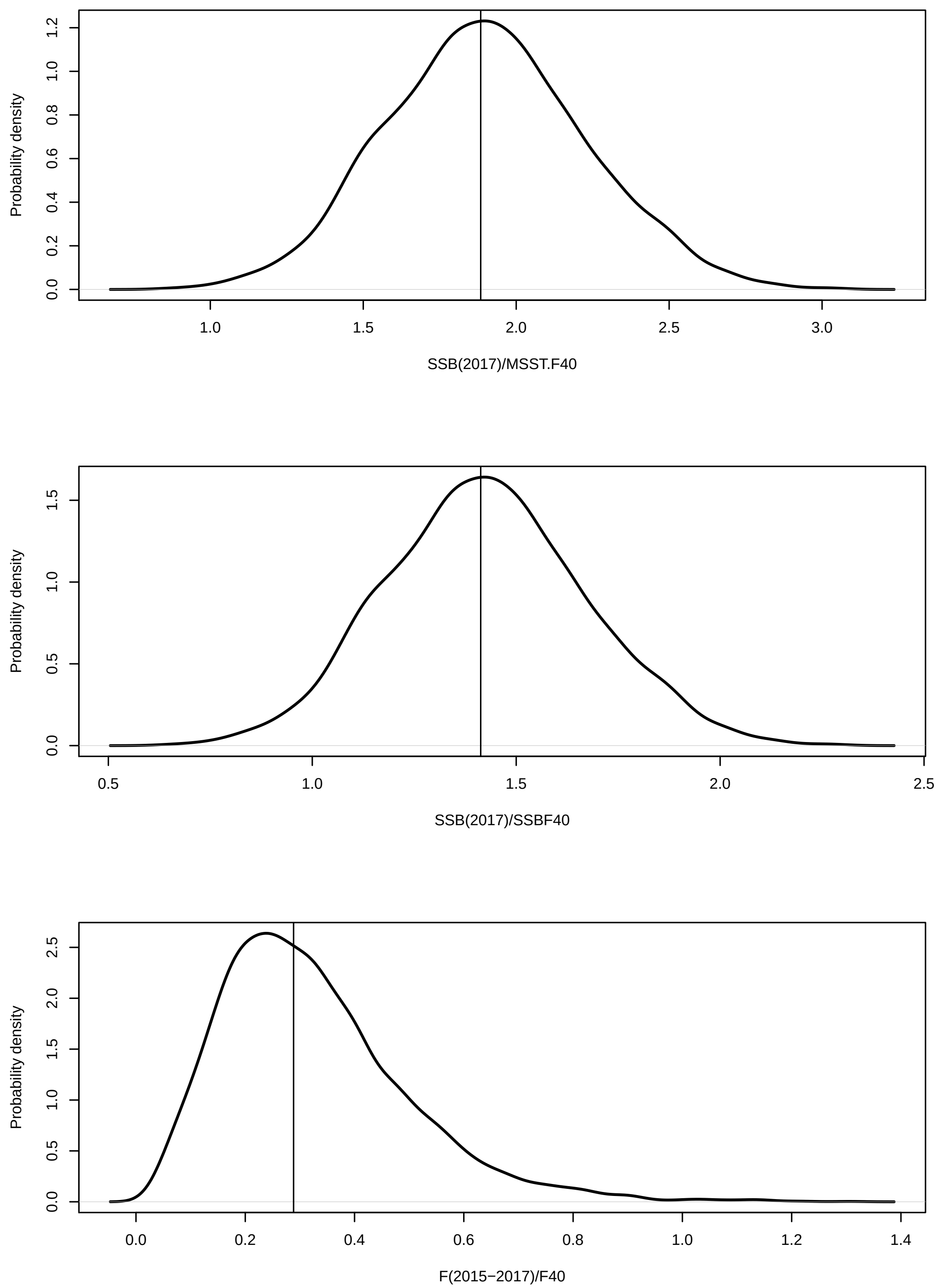


Figure 23. Phase plots of terminal status estimates from the ensemble model of the Beaufort Assessment Model. Top panel is status relative to MSST, *and the bottom panel is status relative to* $\mathrm{SSB_{F40\%}}$. *The intersection of crosshairs indicates estimates from the base run; lengths of crosshairs defined by* 5^{th} *and* 95^{th} *percentiles.*

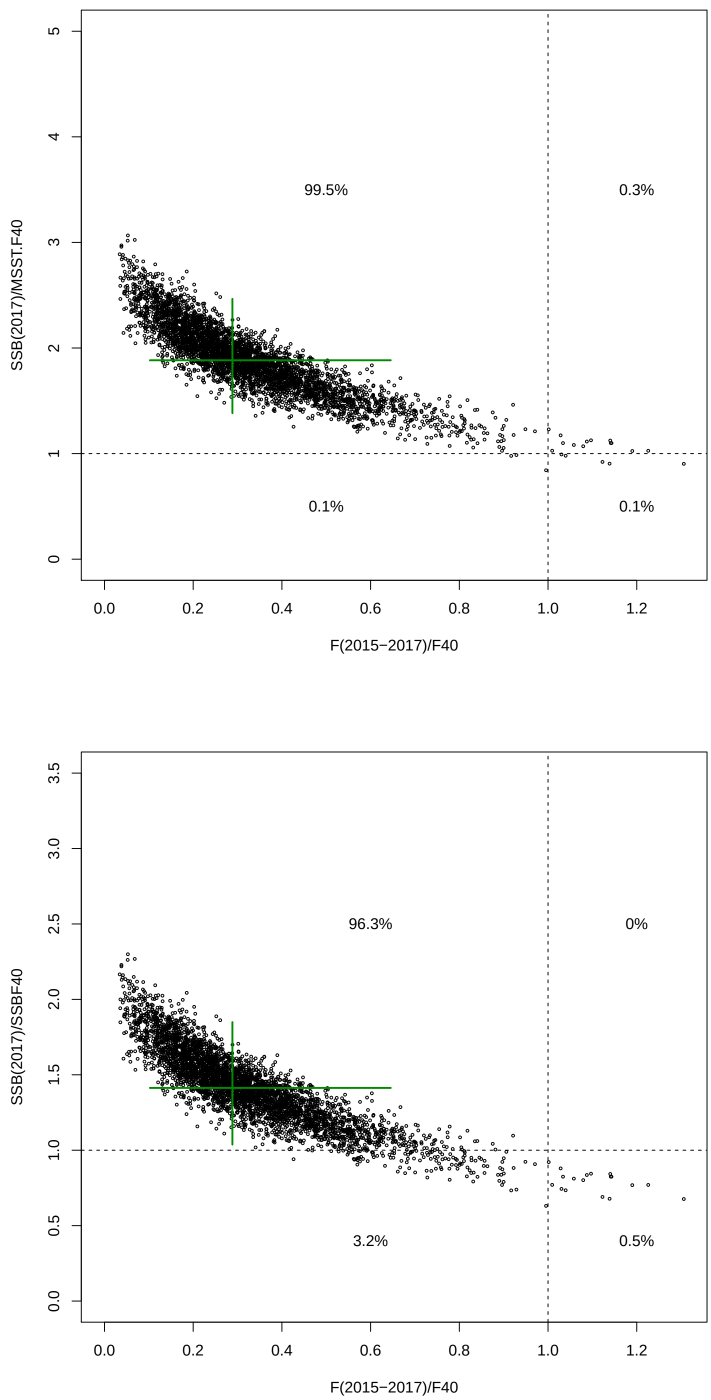


Figure 24. Age structure relative to the equilibrium expected at $L_{\mathrm{F40\%}}$.

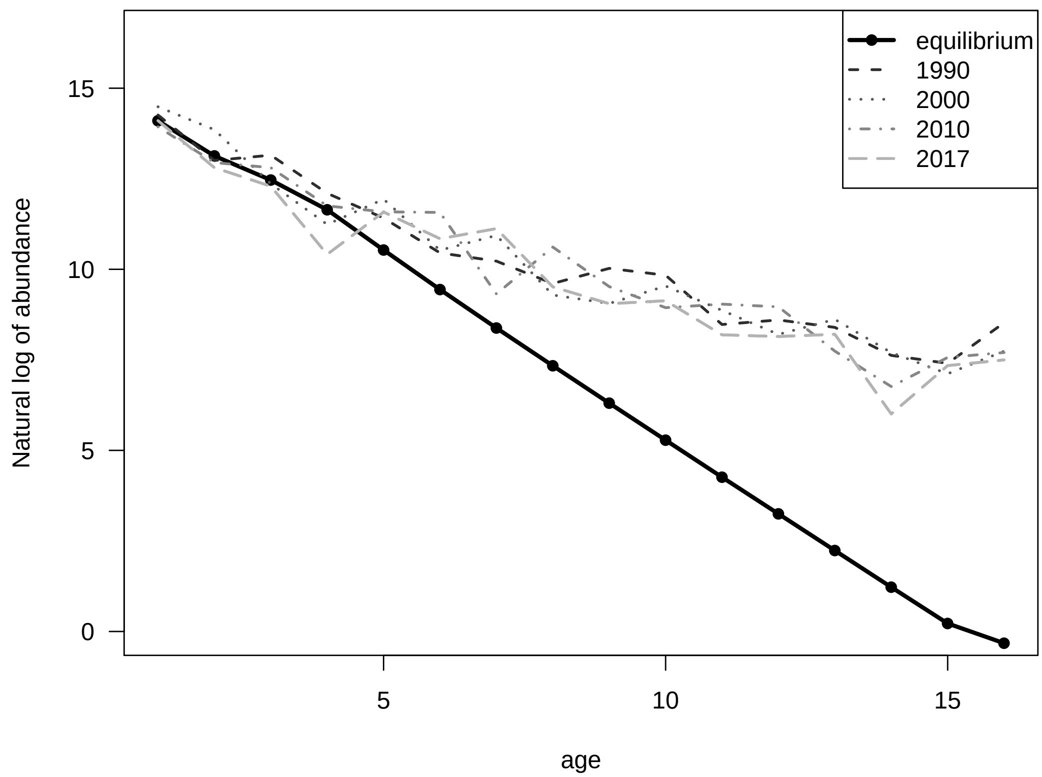


Figure 25. Sensitivity to an earlier start year (sensitivity run S1). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB_{F40\%}}$.

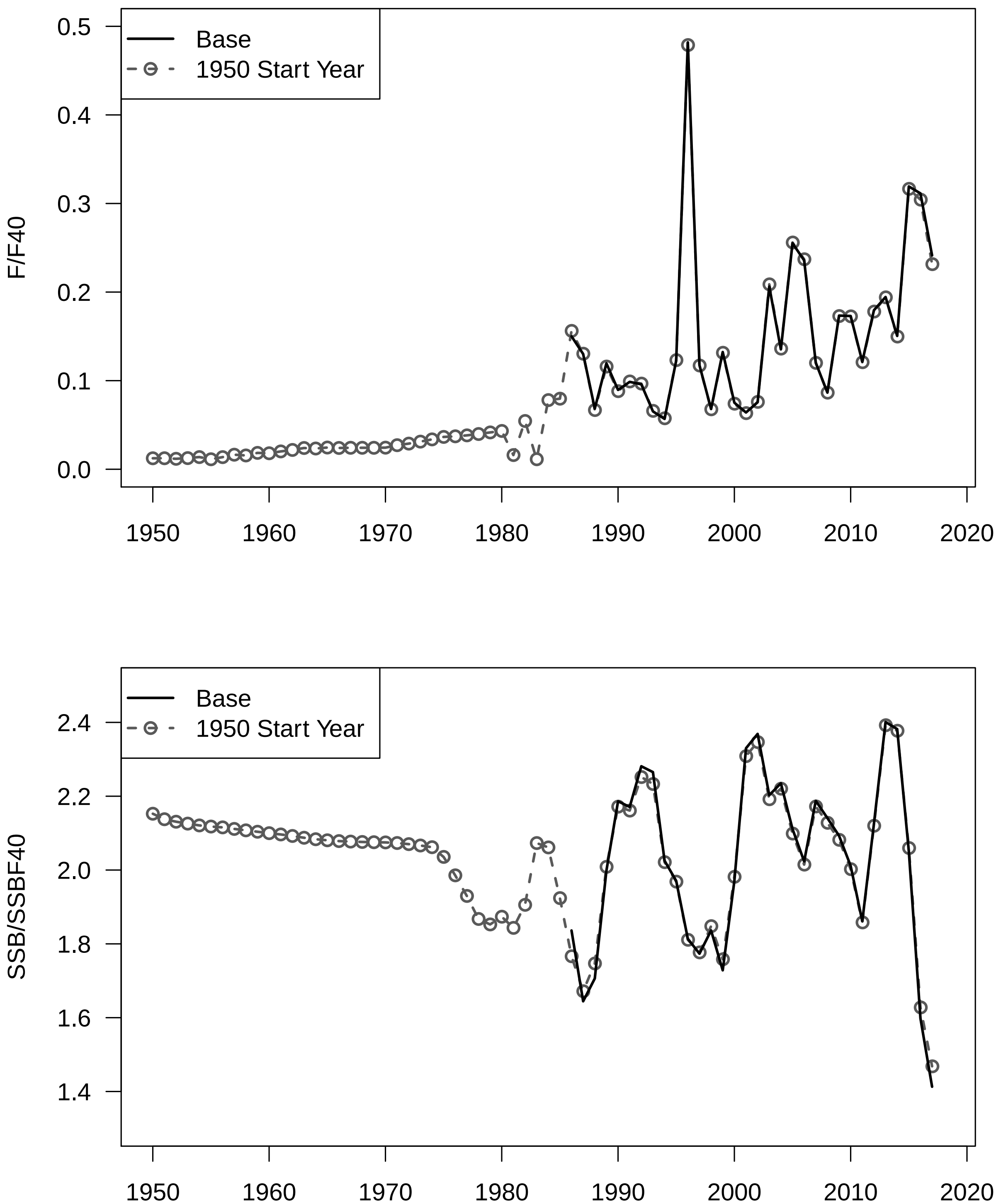
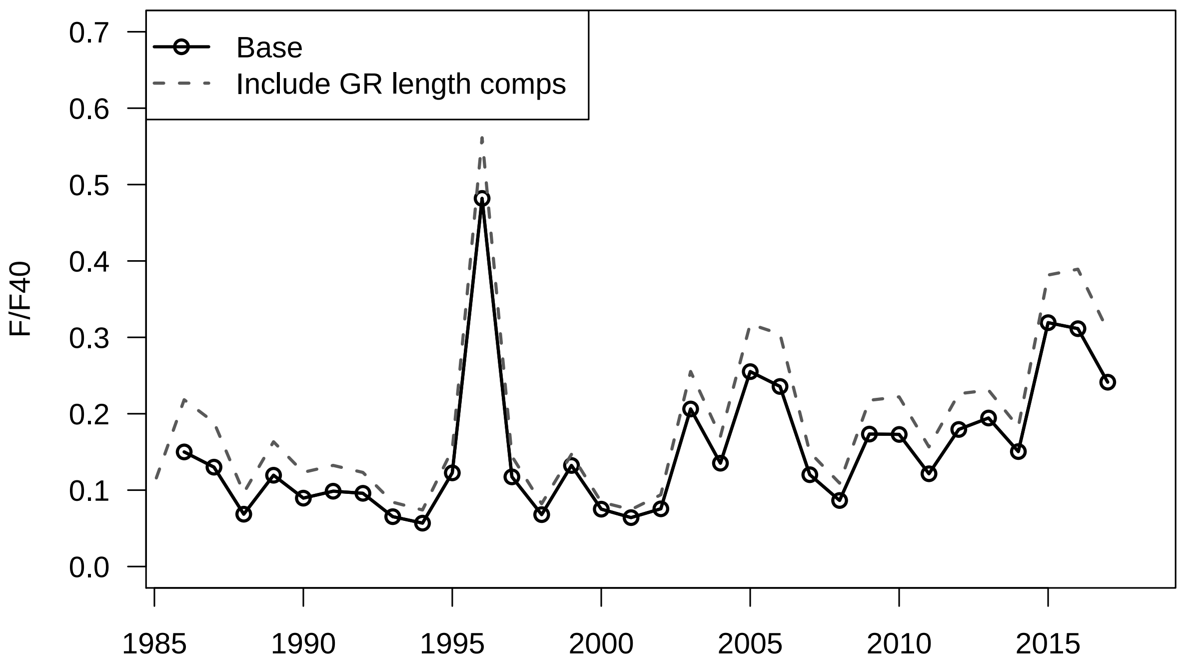


Figure 26. Sensitivity to including recreational length compositions (sensitivity run S2). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.



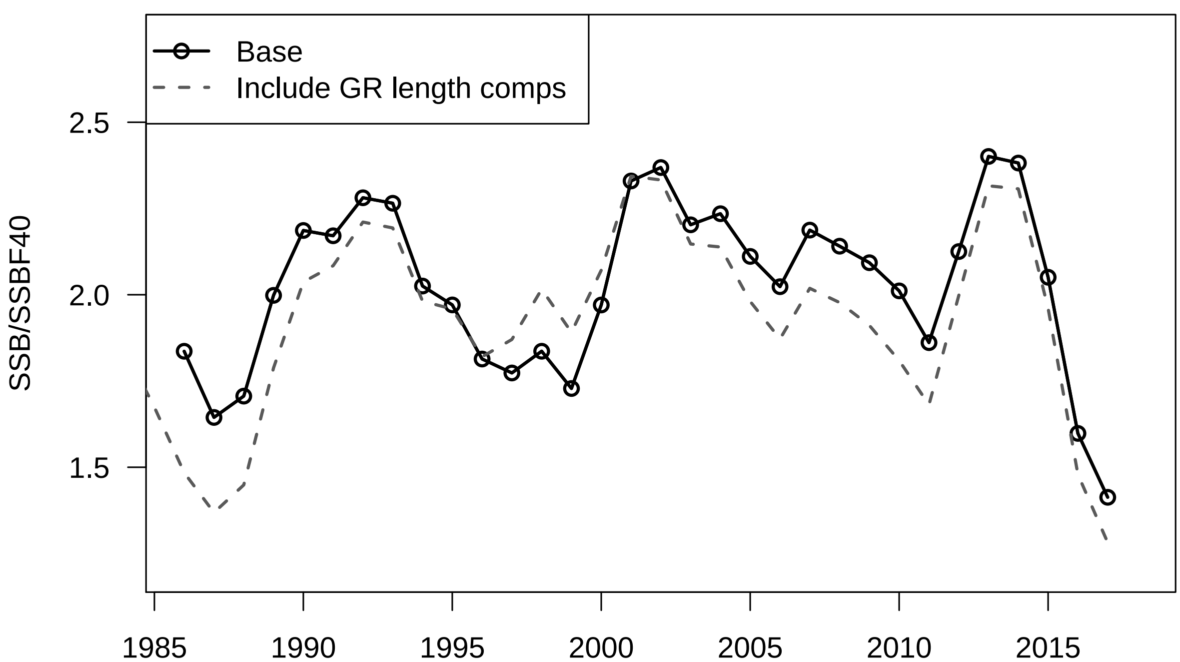
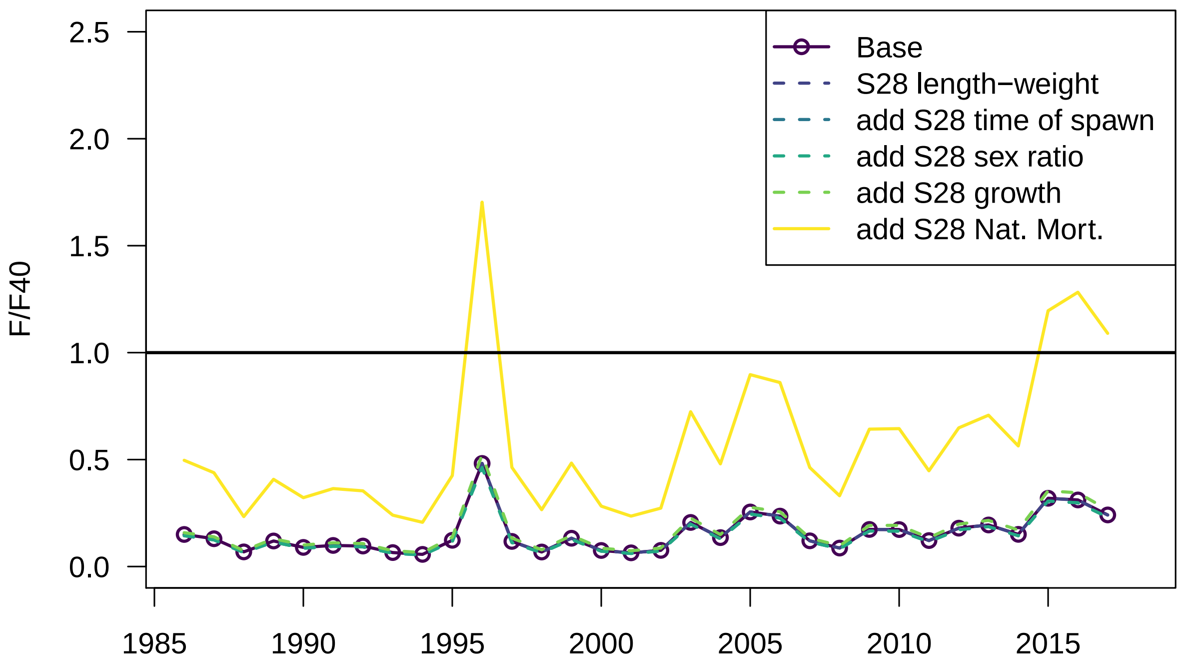


Figure 27. Sensitivity to SEDAR 28 life history values (sensitivity runs S3a-3). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.



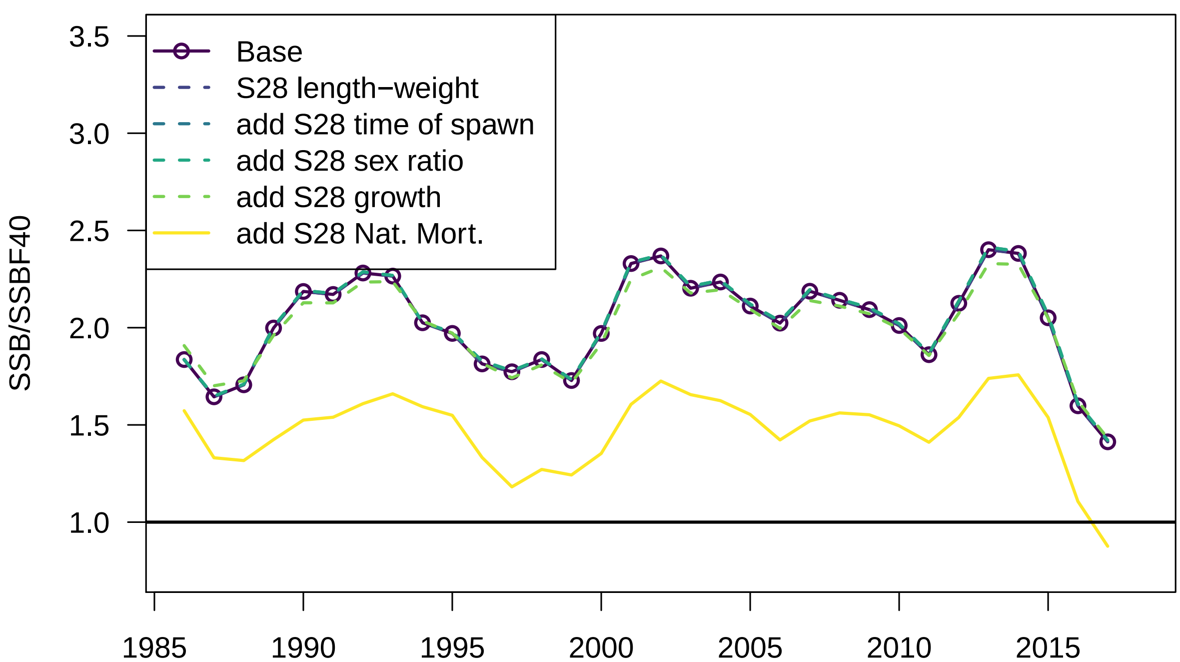


Figure 28. Sensitivity to including the headboat index (sensitivity run S4). Top panel: Ratio of F to $F_{40\%}$*. Bottom panel: Ratio of* SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

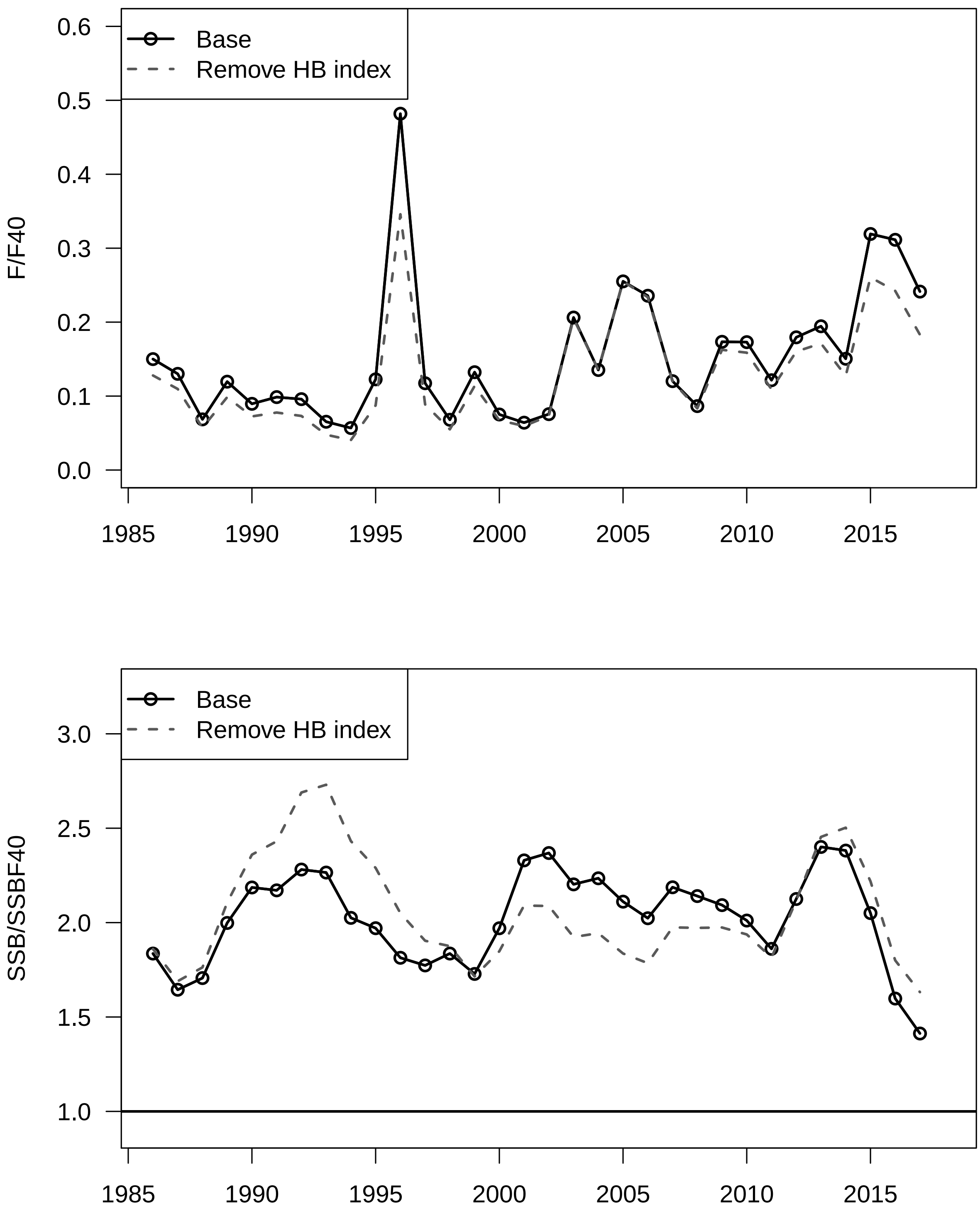


Figure 29. Sensitivity to smoothing the general recreational peak (sensitivity run S5). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

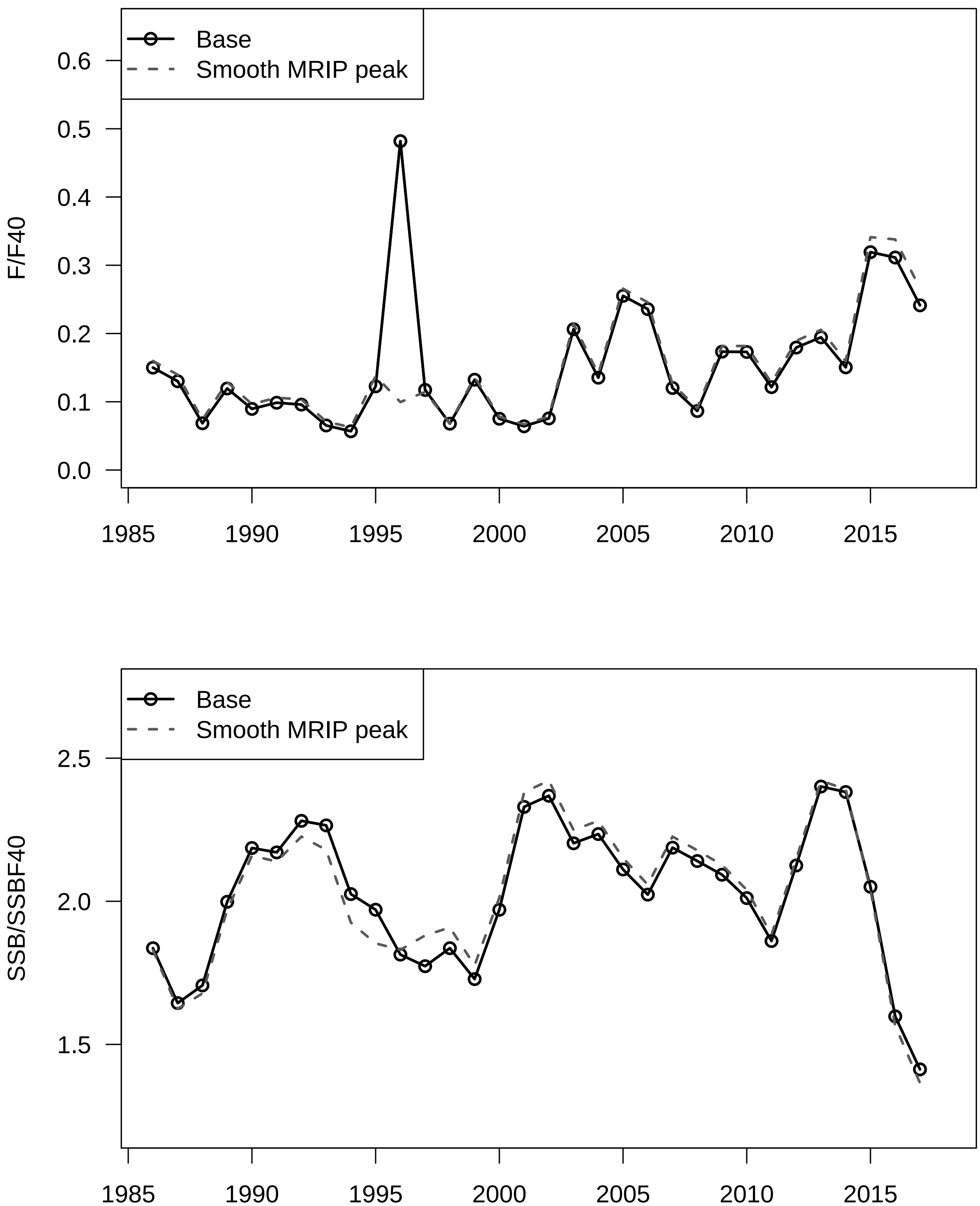


Figure 30. Sensitivity to higher and lower recreational landings (sensitivity runs S6 and S10). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB_{F40\%}}$*. Any lines not visible overlap results of the base run.*

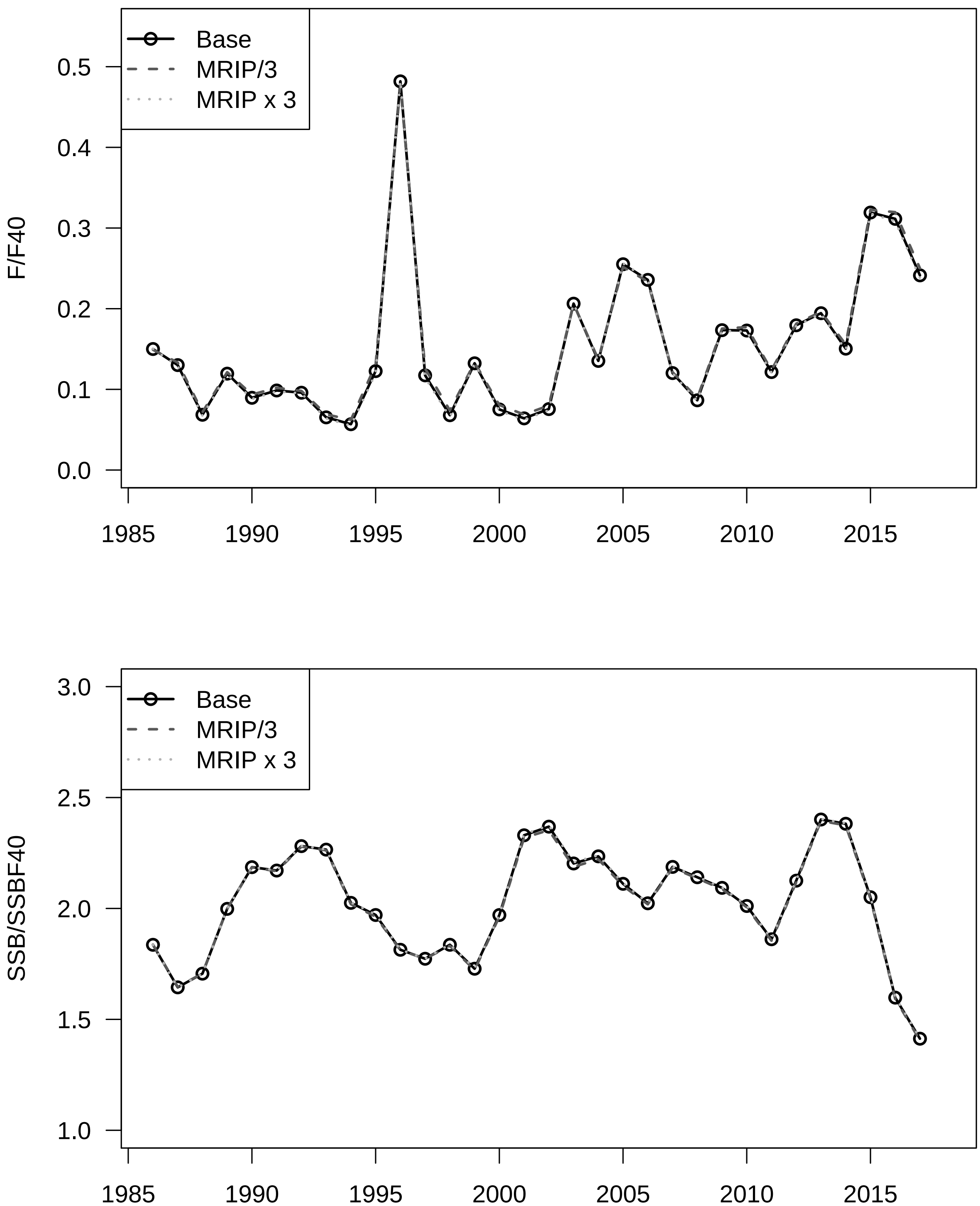


Figure 31. Sensitivity to changes in natural mortality (sensitivity runs S7b–S8b). Top panel: Ratio of F to $F_{40\%}$*. Bottom panel: Ratio of* SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

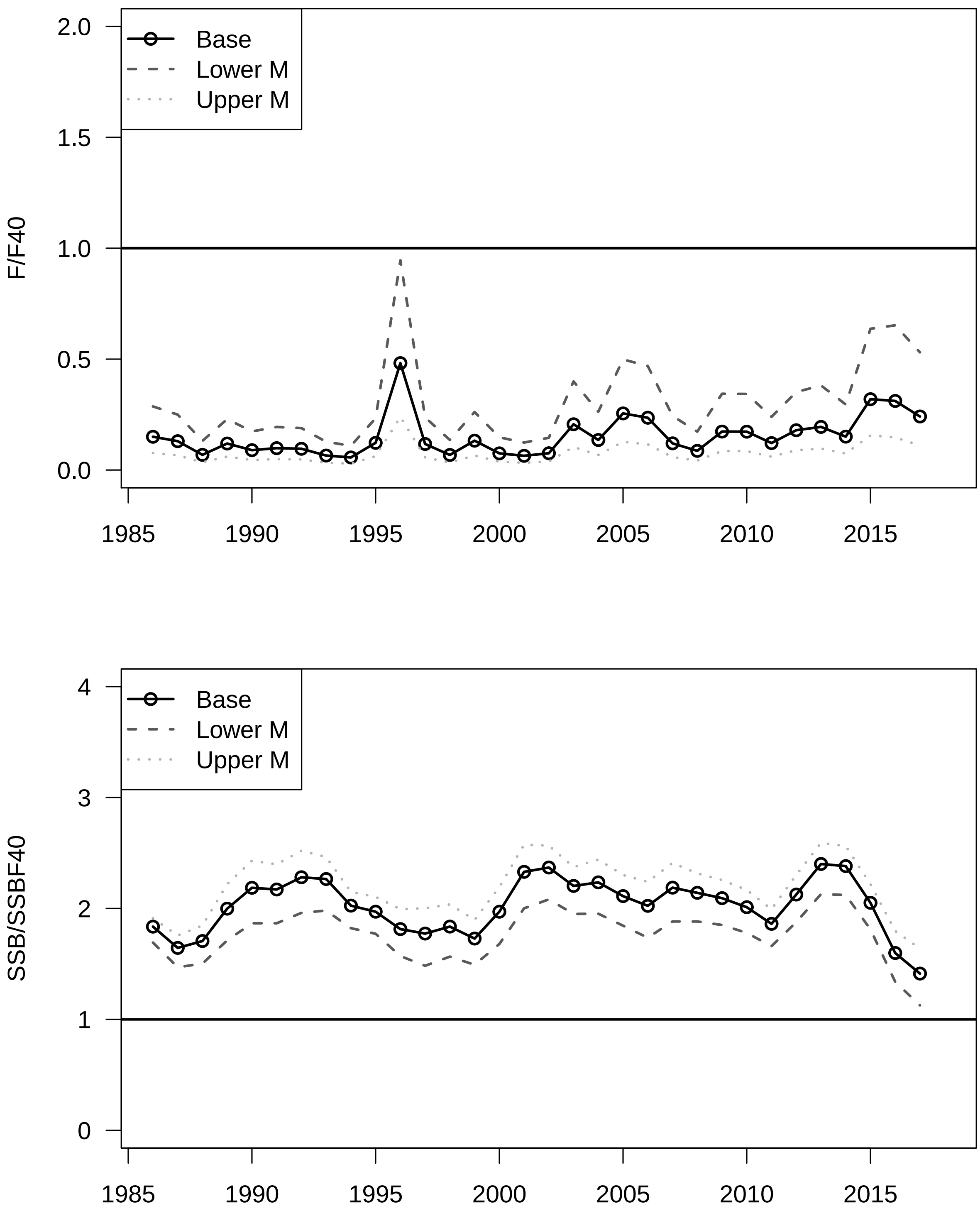


Figure 32. Individual sensitivity comparison of the parameters values provided to the ensemble model. This variation contains the upper and lower bounds for landings, discards, and discard mortality. (sensitivity run S7a–c and S8a–c). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

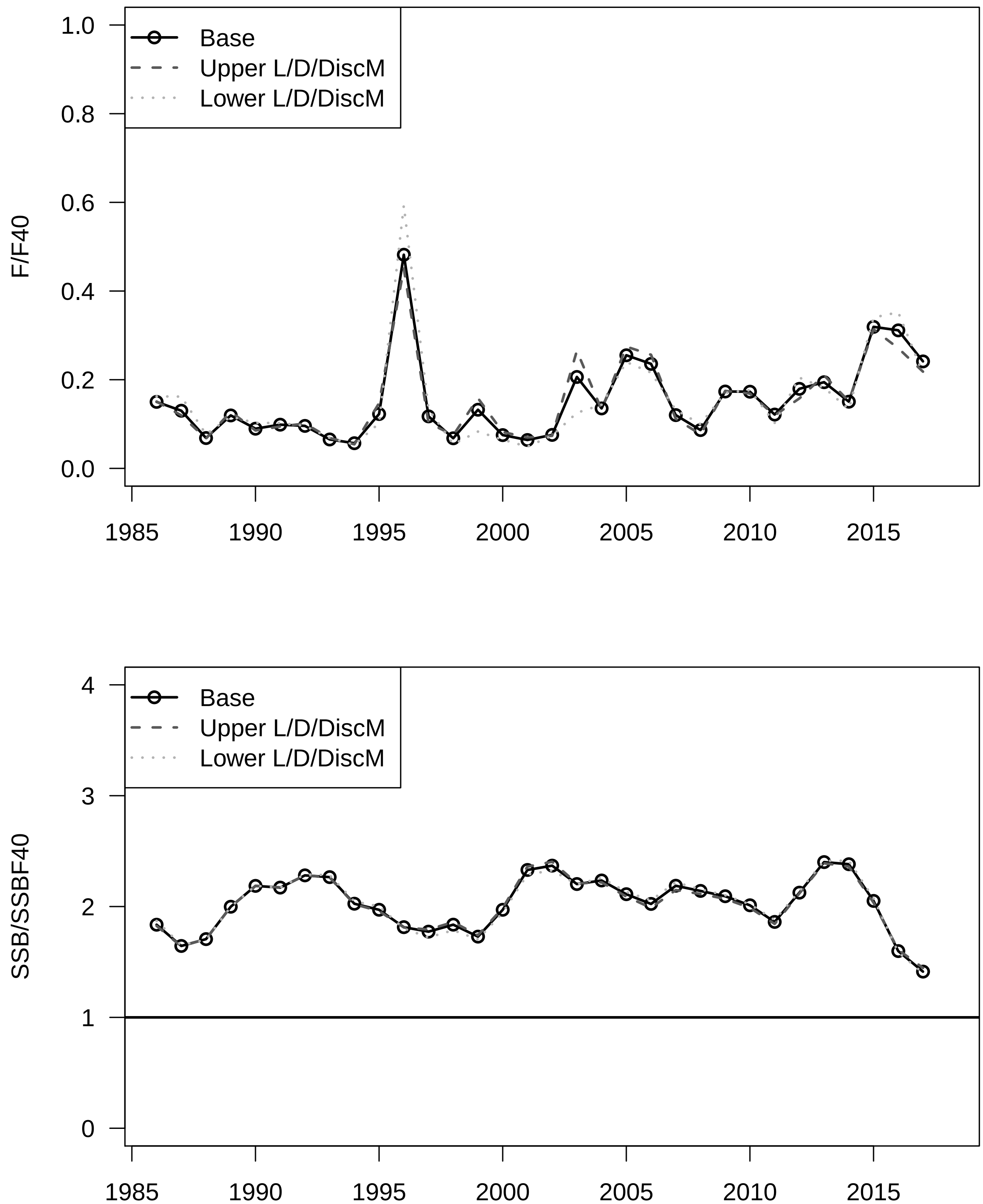


Figure 33. Phase plot of terminal status estimates from sensitivity runs of the Beaufort Assessment Model.

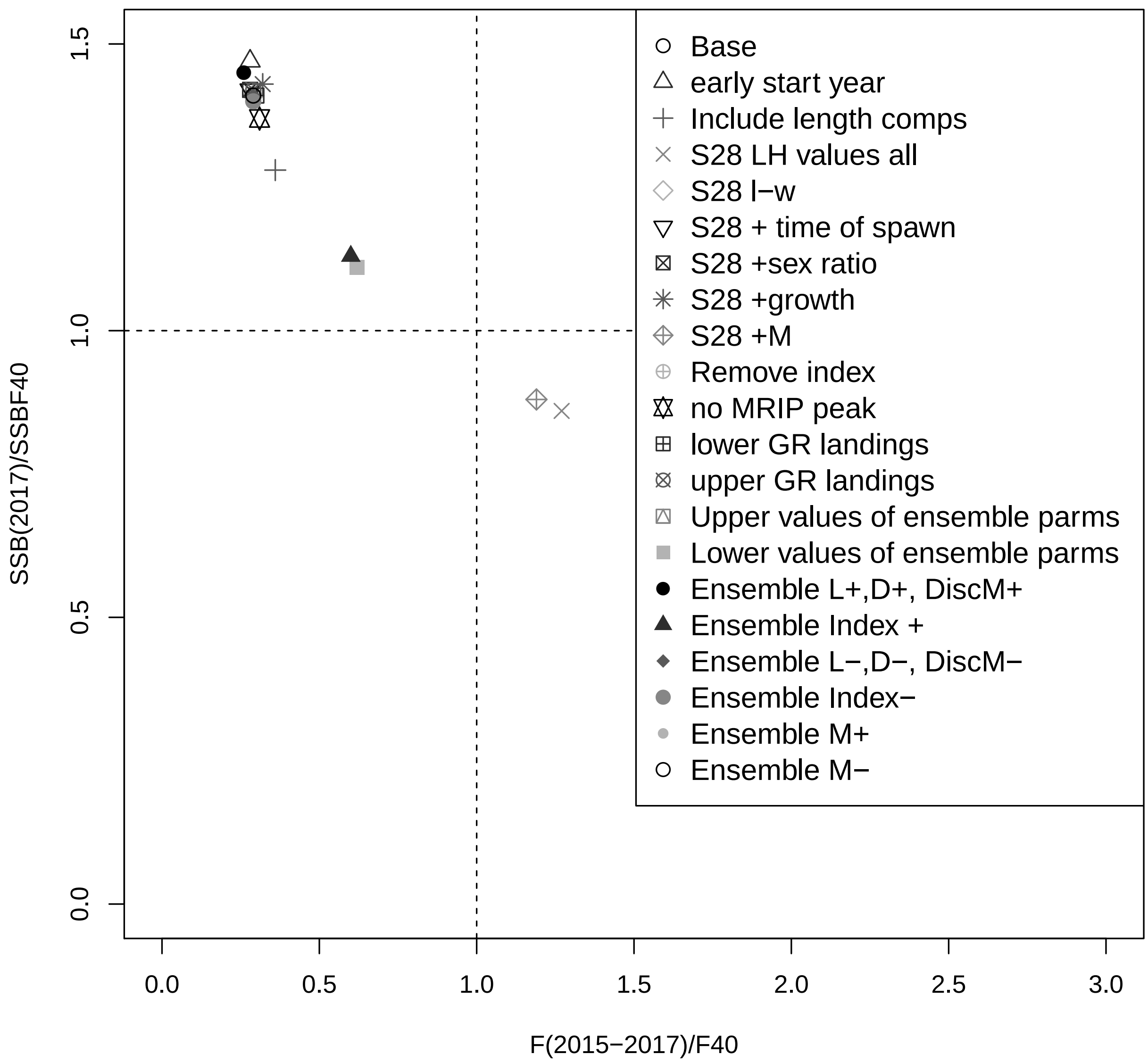


Figure 34. Retrospective analyses. Sensitivity to terminal year of data (sensitivity runs S9a–e). Top panel: Recruits. Bottom panel: Spawning biomass. Closed circles show terminal-year estimates. Imperceptible lines overlap results of the base run.

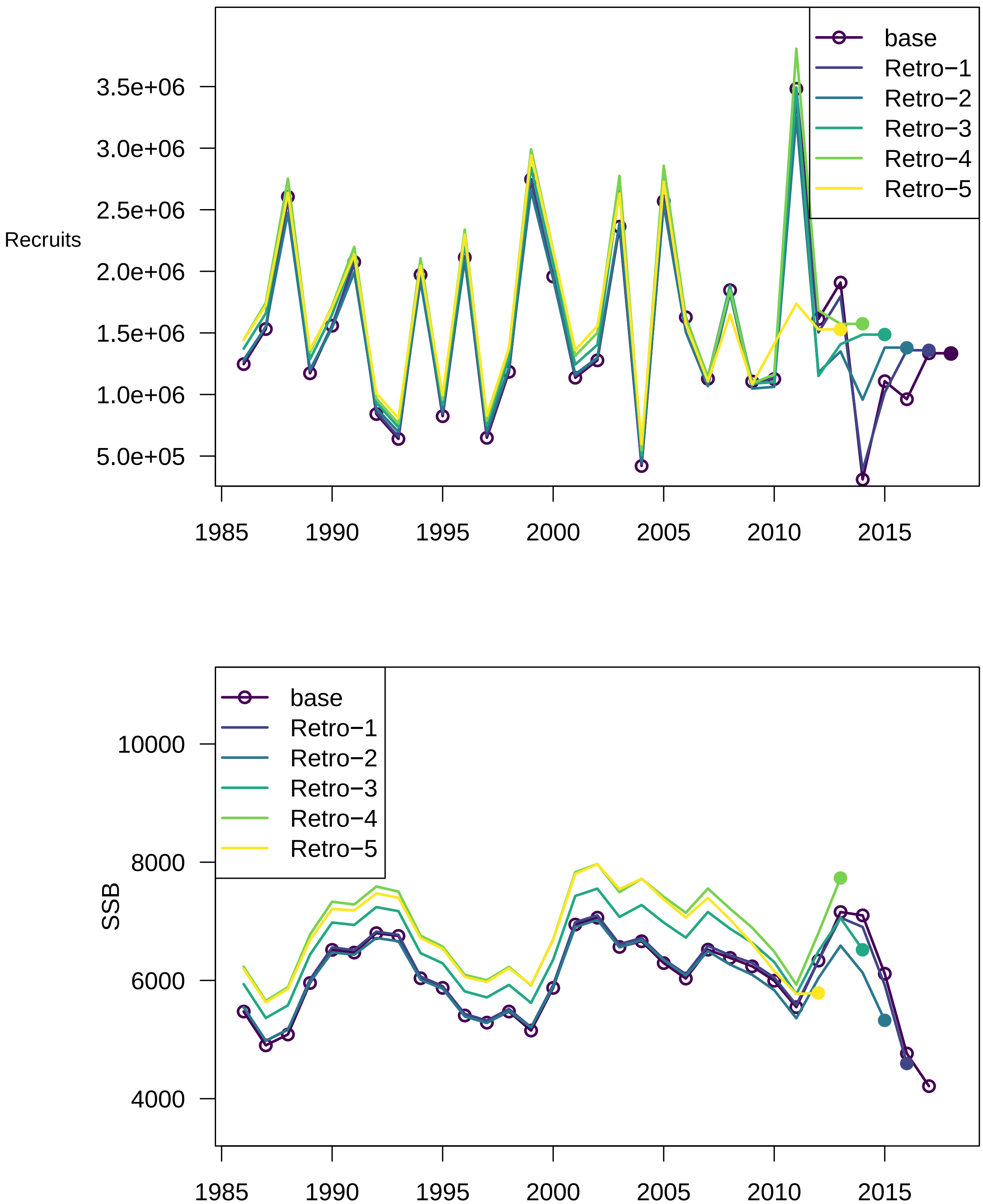
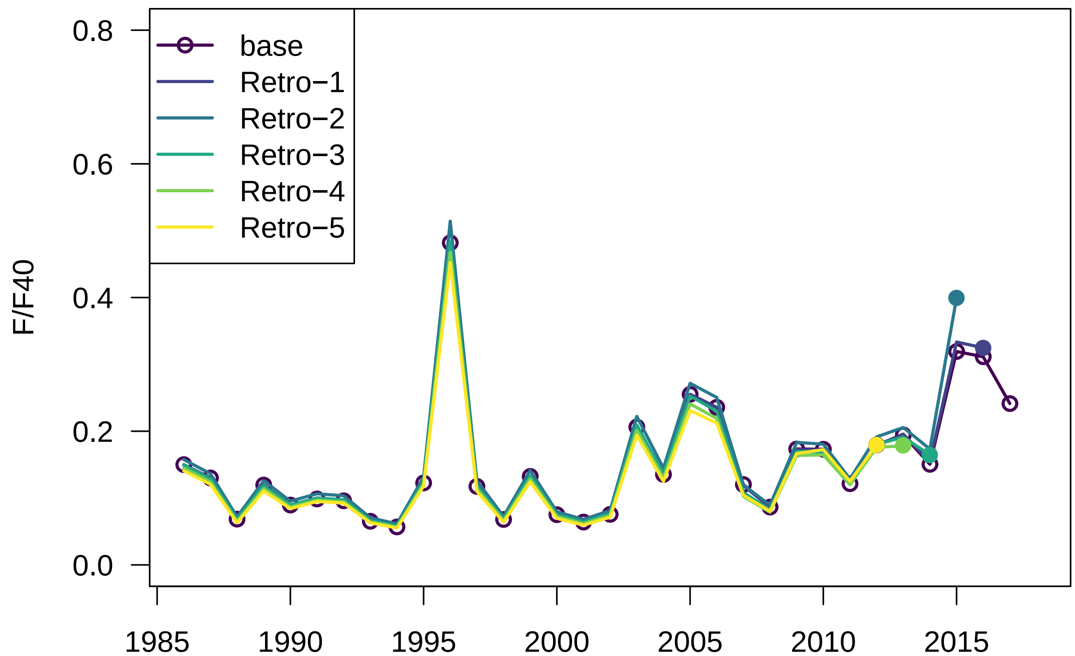


Figure 35. Retrospective status analyses. Sensitivity to terminal year of data (sensitivity runs S9a–e). Top panel: Fishing status. Bottom panel: Biomass status. Closed circles show terminal-year estimates. Imperceptible lines overlap results of the base run.



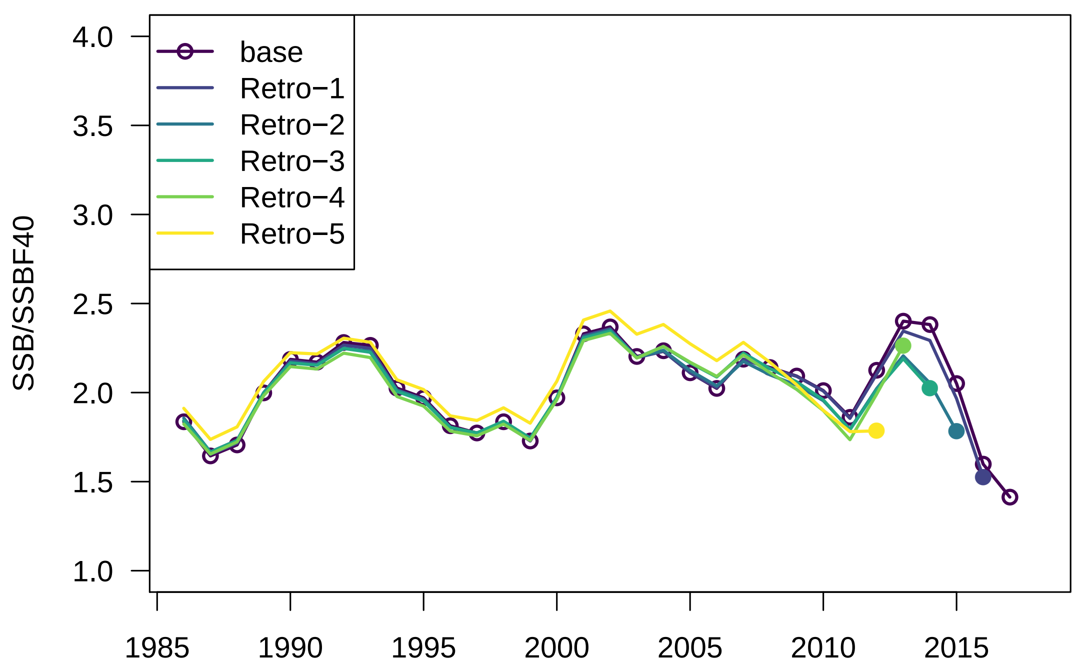


Figure 36. Projection results under scenario 1—fishing mortality rate fixed at F_{current}, with 2020 as the first year of new regulations. The interim years (2018–2019) use a mean of the 2014–2017 landings. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5^{th} and 95^{th} percentiles of replicate projections. Horizontal lines mark $L_{\mathrm{F40\%}}$-related quantities from the base run (solid blue lines) and medians from the MCB runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

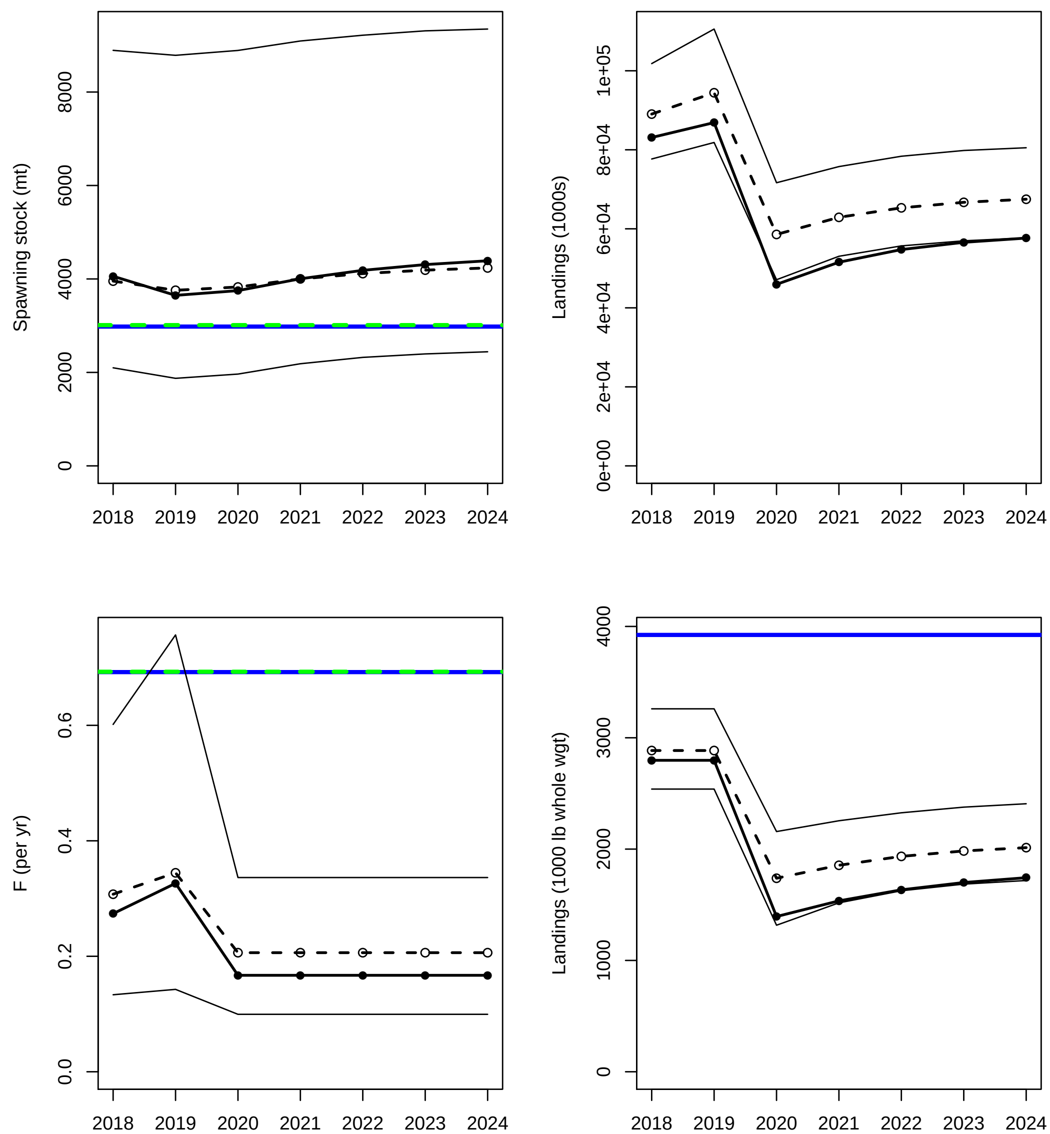


Figure 37. Projection results under scenario 2—fishing mortality rate fixed at $F = F_{40\%}$, with 2020 as the first year of new regulations. The interim years (2018–2019) use a mean of the 2014–2017 landings. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5^{th} and 95^{th} percentiles of replicate projections. Horizontal lines mark $L_{F40\%}$-related quantities from the base run (solid blue lines) and medians from the MCB runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

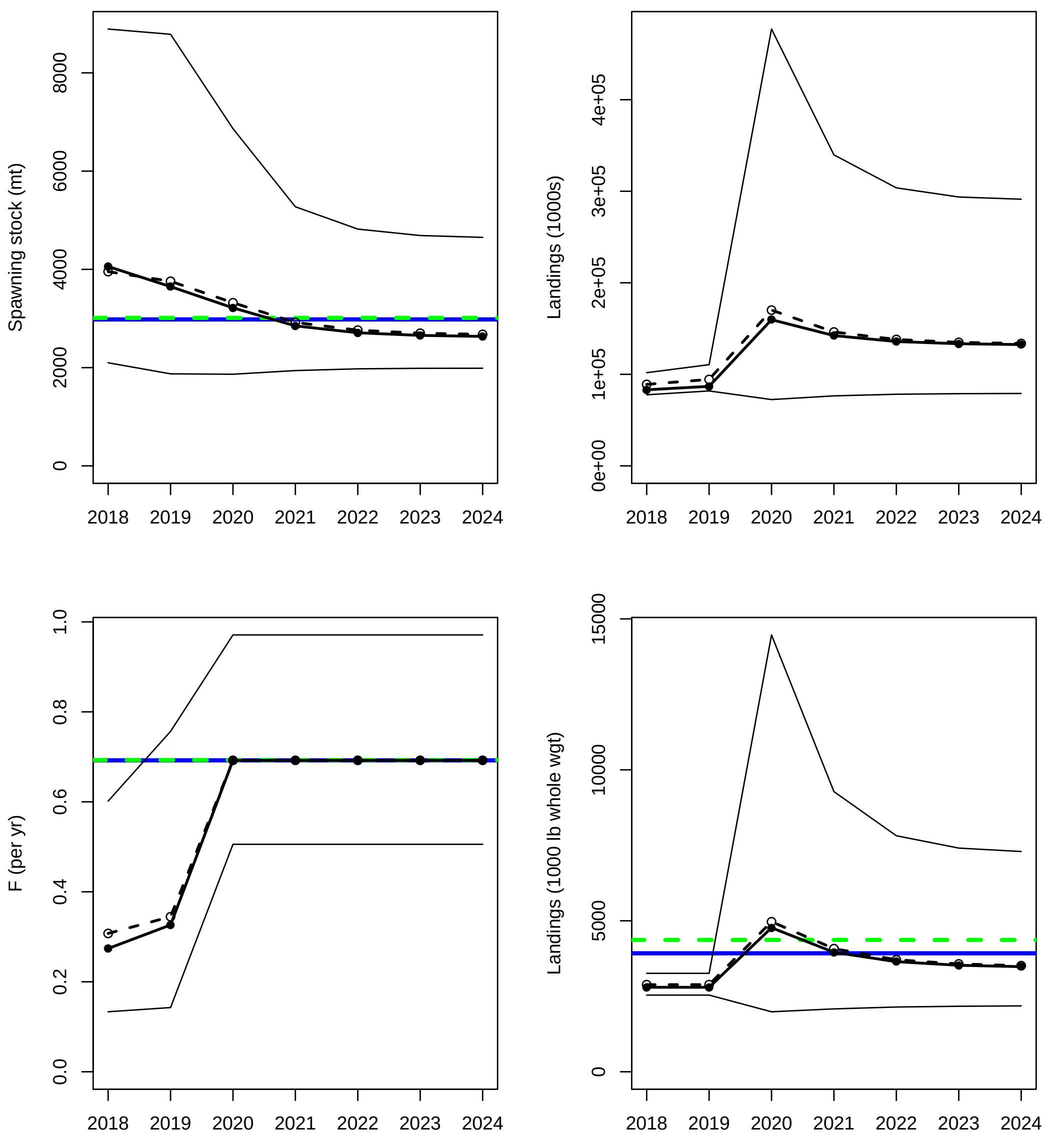


Figure 38. Projection results under scenario 3—fishing mortality rate fixed at $F = 75\%F_{40\%}$, with 2020 as the first year of new regulations. The interim years (2018–2019) use a mean of the 2014–2017 landings. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5^{th} and 95^{th} percentiles of replicate projections. Horizontal lines mark $L_{F40\%}$-related quantities from the base run (solid blue lines) and medians from the MCB runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

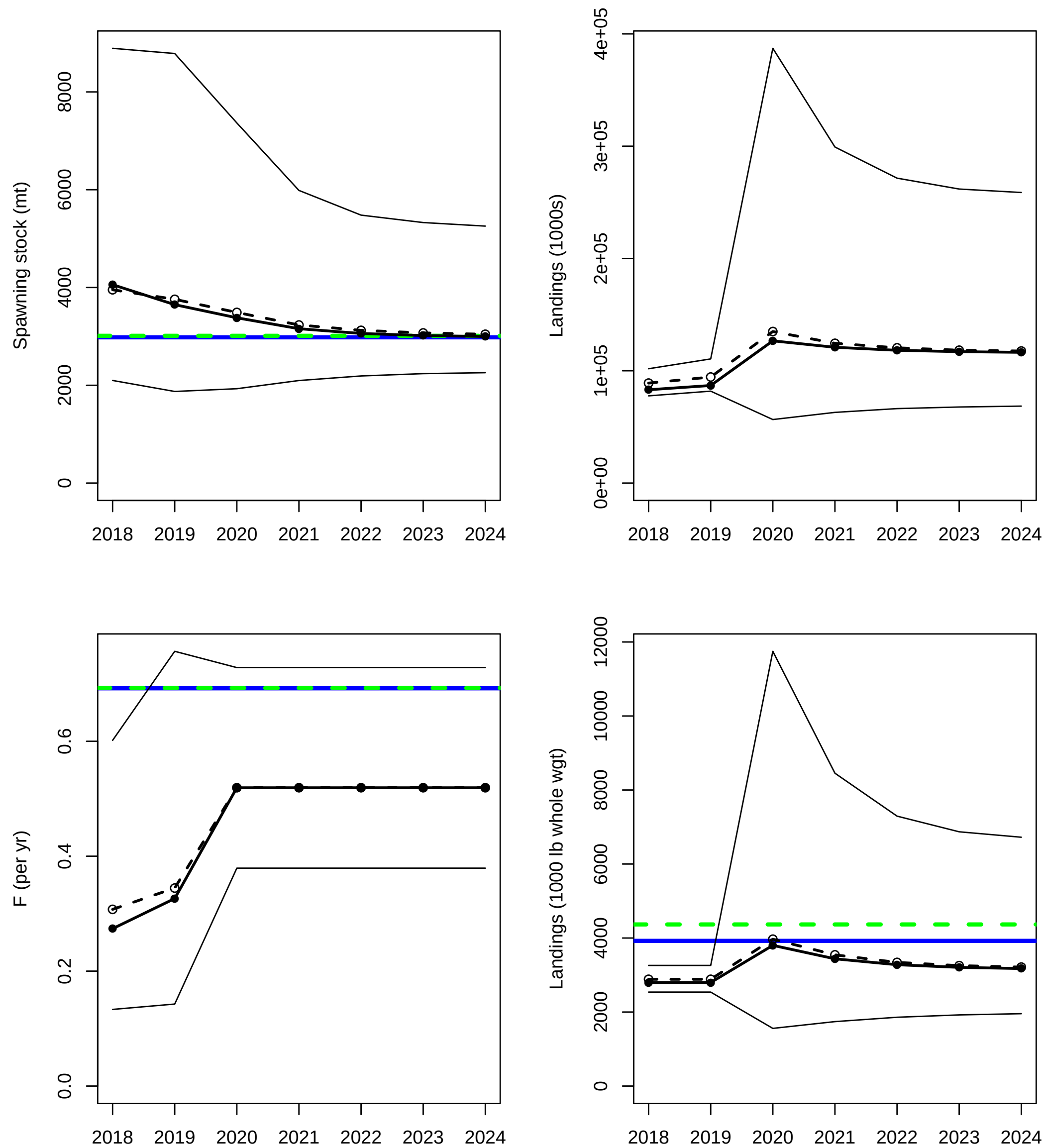


Figure 39. Comparing benchmark time series from current and last assessment. Solid line represents the base run of the current benchmark assessment and the dashed line represents the base run from the last assessment. Top panel: The biomass status time series. Bottom panel: The fishing status time series. The current benchmark assessment used $F_{40\%}$ as an MSY proxy, while the last assessment benchmarks are relative to MSY.

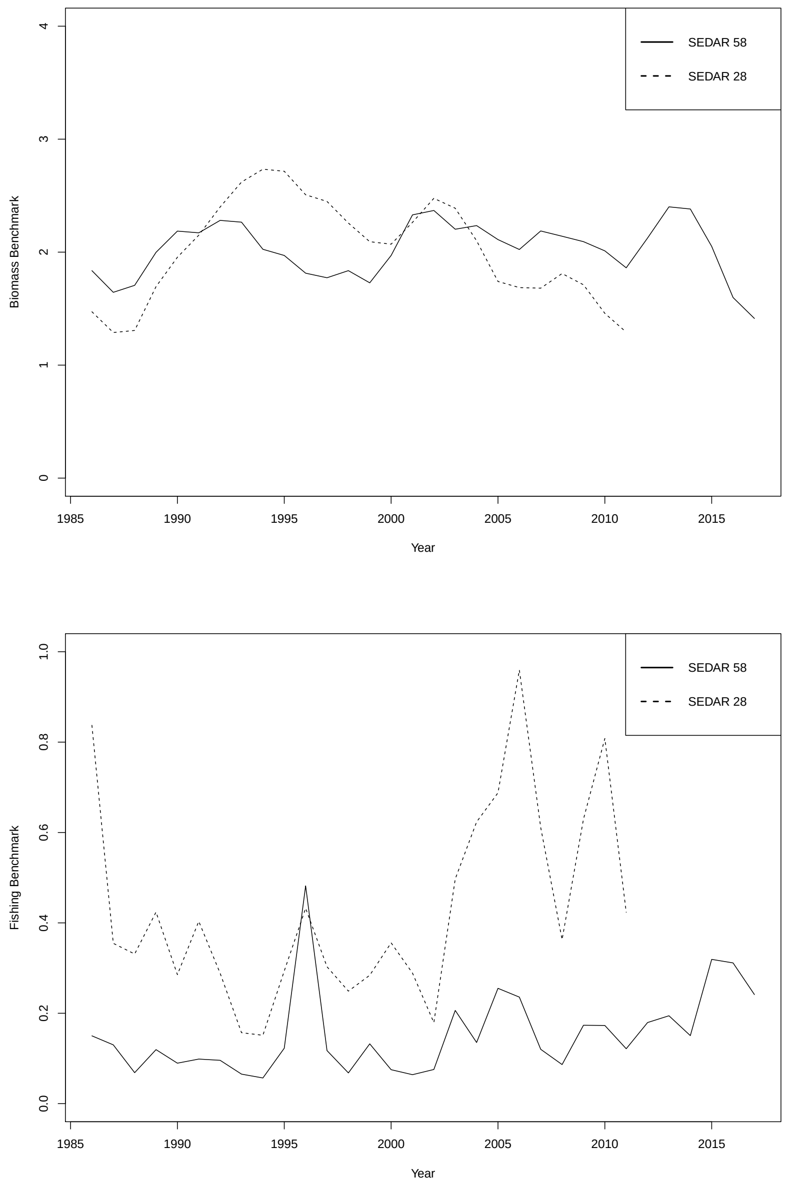
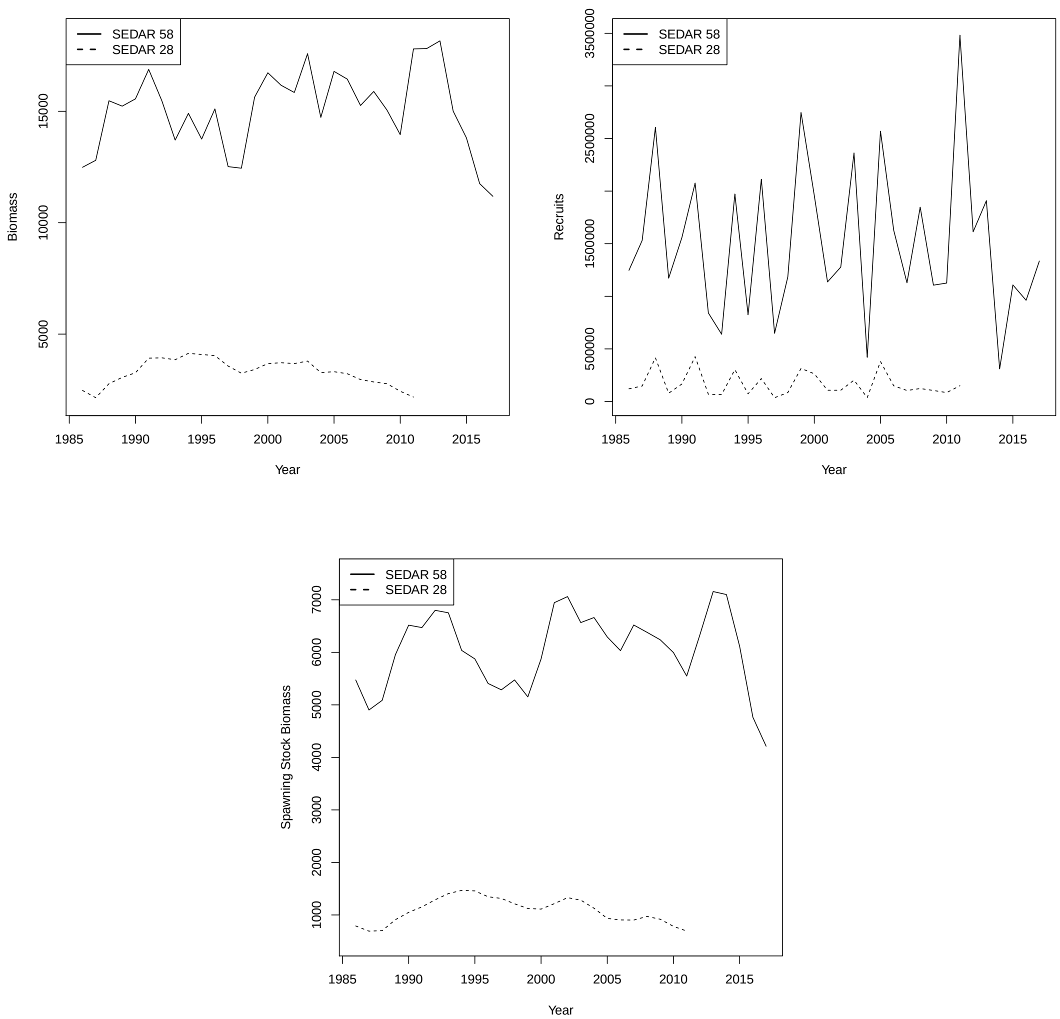


Figure 40. Comparing biological time series from current and last assessment. Solid line represents the base run of the current benchmark assessment and the dashed line represents the base run from the last assessment. Top left panel: The biomass time series. Top right panel: The recruits time series. Bottom panel: The spawning stock biomass time series.



Appendix A Abbreviations and symbols

Table 21. Acronyms and abbreviations used in this report

Symbol	Meaning
ABC	Acceptable Biological Catch
AW	Assessment Workshop (here, for cobia)
ASY	Average Sustainable Yield
B	Total biomass of stock, conventionally on January 1r
BAM	Beaufort Assessment Model (a statistical catch-age formulation)
CPUE	Catch per unit effort; used after adjustment as an index of abundance
CV	Coefficient of variation
DW	Data Workshop (here, for cobia)
F	Instantaneous rate of fishing mortality
F_{MSY}	Fishing mortality rate at which MSY can be attained
FL	State of Florida
GA	State of Georgia
GLM	Generalized linear model
K	Average size of stock when not exploited by man; carrying capacity
kg	Kilogram(s); 1 kg is about 2.2 lb.
klb	Thousand pounds; thousands of pounds
lb	Pound(s); 1 lb is about 0.454 kg
m	Meter(s); 1 m is about 3.28 feet.
M	Instantaneous rate of natural (non-fishing) mortality
MARMAP	Marine Resources Monitoring, Assessment, and Prediction Program, a fishery-independent data collection program of SCDNR
MCB	Monte Carlo/Bootstrap, an approach to quantifying uncertainty in model results
MFMT	Maximum fishing-mortality threshold; a limit reference point used in U.S. fishery management; often based on F_{MSY}
mm	Millimeter(s); 1 inch = 25.4 mm
MRFSS	Marine Recreational Fisheries Statistics Survey, a data-collection program of NMFS, predecessor of MRIP
MRIP	Marine Recreational Information Program, a data-collection program of NMFS, descended from MRFSS
MSST	Minimum stock-size threshold; a limit reference point used in U.S. fishery management. The SAFMC has defined MSST for cobia as $(1-M)\mathrm{SSB}_{\mathrm{MSY}} = 0.7\mathrm{SSB}_{\mathrm{MSY}}$.
MSY	Maximum sustainable yield (per year)
mt	Metric ton(s). One mt is 1000 kg, or about 2205 lb.
N	Number of fish in a stock, conventionally on January 1
NC	State of North Carolina
NMFS	National Marine Fisheries Service, same as "NOAA Fisheries Service"
NOAA	National Oceanic and Atmospheric Administration; parent agency of NMFS
OY	Optimum yield; SFA specifies that OY $\leq$ MSY.
PSE	Proportional standard error
R	Recruitment
SAFMC	South Atlantic Fishery Management Council (also, Council)
SC	State of South Carolina
SCDNR	Department of Natural Resources of SC
SDNR	Standard deviation of normalized residuals
SEDAR	SouthEast Data Assessment and Review process
SEFIS	SouthEast Fishery-Independent Survey
SFA	Sustainable Fisheries Act; the Magnuson–Stevens Act, as amended
SL	Standard length (of a fish)
SPR	Spawning potential ratio
SSB	Spawning stock biomass; mature biomass of males and females
$\mathrm{SSB}_{\mathrm{MSY}}$	Level of SSB at which MSY can be attained
TIP	Trip Interview Program, a fishery-dependent biodata collection program of NMFS
TL	Total length (of a fish), as opposed to FL (fork length) or SL (standard length)
VPA	Virtual population analysis, an age-structured assessment
WW	Whole weight, as opposed to GW (gutted weight)
yr	Year(s)

Appendix B Parameter estimates from the Beaufort Assessment Model

```
# Number of parameters = 125  Objective function value = 13080.1  Maximum gradient component = 7.24114e-005
# len_cv_val_L:
0.246292621485
# log_Nage_dev:
 -0.571328040022 -0.358342787465 -0.548122374181 0.260829557102 0.419324643272 -0.603359869552
 -0.152158192589 -0.0322672153625 -0.480429211345 -0.385742488652 -0.305583223533 -0.238638083007
 -0.184200540903 -0.140679899472 -0.318324840424
# log_R0:
14.1055527809
# rec_sigma:
0.532932145998
# log_rec_dev:
 -0.0694796444876 0.136721164855 0.668450534870 -0.130327997171 0.153934145879 0.440601799111
 -0.462591085839 -0.737264515102 0.389220079552 -0.483226508904 0.458152828414 -0.722379662494
 -0.120131014324 0.721056839717 0.382722529967 -0.161814326411 -0.0451280651772 0.569589501647
 -1.15799561285 0.653739759898 0.197120251717 -0.169403447254 0.323530009507 -0.189306956630
 -0.171359623719 0.957952063844 0.188575919280 0.356668713740 -1.46160033067 -0.187480914497 -0.328546436467
# log_dm_comm_lc:
-1.02103135285
# log_dm_GR_ac:
-1.45865439127
# selpar_A50_comm1:
2.83209618760
# selpar_slope_comm1:
1.92078313134
# selpar_A50_GR1:
4.01560662751
# selpar_slope_GR1:
1.85980822364
# selpar_A50_GR2:
3.05783704693
# selpar_slope_GR2:
3.73727321921
# log_q_HB:
-12.9192930395
# log_avg_F_comm:
-5.92021529102
# log_F_dev_comm:
 -0.487779367253 0.0732171657719 -0.285515029334 -0.216855653613 -0.0579331424753 -0.120272589380
 -0.328147344087 -0.247568173700 -0.0331454907806 0.416825963356 0.437357880978 0.506009214636
 0.0751102092042 -0.390213621618 0.0396750163590 -0.127202260730 -0.151770861108 -0.264850197327
 -0.251406869977 -0.494656744256 -0.255108348645 -0.346319200731 -0.322767162581 0.0263585120872
 0.273144008934 -0.187567046743 0.0449441866246 0.0841282947079 0.311444995691 0.617852841923
 0.898041870000 0.764968944068
# log_avg_F_GR:
-2.41856201273
# log_F_dev_GR:
 0.137868901365 -0.0213906685533 -0.673321602171 -0.100035457446 -0.403893089266 -0.301160539319
 -0.323582992323 -0.725418467052 -0.885387983217 -0.0968190452480 1.30811572509 -0.147693859879
 -0.701238227792 0.00835454649220 -0.592892263235 -0.751750553330 -0.576578726199 0.457674941746
 0.0280803909524 0.675598087090 0.592851358402 -0.0906238656171 -0.430000197215 0.275532200198
 0.266226483886 -0.0841310096070 0.310141199692 0.391202184762 0.121118932610 0.886116606085
 0.852969222745 0.594067766348
# F_init:
0.00505862261875
```

Appendix C Beaufort Assessment Model code for Cobia

```
//##-->><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##
//##  SEDAR 58  SA Cobia, 2019
//##  (Modified from: SEDAR 50  SA BLT assessment model, 2017)
//##  NMFS, Beaufort Lab, Sustainable Fisheries Branch
//##
//##-->><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
DATA_SECTION

!!cout << "Starting Beaufort Assessment Model" << endl;
!!cout << endl;
!!cout << "                BAM!" << endl;
!!cout << endl;

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: set-up section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>

// Starting and ending years of the model (year data starts)
init_int styr;
init_int endyr;

// Starting and ending years to estimate recruitment deviations from S-R curve
init_int styr_rec_dev;
init_int endyr_rec_dev;
// Ending years of 3 phases of constraints on recruitment deviations
// (allows possible heavier constraint (weights defined later) in early and late period, with lighter constraint in the middle)
init_int endyr_rec_phase1;
init_int endyr_rec_phase2;
// ending years of selectivity block 1
//init_int endyr_selex_phase1_comm; // comm
init_int endyr_selex_phase1_GR; // GR
// ending years of selectivity block 2

//number assessment years
number nyrs;
number nyrs_rec;

//this section MUST BE INDENTED!!!
 LOCAL_CALCS
   nyrs=endyr-styr+1.;
   nyrs_rec=endyr_rec_dev-styr_rec_dev+1.;
 END_CALCS

// Number of ages in population model(classes are 1,...,N+; assumes last age is plus group
init_int nages;
// Vector of ages for age bins in population model, last is a plus group
init_vector agebins(1,nages);

//Total number of ages used to match age comps: plus group may differ from popn, first age must not
init_int nages_agec;

//Vector of ages for age bins in age comps
init_vector agebins_agec(1,nages_agec);

// Number length bins used to match length comps and width of bins (mm)
init_int nlenbins;          //used to match data
init_number lenbins_width;  //width of length bins (mm)

// Vector of length bins (mm; midpoint of bin) used to match length comps and bins used to compute plus group
init_vector lenbins(1,nlenbins);

// Max value of F used in spr and msy calculations
init_number max_F_spr_msy;
// Number of iterations in spr calculations
init_int n_iter_spr;
//Total number of iterations for msy calcs
int n_iter_msy;
 LOCAL_CALCS
n_iter_msy=n_iter_spr;
 END_CALCS

// Starting and ending years to compute arithmetic average recruitment for SPR-related values
init_int styr_rec_spr;
init_int endyr_rec_spr;
//Arithmetic average recruitment for SPR-related values
number nyrs_rec_spr;
 LOCAL_CALCS
   nyrs_rec_spr=endyr_rec_spr-styr_rec_spr+1.;
 END_CALCS


// Number of years at end of time series over which to average sector Fs, for weighted selectivities
init_int selpar_n_yrs_wgted;
// Multiplicative bias correction of recruitment (may set to 1.0 for none or negative to compute from recruitment variance)
init_number set_BiasCor;

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: observed data section
```

```
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>

//## comm ######## LANDINGS ########
//## comm ## Starting and ending years of landings (bt50 landings+discards; includes comm and cO (commercial other))
init_int styr_comm_L;
init_int endyr_comm_L;
//## comm ## Observed landings (1000 lbs) and assumed CVs
init_vector obs_comm_L(styr_comm_L,endyr_comm_L);
init_vector comm_L_cv(styr_comm_L,endyr_comm_L);

//## comm ######## LENGTH COMPS ########
//## comm ## Number and vector of years of length compositions to be pooled
init_int nyr_comm_lenc_pool;
init_ivector yrs_comm_lenc_pool(1,nyr_comm_lenc_pool);
//# Annual sample size (nfish) of length comp data; used to weight years for pooling
init_vector nfish_comm_lenc_pool(1,nyr_comm_lenc_pool);
//## comm ## Number and vector of years of length compositions, after pooling
init_int nyr_comm_lenc;
init_ivector yrs_comm_lenc(1,nyr_comm_lenc);
//## comm ## Sample size of length comp data (first row observed n.trips, second row n.fish)
init_vector nsamp_comm_lenc(1,nyr_comm_lenc);
init_vector nfish_comm_lenc(1,nyr_comm_lenc);
//## comm ## Observed length comps (3cm bins; proportions by year)
init_matrix obs_comm_lenc(1,nyr_comm_lenc,1,nlenbins);

//######################################################################################################
//## Recreational Headboat
//######################################################################################################
//## HB ######## INDEX ########
//## HB ## Starting and ending years of CPUE index
init_int styr_HB_cpue;
init_int endyr_HB_cpue;
//## HB ## Observed index CPUE and CVs
init_vector obs_HB_cpue(styr_HB_cpue,endyr_HB_cpue);//Observed CPUE
init_vector HB_cpue_cv(styr_HB_cpue,endyr_HB_cpue); //CV of cpue

//######################################################################################################
//## General Recreational
//######################################################################################################
//## GR ######## LANDINGS ########
//## GR ## Starting and ending years of landings (bt50 landings+discards)
init_int styr_GR_L;
init_int endyr_GR_L;
//## GR ## Observed landings (1000 lbs) and assumed CVs
init_vector obs_GR_L(styr_GR_L,endyr_GR_L);   //vector of observed landings by year
init_vector GR_L_cv(styr_GR_L,endyr_GR_L);    //vector of CV of landings by year

//  Age compositions
init_int nyr_GR_agec;
init_ivector yrs_GR_agec(1,nyr_GR_agec);
init_vector nsamp_GR_agec(1,nyr_GR_agec);
init_vector nfish_GR_agec(1,nyr_GR_agec);
init_matrix obs_GR_agec(1,nyr_GR_agec,1,nages_agec);

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: parameter section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//######################################################################################################
//## Parameter values and initial guesses
//######################################################################################################
//######## Population ########
init_vector set_Linf(1,7); // VonBert Linf (mmFL)
init_vector set_K(1,7); // VonBert K
init_vector set_t0(1,7); // VonBert t0
init_vector set_len_cv(1,7); // CV of length at age
//########Landings growth curve
init_vector set_Linf_L(1,7);            // VonBert Linf (mmFL)
init_vector set_K_L(1,7);               // VonBert K
init_vector set_t0_L(1,7);              // VonBert t0
init_vector set_len_cv_L(1,7);          // CV of length at age
//########Female only growth curve (popl and landings)
init_vector set_Linf_F(1,7);            // VonBert Linf (mmFL)
init_vector set_K_F(1,7);               // VonBert K
init_vector set_t0_F(1,7);              // VonBert t0
init_vector set_len_cv_F(1,7);          // CV of length at age
//######## Constant M ########
init_vector set_M_constant(1,7); // constant M (used only to compute MSST=(1-M)SSBmsy)
//######## StockRecruitment ########
init_vector set_steep(1,7);          // SR steepness parameter
init_vector set_log_R0(1,7);         // SR log_R0 parameter
init_vector set_R_autocorr(1,7);     // SR recruitment autocorrelation (lag 1)
init_vector set_rec_sigma(1,7);      // standard deviation of recruitment in log space
//######## DirichletMultinomial ########
init_vector set_log_dm_comm_lc(1,7);   // Dirichlet-multinomial overdispersion parameter (log-space): comm length comps
init_vector set_log_dm_GR_ac(1,7);    //Dirichlet-multinomial overdispersion parameter
//######## Selectivity ########
init_vector set_selpar_A50_comm1(1,7); // comm age at 0.5 selectivity
init_vector set_selpar_slope_comm1(1,7); // comm slope of ascending limb
init_vector set_selpar_A50_GR1(1,7);  // GR age at 0.5 selectivity
init_vector set_selpar_slope_GR1(1,7); // GR slope of ascending limb
init_vector set_selpar_A50_GR2(1,7); // GR age at 0.5 selectivity (block 2)
init_vector set_selpar_slope_GR2(1,7); // GR slope of ascending limb (block 2)
//######## IndexCatchability ########
init_vector set_log_q_HB(1,7);       // HB CPUE (log q)
//######## FishingMortality ########
```

```
init_vector set_F_init(1,7);   // initial F (not log space)
init_vector set_log_avg_F_comm(1,7); // comm log mean F
//init_vector set_log_avg_F_cL(1,7); // cL log mean F
init_vector set_log_avg_F_GR(1,7); // GR log mean F

//##########################################################################################################
//## Dev vectors
//##########################################################################################################
init_vector set_log_F_dev_comm(1,3);  // comm F devs
//init_vector set_log_F_dev_cL(1,3); // cL F devs
init_vector set_log_F_dev_GR(1,3); // GR F devs
init_vector set_log_RWq_dev(1,3); // Random walk on q
init_vector set_log_rec_dev(1,3); // recruitment devs
init_vector set_log_Nage_dev(1,3); // Nage devs

//######## F dev initial guesses ########
//## comm (1962 - 2015)
init_vector set_log_F_dev_comm_vals(styr_comm_L,endyr_comm_L);
// ## GR (1973 - 2015)
init_vector set_log_F_dev_GR_vals(styr_GR_L,endyr_GR_L);

//######## Rec dev initial guesses (1958 - 2015) ########
init_vector set_log_rec_dev_vals(styr_rec_dev,endyr_rec_dev);

//######## initial N age devs, all ages but the first one (2 to 15) ########
init_vector set_log_Nage_dev_vals(2,nages);

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: likelihood weights section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
init_number set_w_L; // landings

init_number set_w_I_HB;         // HB index
init_number set_w_lc_comm;        // comm length comps
init_number set_w_ac_GR; //weight for the Recreational age comps
init_number set_w_Nage_init;    // log N.age.dev residuals (initial abundance)for fitting initial abundance at age (excluding first age)
init_number set_w_rec;          // SR residuals (for fitting SR curve)
init_number set_w_rec_early;    // constraint on early recruitment deviations
init_number set_w_rec_end;      // constraint on ending recruitment deviations
init_number set_w_fullF;        // penalty if F exceeds 3.0 (reduced by factor of 10 each phase, not applied in final phase of optimization) full F summed over fisheries
init_number set_w_Ftune;        // weight on tuning F (penalty not applied in final phase of optimization)

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: miscellaneous stuff section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>

// Length-weight parameter a (W=aL^b); mm to kg
init_number wgtpar_a;
// Length-weight parameter b (W=aL^b); mm to kg
init_number wgtpar_b;

// vector of maturity-at-age for females (ages 1 - 15 )
init_vector maturity_f_obs(1,nages);
// Proportion female by age (assumed 50:50 sex ratio)
init_vector prop_f_obs(1,nages);
// time of year (as fraction) for spawning
init_number spawn_time_frac;
// age-dependent natural mortality at age (ages 1 - 15 )
init_vector set_M(1,nages);

// Spawner-recruit parameters:  SR function switch (integer 1=Beverton-Holt, 2=Ricker)
init_int SR_switch;

// switch for rate increase in q: Integer value (choose estimation phase, negative value turns it off)
init_int set_q_rate_phase;
// annual positive rate of increase on all fishery dependent q's due to technology creep
init_number set_q_rate;

// density dependence on fishery catchability coefficients (DDq) switch: Integer value (choose estimation phase of random walk, negative value turns it off)
init_int set_q_DD_phase;
// q_DD exponent, value of zero is density independent, est range is (0.1,0.9)
init_number set_q_DD_beta;
// SE of q_DD exponent (0.128 provides 95% CI in range 0.5)
init_number set_q_DD_beta_se;
// Age to begin counting q_DD (should be age near full exploitation)
init_int set_q_DD_stage;      //age to begin counting biomass, should be near full exploitation

// Variance (sd^2) of fishery dependent random walk catchabilities (0.03 is near the sd=0.17 of Wilberg and Bence)
init_number set_RWq_var;     //assumed variance of RW q

// Tuning F (not applied in last phase of optimization, or not applied at all if penalty weight=0)
init_number set_Ftune;
// Year for tuning F
init_int set_Ftune_yr;

// threshold sample sizes ntrips (>=)for length comps (set to 99999.0 if sel is fixed):
init_number minSS_comm_lenc; // comm len comps
//threshold sample sizes for age comps
init_number minSS_GR_agec;

// Input for deterministic F-based projections
// Last year of projections, must be later than assessment endyr by default
init_int endyr_proj; // Projection end year (must be later than assessment endyr)
init_int styr_regs;   // Apply current F until styr_regs, then the projection F
init_int Fproj_switch;  // Switching indicating value to use for defining projection F: 1=Fcurrent, 2=Fmsy, 3=F30, 4=F40
```

```
init_number Fproj_mult; // Multiplier 'c' applied to compute projection F, for example Fproj=cFmsy
// Calculate projection start year
int styr_proj;
 LOCAL_CALCS
   styr_proj=endyr+1;
 END_CALCS

// Aging error matrix (columns are true age 1- 15 , rows are ages as read for age comps: columns should sum to one)
init_matrix age_error(1,nages,1,nages);

//-----------------------------------<< 999 >>-------------------------------------
// END OF READING IN VALUES FROM .dat file
//-----------------------------------<< 999 >>-------------------------------------
// #######Indexing integers for year(iyear), age(iage),length(ilen) ##############
int iyear;
int iage;
int ilen;
int ff;

number sqrt2pi;
number g2mt;                    //conversion of grams to metric tons
number g2kg;                    //conversion of grams to kg
number g2klb;                   //conversion of grams to 1000 lb
number mt2klb;                  //conversion of metric tons to 1000 lb
number mt2lb;                   //conversion of metric tons to lb
number dzero;                   //small additive constant to prevent division by zero
number huge_number;             //huge number, to avoid irregular parameter space

init_number end_of_data_file;
//this section MUST BE INDENTED!!!
 LOCAL_CALCS
   if(end_of_data_file!=999)
   {
       cout << "*** WARNING: Data File NOT READ CORRECTLY ****" << endl;
       exit(0);
   }
   else
   {cout << "Data File read correctly" << endl;}
 END_CALCS

//##################################################################################################
PARAMETER_SECTION //##################################################################################################
//##################################################################################################

 LOCAL_CALCS
  const double Linf_LO=set_Linf(2); const double Linf_HI=set_Linf(3); const double Linf_PH=set_Linf(4);
  const double K_LO=set_K(2); const double K_HI=set_K(3); const double K_PH=set_K(4);
  const double t0_LO=set_t0(2); const double t0_HI=set_t0(3); const double t0_PH=set_t0(4);
  const double len_cv_LO=set_len_cv(2); const double len_cv_HI=set_len_cv(3); const double len_cv_PH=set_len_cv(4);

  const double Linf_L_LO=set_Linf_L(2); const double Linf_L_HI=set_Linf_L(3); const double Linf_L_PH=set_Linf_L(4);
  const double K_L_LO=set_K_L(2); const double K_L_HI=set_K_L(3); const double K_L_PH=set_K_L(4);
  const double t0_L_LO=set_t0_L(2); const double t0_L_HI=set_t0_L(3); const double t0_L_PH=set_t0_L(4);
  const double len_cv_L_LO=set_len_cv_L(2); const double len_cv_L_HI=set_len_cv_L(3); const double len_cv_L_PH=set_len_cv_L(4);

  const double Linf_F_LO=set_Linf_F(2); const double Linf_F_HI=set_Linf_F(3); const double Linf_F_PH=set_Linf_F(4);
  const double K_F_LO=set_K_F(2); const double K_F_HI=set_K_F(3); const double K_F_PH=set_K_F(4);
  const double t0_F_LO=set_t0_F(2); const double t0_F_HI=set_t0_F(3); const double t0_F_PH=set_t0_F(4);
  const double len_cv_F_LO=set_len_cv_F(2); const double len_cv_F_HI=set_len_cv_F(3); const double len_cv_F_PH=set_len_cv_F(4);

  const double M_constant_LO=set_M_constant(2); const double M_constant_HI=set_M_constant(3); const double M_constant_PH=set_M_constant(4);
  const double steep_LO=set_steep(2); const double steep_HI=set_steep(3); const double steep_PH=set_steep(4);
  const double log_R0_LO=set_log_R0(2); const double log_R0_HI=set_log_R0(3); const double log_R0_PH=set_log_R0(4);
  const double R_autocorr_LO=set_R_autocorr(2); const double R_autocorr_HI=set_R_autocorr(3); const double R_autocorr_PH=set_R_autocorr(4);
  const double rec_sigma_LO=set_rec_sigma(2); const double rec_sigma_HI=set_rec_sigma(3); const double rec_sigma_PH=set_rec_sigma(4);

  const double log_dm_comm_lc_LO=set_log_dm_comm_lc(2); const double log_dm_comm_lc_HI=set_log_dm_comm_lc(3); const double log_dm_comm_lc_PH=set_log_dm_comm_lc(4);
  const double log_dm_GR_ac_LO=set_log_dm_GR_ac(2); const double log_dm_GR_ac_HI=set_log_dm_GR_ac(3); const double log_dm_GR_ac_PH=set_log_dm_GR_ac(4);

  const double selpar_A50_comm1_LO=set_selpar_A50_comm1(2); const double selpar_A50_comm1_HI=set_selpar_A50_comm1(3); const double selpar_A50_comm1_PH=set_selpar_A50_comm1(4);
  const double selpar_slope_comm1_LO=set_selpar_slope_comm1(2); const double selpar_slope_comm1_HI=set_selpar_slope_comm1(3); const double selpar_slope_comm1_PH=set_selpar_slope_comm1(4);

  const double selpar_A50_GR1_LO=set_selpar_A50_GR1(2); const double selpar_A50_GR1_HI=set_selpar_A50_GR1(3); const double selpar_A50_GR1_PH=set_selpar_A50_GR1(4);
  const double selpar_slope_GR1_LO=set_selpar_slope_GR1(2); const double selpar_slope_GR1_HI=set_selpar_slope_GR1(3); const double selpar_slope_GR1_PH=set_selpar_slope_GR1(4);
  const double selpar_A50_GR2_LO=set_selpar_A50_GR2(2); const double selpar_A50_GR2_HI=set_selpar_A50_GR2(3); const double selpar_A50_GR2_PH=set_selpar_A50_GR2(4);
  const double selpar_slope_GR2_LO=set_selpar_slope_GR2(2); const double selpar_slope_GR2_HI=set_selpar_slope_GR2(3); const double selpar_slope_GR2_PH=set_selpar_slope_GR2(4);

  const double log_q_HB_LO=set_log_q_HB(2); const double log_q_HB_HI=set_log_q_HB(3); const double log_q_HB_PH=set_log_q_HB(4);

  const double F_init_LO=set_F_init(2); const double F_init_HI=set_F_init(3); const double F_init_PH=set_F_init(4);
  const double log_avg_F_comm_LO=set_log_avg_F_comm(2); const double log_avg_F_comm_HI=set_log_avg_F_comm(3); const double log_avg_F_comm_PH=set_log_avg_F_comm(4);
  const double log_avg_F_GR_LO=set_log_avg_F_GR(2); const double log_avg_F_GR_HI=set_log_avg_F_GR(3); const double log_avg_F_GR_PH=set_log_avg_F_GR(4);

  //-dev vectors-----------------------------------------------------------------------------------------------------------
  const double log_F_dev_comm_LO=set_log_F_dev_comm(1); const double log_F_dev_comm_HI=set_log_F_dev_comm(2); const double log_F_dev_comm_PH=set_log_F_dev_comm(3);
  const double log_F_dev_GR_LO=set_log_F_dev_GR(1); const double log_F_dev_GR_HI=set_log_F_dev_GR(2); const double log_F_dev_GR_PH=set_log_F_dev_GR(3);

  const double log_RWq_LO=set_log_RWq_dev(1); const double log_RWq_HI=set_log_RWq_dev(2); const double log_RWq_PH=set_log_RWq_dev(3);

  const double log_rec_dev_LO=set_log_rec_dev(1); const double log_rec_dev_HI=set_log_rec_dev(2); const double log_rec_dev_PH=set_log_rec_dev(3);
  const double log_Nage_dev_LO=set_log_Nage_dev(1); const double log_Nage_dev_HI=set_log_Nage_dev(2); const double log_Nage_dev_PH=set_log_Nage_dev(3);

 END_CALCS

////-------------Growth--------------------------------------------------------------------------
```

```
  //Population growth parms and conversions
  init_bounded_number Linf(Linf_LO,Linf_HI,Linf_PH);
  init_bounded_number K(K_LO,K_HI,K_PH);
  init_bounded_number t0(t0_LO,t0_HI,t0_PH);
  init_bounded_number len_cv_val(len_cv_LO,len_cv_HI,len_cv_PH);
  vector Linf_out(1,8);
  vector K_out(1,8);
  vector t0_out(1,8);
  vector len_cv_val_out(1,8);

  vector meanlen_TL(1,nages);   //mean total length (mm) at age all fish

  vector wgt_g(1,nages);        //whole wgt in g
  vector wgt_kg(1,nages);       //whole wgt in kg
  vector wgt_mt(1,nages);       //whole wgt in mt
  vector wgt_klb(1,nages);      //whole wgt in 1000 lb
  vector wgt_lb(1,nages);       //whole wgt in lb

  init_bounded_number Linf_L(Linf_L_LO,Linf_L_HI,Linf_L_PH);
  init_bounded_number K_L(K_L_LO,K_L_HI,K_L_PH);
  init_bounded_number t0_L(t0_L_LO,t0_L_HI,t0_L_PH);
  init_bounded_number len_cv_val_L(len_cv_L_LO,len_cv_L_HI,len_cv_L_PH);
  vector Linf_L_out(1,8);
  vector K_L_out(1,8);
  vector t0_L_out(1,8);
  vector len_cv_val_L_out(1,8);
  vector meanlen_TL_L(1,nages);   //mean total length (mm) at age all fish

  vector wgt_g_L(1,nages);        //whole wgt in g
  vector wgt_kg_L(1,nages);       //whole wgt in kg
  vector wgt_mt_L(1,nages);       //whole wgt in mt
  vector wgt_klb_L(1,nages);      //whole wgt in 1000 lb
  vector wgt_lb_L(1,nages);       //whole wgt in lb
  vector wgt_klb_gut_L(1,nages);  //gutted wgt in 1000 lb
  vector wgt_lb_gut_L(1,nages);   //gutted wgt in lb

  init_bounded_number Linf_F(Linf_F_LO,Linf_F_HI,Linf_F_PH);
  init_bounded_number K_F(K_F_LO,K_F_HI,K_F_PH);
  init_bounded_number t0_F(t0_F_LO,t0_F_HI,t0_F_PH);
  init_bounded_number len_cv_val_F(len_cv_F_LO,len_cv_F_HI,len_cv_F_PH);
  vector Linf_F_out(1,8);
  vector K_F_out(1,8);
  vector t0_F_out(1,8);
  vector len_cv_val_F_out(1,8);
  vector meanlen_TL_F(1,nages);   //mean total length (mm) at age all fish

  vector wgt_g_F(1,nages);        //whole wgt in g
  vector wgt_kg_F(1,nages);       //whole wgt in kg
  vector wgt_mt_F(1,nages);       //whole wgt in mt
  vector wgt_klb_F(1,nages);      //whole wgt in 1000 lb
  vector wgt_lb_F(1,nages);       //whole wgt in lb

  matrix len_comm_mm(styr,endyr,1,nages);          //mean length at age of commercial handline landings in mm
  matrix wholewgt_comm_klb(styr,endyr,1,nages);    //whole wgt of commercial handline landings in 1000 lb
  matrix len_HB_mm(styr,endyr,1,nages);          //mean length at age of HB landings in mm
  matrix wholewgt_HB_klb(styr,endyr,1,nages);    //whole wgt of HB landings in 1000 lb
  matrix len_GR_mm(styr,endyr,1,nages);          //mean length at age of GR landings in mm
  matrix wholewgt_GR_klb(styr,endyr,1,nages);    //whole wgt of GR landings in 1000 lb

  matrix lenprob(1,nages,1,nlenbins);           //distn of size at age (age-length key, 3 cm bins) in population
  number zscore_len;                            //standardized normal values used for computing lenprob
  vector cprob_lenvec(1,nlenbins);              //cumulative probabilities used for computing lenprob
  number zscore_lzero;                          //standardized normal values for length = 0
  number cprob_lzero;                           //length probability mass below zero, used for computing lenprob

  matrix lenprob_L(1,nages,1,nlenbins);
  number zscore_len_L;                            //standardized normal values used for computing lenprob
  vector cprob_lenvec_L(1,nlenbins);              //cumulative probabilities used for computing lenprob
  number zscore_lzero_L;                          //standardized normal values for length = 0
  number cprob_lzero_L;                           //length probability mass below zero, used for computing lenprob

  matrix lenprob_F(1,nages,1,nlenbins);
  number zscore_len_F;                            //standardized normal values used for computing lenprob
  vector cprob_lenvec_F(1,nlenbins);              //cumulative probabilities used for computing lenprob
  number zscore_lzero_F;                          //standardized normal values for length = 0
  number cprob_lzero_F;                           //length probability mass below zero, used for computing lenprob


  //matrices below are used to match length comps
  matrix lenprob_comm(1,nages,1,nlenbins);     //distn of size at age in comm
  matrix lenprob_HB(1,nages,1,nlenbins);     //distn of size at age in HB
  matrix lenprob_GR(1,nages,1,nlenbins);     //distn of size at age in GR

  vector len_sd(1,nages);
  vector len_cv(1,nages); //for fishgraph
  //All Fishery-dependent
  vector len_sd_L(1,nages);
  vector len_cv_L(1,nages); //for fishgraph
  //Females
  vector len_sd_F(1,nages);
  vector len_cv_F(1,nages);

//----Predicted length and age compositions
  matrix pred_comm_lenc(1,nyr_comm_lenc,1,nlenbins); //predicted length comps pooled across years
  matrix pred_comm_lenc_yr(1,nyr_comm_lenc_pool,1,nlenbins); //annual predicted length comps
```

```
  matrix pred_GR_agec(1,nyr_GR_agec,1,nages_agec);
  matrix pred_GR_agec_allages(1,nyr_GR_agec,1,nages);
  matrix ErrorFree_GR_agec(1,nyr_GR_agec,1,nages);

//Sample size (perhaps adjusted herein) used in fitting comp data
  vector nsamp_comm_lenc_allyr(styr,endyr);
  vector nsamp_GR_agec_allyr(styr,endyr);

//Nfish used in MCB analysis (not used in fitting)
  vector nfish_comm_lenc_allyr(styr,endyr);
  vector nfish_GR_agec_allyr(styr,endyr);

//Computed effective sample size for output (not used in fitting)
  vector neff_comm_lenc_allyr(styr,endyr);
  vector neff_GR_agec_allyr(styr,endyr);

//-----Population-----------------------------------------------------------------------------------
  matrix N(styr,endyr+1,1,nages);           //Population numbers by year and age at start of yr
  matrix N_mdyr(styr,endyr,1,nages);        //Population numbers by year and age at mdpt of yr: used for comps and cpue
  matrix N_spawn(styr,endyr,1,nages);       //Population numbers by year and age at peaking spawning: used for SSB
  init_bounded_vector log_Nage_dev(2,nages,log_Nage_dev_LO,log_Nage_dev_HI,log_Nage_dev_PH);
  vector log_Nage_dev_output(1,nages);      //used in output. equals zero for first age
  matrix B(styr,endyr+1,1,nages);           //Population biomass by year and age at start of yr
  vector totB(styr,endyr+1);                //Total biomass by year
  vector totN(styr,endyr+1);                //Total abundance by year
  vector SSB(styr,endyr);                   //Total spawning biomass by year (female mature biomass)
  vector SSB_knum(styr,endyr);              //Total spawning numbers by year (number of mature females)
  vector rec(styr,endyr+1);                 //Recruits by year
  vector prop_f(1,nages);
  vector maturity_f(1,nages);
  vector reprod(1,nages);
  vector reprodknum(1,nages);

//---Stock-Recruit Function (Beverton-Holt, steepness parameterization)----------
  init_bounded_number log_R0(log_R0_LO,log_R0_HI,log_R0_PH);        //log(virgin Recruitment)
  vector log_R0_out(1,8);
  number R0;                                  //virgin recruitment
  init_bounded_number steep(steep_LO,steep_HI,steep_PH); //steepness
  vector steep_out(1,8);
  init_bounded_number rec_sigma(rec_sigma_LO,rec_sigma_HI,rec_sigma_PH);  //sd recruitment residuals
  vector rec_sigma_out(1,8);
  init_bounded_number R_autocorr(R_autocorr_LO,R_autocorr_HI,R_autocorr_PH);  //autocorrelation in SR
  vector R_autocorr_out(1,8);

  number rec_sigma_sq;                        //square of rec_sigma
  number rec_logL_add;                        //additive term in -logL term

  init_bounded_dev_vector log_rec_dev(styr_rec_dev,endyr_rec_dev,log_rec_dev_LO,log_rec_dev_HI,log_rec_dev_PH);
  vector log_rec_dev_output(styr,endyr+1);             //used in t.series output. equals zero except for yrs in log_rec_dev
  vector log_rec_dev_out(styr_rec_dev,endyr_rec_dev);  //used in output for bound checking

  number var_rec_dev;                           //variance of log recruitment deviations, from yrs with unconstrainted S-R(XXXX-XXXX)
  number sigma_rec_dev;                         //sample SD of log residuals (may not equal rec_sigma
  number BiasCor;                               //Bias correction in equilibrium recruits
  number S0;                                    //equal to spr_F0*R0 = virgin SSB
  number B0;                                    //equal to bpr_F0*R0 = virgin B
  number R1;                                    //Recruits in styr
  number R_virgin;                              //unfished recruitment with bias correction
  vector SdS0(styr,endyr);                      //Spawners relative to the unfished level


  init_bounded_number log_dm_comm_lc(log_dm_comm_lc_LO,log_dm_comm_lc_HI,log_dm_comm_lc_PH);
  init_bounded_number log_dm_GR_ac(log_dm_GR_ac_LO,log_dm_GR_ac_HI,log_dm_GR_ac_PH);

  vector log_dm_comm_lc_out(1,8);
  vector log_dm_GR_ac_out(1,8);
//-----------------------------------------------------------------------------------------------------------------------------------------------
////---Selectivity-------------------------------------------------------------------------

//Commercial handline-------------------------------------------------
  matrix sel_comm(styr,endyr,1,nages);
  vector sel_comm_vec(1,nages);

  init_bounded_number selpar_A50_comm1(selpar_A50_comm1_LO,selpar_A50_comm1_HI,selpar_A50_comm1_PH);
  init_bounded_number selpar_slope_comm1(selpar_slope_comm1_LO,selpar_slope_comm1_HI,selpar_slope_comm1_PH);

  vector selpar_A50_comm1_out(1,8);
  vector selpar_slope_comm1_out(1,8);

  //Headboat -------------------------------------------------
  matrix sel_HB(styr,endyr,1,nages);
  vector sel_HB_block1(1,nages);
  vector sel_HB_block2(1,nages);

  //General Rec
  matrix sel_GR(styr,endyr,1,nages);
  vector sel_GR_block1(1,nages);
  vector sel_GR_block2(1,nages);

  init_bounded_number selpar_A50_GR1(selpar_A50_GR1_LO,selpar_A50_GR1_HI,selpar_A50_GR1_PH);
  init_bounded_number selpar_slope_GR1(selpar_slope_GR1_LO,selpar_slope_GR1_HI,selpar_slope_GR1_PH);
  init_bounded_number selpar_A50_GR2(selpar_A50_GR2_LO,selpar_A50_GR2_HI,selpar_A50_GR2_PH);
  init_bounded_number selpar_slope_GR2(selpar_slope_GR2_LO,selpar_slope_GR2_HI,selpar_slope_GR2_PH);

  vector selpar_A50_GR1_out(1,8);
```

```
  vector selpar_slope_GR1_out(1,8);
  vector selpar_A50_GR2_out(1,8);
  vector selpar_slope_GR2_out(1,8);

//Weighted total selectivity--------------------------------------------
  //effort-weighted, recent selectivities
  vector sel_wgted_L(1,nages);  //toward landings
  vector sel_wgted_tot(1,nages);//toward Z, landings plus deads discards

//--------------------------------------------------------------------------------------------------------------------------------------
//-------CPUE Predictions--------------------------------
  vector pred_HB_cpue(styr_HB_cpue,endyr_HB_cpue);                  //predicted HB index (number fish per effort)
  matrix N_HB(styr_HB_cpue,endyr_HB_cpue,1,nages);                  //used to compute HB index

//---Catchability (CPUE q's)---------------------------------------------------------
  init_bounded_number log_q_HB(log_q_HB_LO,log_q_HB_HI,log_q_HB_PH);

  vector log_q_HB_out(1,8);

  number q_rate;
  vector q_rate_fcn_HB(styr_HB_cpue,endyr_HB_cpue);         //increase due to technology creep (saturates in 2003)

  number q_DD_beta;
  vector q_DD_fcn(styr,endyr);    //density dependent function as a multiple of q (scaled a la Katsukawa and Matsuda. 2003)
  number B0_q_DD;                 //B0 of ages q_DD_age plus
  vector B_q_DD(styr,endyr);      //annual biomass of ages q_DD_age plus

//Fishery dependent random walk catchability
  init_bounded_vector q_RW_log_dev_HB(styr_HB_cpue,endyr_HB_cpue-1,log_RWq_LO,log_RWq_HI,log_RWq_PH);

//Fishery dependent catchability over time, may be constant

 vector q_HB(styr_HB_cpue,endyr_HB_cpue);

//--------------------------------------------------------------------------------------------------------------------------------------
//---Landings in numbers (total or 1000 fish) and in wgt (whole klb)--------------------------------------------------
  matrix L_comm_num(styr,endyr,1,nages);   //landings (numbers) at age
  matrix L_comm_klb(styr,endyr,1,nages);   //landings (1000 lb whole weight) at age
  vector pred_comm_L_knum(styr,endyr);     //yearly landings in 1000 fish summed over ages
  vector pred_comm_L_klb(styr,endyr);      //yearly landings in 1000 lb whole summed over ages

  matrix L_GR_num(styr,endyr,1,nages);   //landings (numbers) at age
  matrix L_GR_klb(styr,endyr,1,nages);   //landings (1000 lb whole weight) at age
  vector pred_GR_L_knum(styr,endyr);     //yearly landings in 1000 fish summed over ages
  vector pred_GR_L_klb(styr,endyr);      //yearly landings in 1000 lb whole summed over ages

  matrix L_total_num(styr,endyr,1,nages);//total landings in number at age
  matrix L_total_klb(styr,endyr,1,nages);//landings in klb whole wgt at age
  vector L_total_knum_yr(styr,endyr);    //total landings in 1000 fish by yr summed over ages
  vector L_total_klb_yr(styr,endyr);     //total landings (klb whole wgt) by yr summed over ages

////---MSY calcs----------------------------------------------------------------------------
  number F_comm_prop;       //proportion of F_sum attributable to comm, last X=selpar_n_yrs_wgted yrs
  number F_GR_prop;       //proportion of F_sum attributable to GR, last X=selpar_n_yrs_wgted yrs

  number F_init_comm_prop;  //proportion of F_init attributable to comm, first X yrs
  number F_init_GR_prop;  //proportion of F_init attributable to GR, first X yrs

  number F_temp_sum;      //sum of geom mean Fsum's in last X yrs, used to compute F_fishery_prop

  vector F_end(1,nages);
  vector F_end_L(1,nages);
  number F_end_apex;

  number SSB_msy_out;           //SSB (total mature biomass) at msy
  number F_msy_out;             //F at msy
  number msy_klb_out;           //max sustainable yield (1000 lb whole wgt)
  number msy_knum_out;          //max sustainable yield (1000 fish)
  number B_msy_out;             //total biomass at MSY
  number R_msy_out;             //equilibrium recruitment at F=Fmsy
  number spr_msy_out;           //spr at F=Fmsy

  number F20_dum; //intermediate calculation for F20
  number F30_dum; //intermediate calculation for F30
  number F40_dum; //intermediate calculation for F40
  number F20_out;               //F20
  number F30_out;               //F30
  number F40_out;               //F40
  number SSB_F30_out;
  number SSB_F30_knum_out;
  number B_F30_out;
  number R_F30_out;
  number L_F30_knum_out;
  number L_F30_klb_out;

  number SSB_F40_out;
  number SSB_F40_knum_out;
  number B_F40_out;
  number R_F40_out;
  number L_F40_knum_out;
  number L_F40_klb_out;
  number rec_mean;   //arithmetic average recruitment used in SPR-related quantities

  vector N_age_msy(1,nages);         //numbers at age for MSY calculations: beginning of yr
  vector N_age_msy_spawn(1,nages);   //numbers at age for MSY calculations: time of peak spawning
```

```
  vector L_age_msy(1,nages);         //landings at age for MSY calculations
  vector Z_age_msy(1,nages);         //total mortality at age for MSY calculations
  vector F_L_age_msy(1,nages);       //fishing mortality landings (not discards) at age for MSY calculations
  vector F_msy(1,n_iter_msy);        //values of full F to be used in equilibrium calculations
  vector spr_msy(1,n_iter_msy);      //reproductive capacity-per-recruit values corresponding to F values in F_msy
  vector R_eq(1,n_iter_msy);         //equilibrium recruitment values corresponding to F values in F_msy
  vector L_eq_klb(1,n_iter_msy);     //equilibrium landings(klb whole wgt) values corresponding to F values in F_msy
  vector L_eq_knum(1,n_iter_msy);    //equilibrium landings(1000 fish) values corresponding to F values in F_msy
  vector SSB_eq(1,n_iter_msy);       //equilibrium reproductive capacity values corresponding to F values in F_msy
  vector SSB_eq_knum(1,n_iter_msy);
  vector B_eq(1,n_iter_msy);         //equilibrium biomass values corresponding to F values in F_msy

  vector FdF_msy(styr,endyr);
  vector FdF30(styr,endyr);
  vector FdF40(styr,endyr);
  vector SdSSB_msy(styr,endyr);
  number SdSSB_msy_end;
  number FdF_msy_end;
  number FdF_msy_end_mean;           //geometric mean of last X yrs

  vector SdSSB_F30(styr,endyr);
  vector Sdmsst_F30(styr,endyr);
  number SdSSB_F30_end;
  number Sdmsst_F30_end;
  number FdF30_end_mean;             //geometric mean of last selpar_n_yrs_wgted yrs
  vector L_age_F30(1,nages);         //landings at age for F30 calculations

  vector SdSSB_F40(styr,endyr);
  vector Sdmsst_F40(styr,endyr);
  number SdSSB_F40_end;
  number Sdmsst_F40_end;
  number FdF40_end_mean;             //geometric mean of last selpar_n_yrs_wgted yrs
  number Fend_mean_temp;  //intermediate calc for geometric mean of last selpar_n_yrs_wgted yrs
  number Fend_mean;  //geometric mean of last selpar_n_yrs_wgted yrs
  vector L_age_F40(1,nages);         //landings at age for F40 calculations

  vector wgt_wgted_L_klb(1,nages);   //fishery-weighted average weight at age of landings in whole weight
  number wgt_wgted_L_denom;          //used in intermediate calculations

  number iter_inc_msy;               //increments used to compute msy, equals 1/(n_iter_msy-1)

////--------Mortality------------------------------------------------------------------

  vector M(1,nages);                         //age-dependent natural mortality
  init_bounded_number M_constant(M_constant_LO,M_constant_HI,M_constant_PH);   //age-indpendent: used only for MSST
  vector M_constant_out(1,8);
  number smsy2msstM;                         //scales Smsy to get msst using (1-M). Used only in output.
  number smsy2msst75;                        //scales Smsy to get msst using 75%. Used only in output.

  matrix F(styr,endyr,1,nages);
  vector Fsum(styr,endyr);                   //Full fishing mortality rate by year
  vector Fapex(styr,endyr);                  //Max across ages, fishing mortality rate by year (may differ from Fsum bc of dome-shaped sel
  matrix Z(styr,endyr,1,nages);

  init_bounded_number log_avg_F_comm(log_avg_F_comm_LO,log_avg_F_comm_HI,log_avg_F_comm_PH);
  vector log_avg_F_comm_out(1,8);
  init_bounded_dev_vector log_F_dev_comm(styr_comm_L,endyr_comm_L,log_F_dev_comm_LO,log_F_dev_comm_HI,log_F_dev_comm_PH);
  vector log_F_dev_comm_out(styr_comm_L,endyr_comm_L);
  matrix F_comm(styr,endyr,1,nages);
  vector F_comm_out(styr,endyr);        //used for intermediate calculations in fcn get_mortality
  number log_F_dev_init_comm;
  number log_F_dev_end_comm;

  init_bounded_number log_avg_F_GR(log_avg_F_GR_LO,log_avg_F_GR_HI,log_avg_F_GR_PH);
  vector log_avg_F_GR_out(1,8);
  init_bounded_dev_vector log_F_dev_GR(styr_GR_L,endyr_GR_L,log_F_dev_GR_LO,log_F_dev_GR_HI,log_F_dev_GR_PH);
  vector log_F_dev_GR_out(styr_GR_L,endyr_GR_L);
  matrix F_GR(styr,endyr,1,nages);
  vector F_GR_out(styr,endyr); //used for intermediate calculations in fcn get_mortality
  number log_F_dev_init_GR;
  number log_F_dev_end_GR;

  init_bounded_number F_init(F_init_LO,F_init_HI,F_init_PH); //scales early F for initialization
  vector F_init_out(1,8);
  number F_init_denom;  //interim calculation. From Erik's red snapper ASPM

//---Per-recruit stuff----------------------------------------------------------------------------------
  vector N_age_spr(1,nages);         //numbers at age for SPR calculations: beginning of year
  vector N_age_spr_spawn(1,nages);   //numbers at age for SPR calculations: time of peak spawning
  vector L_age_spr(1,nages);         //catch at age for SPR calculations
  vector Z_age_spr(1,nages);         //total mortality at age for SPR calculations
  vector spr_static(styr,endyr);     //vector of static SPR values by year
  vector F_L_age_spr(1,nages);       //fishing mortality of landings (not discards) at age for SPR calculations
  vector F_spr(1,n_iter_spr);        //values of full F to be used in per-recruit calculations
  vector spr_spr(1,n_iter_spr);      //reproductive capacity-per-recruit values corresponding to F values in F_spr
  vector spr_ratio(1,n_iter_spr);    //reproductive capacity-per-recruit relative to spr_F0 values corresponding to F values in F_spr
  vector L_spr(1,n_iter_spr);        //landings(lb)-per-recruit (ypr) values corresponding to F values in F_spr

  vector N_spr_F0(1,nages);          //Used to compute spr at F=0: at time of peak spawning
  vector N_bpr_F0(1,nages);          //Used to compute bpr at F=0: at start of year
  vector N_spr_initial(1,nages);     //Initial spawners per recruit at age given initial F
  vector N_initial_eq(1,nages);      //Initial equilibrium abundance at age
  vector F_initial(1,nages);         //initial F at age
  vector Z_initial(1,nages);         //initial Z at age
  number spr_initial;                //initial spawners per recruit
```

```
  number spr_F0;                    //Spawning biomass per recruit at F=0
  number bpr_F0;                    //Biomass per recruit at F=0

  number iter_inc_spr;              //increments used to compute msy, equals max_F_spr_msy/(n_iter_spr-1)

////-------SDNR output------------------------------------------------------------------------------

  number sdnr_lc_comm;
  number sdnr_ac_GR;
  number sdnr_I_HB;

////-------Objective function components-----------------------------------------------------------------------------
  number w_L;

  number w_I_HB;

  number w_lc_comm;
  number w_ac_GR;

  number w_Nage_init;
  number w_rec;
  number w_rec_early;
  number w_rec_end;
  number w_fullF;
  number w_Ftune;

  number f_comm_L;
  number f_GR_L;

  number f_HB_cpue;

  number f_HB_RWq_cpue;

  number f_comm_lenc;
  number f_GR_lenc;

  number f_GR_agec;

//  Penalties and constraints. Not all are used.
  number f_Nage_init;             //weight on log devs to estimate initial abundance (excluding first age)
  number f_rec_dev;               //weight on recruitment deviations to fit S-R curve
  number f_rec_dev_early;         //extra weight on deviations in first recruitment stanza
  number f_rec_dev_end;           //extra weight on deviations in ending recruitment stanza
  number f_fullF_constraint;      //penalty for Fapex>X
  number f_Ftune;                 //penalty for tuning F in Ftune yr.  Not applied in final optimization phase.
  number f_priors;                //prior information on parameters

   //init_number xdum;
   objective_function_value fval;
   number fval_data;
   number grad_max;

 //--Dummy variables ----
   number denom;                  //denominator used in some calculations
   number numer;                  //numerator used in some calculations

  //---------- Projection quantities--------------------------------------------------------------
  number F_reg_proj;    //value used to define the projections
  vector F_proj(styr_proj,endyr_proj);         //F by yr for projections (=F_reg_proj after regulations start, current F till then)
  vector L_knum_proj(styr_proj,endyr_proj);    //total landings in 1000 fish for projections
  vector L_klb_proj(styr_proj,endyr_proj);     //total landings in weight (1000 lb) for projections

  vector B_proj(styr_proj,endyr_proj);         //Biomass for projections
  vector SSB_proj(styr_proj,endyr_proj);       //SSB for projections
  vector R_proj(styr_proj,endyr_proj);         //recruits for projections
  vector FL_age_proj(1,nages);          //F (landings) by age for projections

  matrix N_proj(styr_proj,endyr_proj,1,nages);           //Population numbers by year and age at start of yr
  matrix N_spawn_proj(styr_proj,endyr_proj,1,nages);     //Population numbers by year and age at peaking spawning: used for SSB in projections
  matrix Z_proj(styr_proj,endyr_proj,1,nages);           //Z by year and age for projections
  matrix L_age_proj(styr_proj,endyr_proj,1,nages);       //Projected landings at age in numbers

//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//INITIALIZATION_SECTION
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
GLOBALS_SECTION
  #include "admodel.h"          // Include AD class definitions
  #include "admb2r.cpp"         // Include S-compatible output functions (needs preceding)
  #include <time.h>
time_t start,finish;
long hour,minute,second;
double elapsed_time;

//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
RUNTIME_SECTION
 maximum_function_evaluations 1000, 2000,3000, 5000, 10000;//, 10000, 10000;
 convergence_criteria 1e-2, 1e-2,1e-3, 1e-3, 1e-4;//, 1e-4, 1e-4;

//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
PRELIMINARY_CALCS_SECTION

// Set values of fixed parameters or set initial guess of estimated parameters
```

```
//Population
 Linf=set_Linf(1);
 K=set_K(1);
 t0=set_t0(1);
 len_cv_val=set_len_cv(1);

 //All fisheries
 Linf_L=set_Linf_L(1);
 K_L=set_K_L(1);
 t0_L=set_t0_L(1);
 len_cv_val_L=set_len_cv_L(1);
 //Females
 Linf_F=set_Linf_F(1);
 K_F=set_K_F(1);
 t0_F=set_t0_F(1);
 len_cv_val_F=set_len_cv_F(1);

 M=set_M;
 M_constant=set_M_constant(1);
 smsy2msstM=1.0-M_constant;
 smsy2msst75=0.75;

 log_R0=set_log_R0(1);
 steep=set_steep(1);
 R_autocorr=set_R_autocorr(1);
 rec_sigma=set_rec_sigma(1);

 log_dm_comm_lc=set_log_dm_comm_lc(1);
 log_dm_GR_ac=set_log_dm_GR_ac(1);

 log_q_HB=set_log_q_HB(1);

 q_rate=set_q_rate;
 q_rate_fcn_HB=1.0;
 q_DD_beta=set_q_DD_beta;
 q_DD_fcn=1.0;

 q_RW_log_dev_HB.initialize();

  if (set_q_rate_phase<0 & q_rate!=0.0)
 {

   for (iyear=styr_HB_cpue; iyear<=endyr_HB_cpue; iyear++)
     {   if (iyear>styr_HB_cpue & iyear <=2003)
         {//q_rate_fcn_HB(iyear)=(1.0+q_rate)*q_rate_fcn_HB(iyear-1); //compound
            q_rate_fcn_HB(iyear)=(1.0+(iyear-styr_HB_cpue)*q_rate)*q_rate_fcn_HB(styr_HB_cpue);  //linear
         }
         if (iyear>2003) {q_rate_fcn_HB(iyear)=q_rate_fcn_HB(iyear-1);}
     }
 } //end q_rate conditional

 w_L=set_w_L;

 w_I_HB=set_w_I_HB;

 w_lc_comm=set_w_lc_comm;
 w_ac_GR=set_w_ac_GR;

 w_Nage_init=set_w_Nage_init;
 w_rec=set_w_rec;
 w_rec_early=set_w_rec_early;
 w_rec_end=set_w_rec_end;
 w_fullF=set_w_fullF;
 w_Ftune=set_w_Ftune;

 F_init=set_F_init(1);

 log_avg_F_comm=set_log_avg_F_comm(1);
 log_avg_F_GR=set_log_avg_F_GR(1);

 log_F_dev_comm=set_log_F_dev_comm_vals;
 log_F_dev_GR=set_log_F_dev_GR_vals;

 selpar_A50_comm1=set_selpar_A50_comm1(1);
 selpar_slope_comm1=set_selpar_slope_comm1(1);

 selpar_A50_GR1=set_selpar_A50_GR1(1);
 selpar_slope_GR1=set_selpar_slope_GR1(1);
 selpar_A50_GR2=set_selpar_A50_GR2(1);
 selpar_slope_GR2=set_selpar_slope_GR2(1);

sqrt2pi=sqrt(2.*3.14159265);
g2mt=0.000001;         //conversion of grams to metric tons
g2kg=0.001;            //conversion of grams to kg
mt2klb=2.20462;        //conversion of metric tons to 1000 lb
mt2lb=mt2klb*1000.0;   //conversion of metric tons to lb
g2klb=g2mt*mt2klb;     //conversion of grams to 1000 lb
dzero=0.00001;
huge_number=1.0e+10;

SSB_msy_out=0.0;

iter_inc_msy=max_F_spr_msy/(n_iter_msy-1);
iter_inc_spr=max_F_spr_msy/(n_iter_spr-1);
```

```
 maturity_f=maturity_f_obs;

 prop_f=prop_f_obs;

//Fill in sample sizes of comps, possibly sampled in nonconsec yrs
//Used primarily for output in R object

      nsamp_comm_lenc_allyr=missing;
  nsamp_GR_agec_allyr=missing;

      nfish_comm_lenc_allyr=missing;
  nfish_GR_agec_allyr=missing;

      for (iyear=1; iyear<=nyr_comm_lenc; iyear++)
         {if (nsamp_comm_lenc(iyear)>=minSS_comm_lenc)
           {nsamp_comm_lenc_allyr(yrs_comm_lenc(iyear))=nsamp_comm_lenc(iyear);
            nfish_comm_lenc_allyr(yrs_comm_lenc(iyear))=nfish_comm_lenc(iyear);}}
      for (iyear=1; iyear<=nyr_GR_agec; iyear++)
         {if (nsamp_GR_agec(iyear)>=minSS_GR_agec)
           {nsamp_GR_agec_allyr(yrs_GR_agec(iyear))=nsamp_GR_agec(iyear);
             nfish_GR_agec_allyr(yrs_GR_agec(iyear))=nfish_GR_agec(iyear);}}

//fill in Fs for msy and per-recruit analyses
  F_msy(1)=0.0;
  for (ff=2;ff<=n_iter_msy;ff++) {F_msy(ff)=F_msy(ff-1)+iter_inc_msy;}
  F_spr(1)=0.0;
  for (ff=2;ff<=n_iter_spr;ff++) {F_spr(ff)=F_spr(ff-1)+iter_inc_spr;}


//fill in F's, Catch matrices, and log rec dev with zero's
  F_comm.initialize(); L_comm_num.initialize();
  F_GR.initialize(); L_GR_num.initialize();

  F_comm_out.initialize();
  F_GR_out.initialize();

  sel_comm.initialize();
  sel_comm_vec.initialize();
  sel_HB.initialize();
  sel_GR.initialize();

  sel_HB_block1.initialize();
  sel_HB_block2.initialize();
  sel_GR_block1.initialize();
  sel_GR_block2.initialize();


  log_rec_dev_output.initialize();
  log_rec_dev=set_log_rec_dev_vals;
  log_Nage_dev_output.initialize();
  log_Nage_dev=set_log_Nage_dev_vals;


//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
TOP_OF_MAIN_SECTION
  time(&start);
  arrmblsize=20000000;
  gradient_structure::set_MAX_NVAR_OFFSET(1600);
  gradient_structure::set_GRADSTACK_BUFFER_SIZE(2000000);
  gradient_structure::set_CMPDIF_BUFFER_SIZE(2000000);
  gradient_structure::set_NUM_DEPENDENT_VARIABLES(10000);

//>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
PROCEDURE_SECTION

 //cout<<"start"<<endl;

 //get_M_at_age(); //Needed only if M is estimated

  get_length_weight_at_age();
  //cout << "got length, weight, fecundity transitions" <<endl;
  get_reprod();
  //cout << "got reprod" << endl;
  get_length_at_age_dist();
  //cout<< "got predicted length at age distribution"<<endl;
  get_weight_at_age_landings();
  //cout<< "got weight at age of landings"<<endl;
  get_spr_F0();
  //cout << "got F0 spr" << endl;
  get_selectivity();
  //cout << "got selectivity" << endl;
  get_mortality();
  // cout << "got mortalities" << endl;
  get_bias_corr();
  //cout<< "got recruitment bias correction" << endl;
  get_numbers_at_age();
  //cout << "got numbers at age" << endl;
  get_landings_numbers();
  //cout << "got landings in numbers" << endl;
  get_landings_wgt();
  //cout << "got landings in wgt" << endl;
  // get_dead_discards();
```

```
  //cout << "got dead discards in num and wgt" << endl;
  get_catchability_fcns();
  //cout << "got catchability_fcns" << endl;
  get_indices();
  //cout << "got indices" << endl;
  get_length_comps();
  // cout<< "got length comps"<< endl;
   get_age_comps();
  //cout<< "got age comps"<< endl;
   evaluate_objective_function();
   //cout << "objective function calculations complete" << endl;


FUNCTION get_length_weight_at_age
//population total length in mm
    //compute mean length (mm TL) and weight (whole) at age
    meanlen_TL=Linf*(1.0-mfexp(-K*(agebins-t0+0.5))); //Actually fork length
    wgt_kg=wgtpar_a*pow(meanlen_TL,wgtpar_b);             //whole wgt in kg
    wgt_g=wgt_kg/g2kg;                                    //convert wgt in kg to weight in g
    wgt_mt=wgt_g*g2mt;                                    //convert weight in g to weight in mt
    wgt_klb=mt2klb*wgt_mt;                                //1000 lb of whole wgt
    wgt_lb=mt2lb*wgt_mt;                                  //lb of whole wgt

//All fisheries
meanlen_TL_L=Linf_L*(1.0-mfexp(-K_L*(agebins-t0_L+0.5)));    //Landings total length in mm
    wgt_kg_L=wgtpar_a*pow(meanlen_TL_L,wgtpar_b);             //whole wgt in kg
    wgt_g_L=wgt_kg_L/g2kg;                                    //convert wgt in kg to weight in g
    wgt_mt_L=wgt_g_L*g2mt;                                    //convert weight in g to weight in mt
    wgt_klb_L=mt2klb*wgt_mt_L;                               //1000 lb of whole wgt
    wgt_lb_L=mt2lb*wgt_mt_L;                                 //1000 lb of whole wgt

//Females
meanlen_TL_F=Linf_F*(1.0-mfexp(-K_F*(agebins-t0_F+0.5)));    //Landings total length in mm
    wgt_kg_F=wgtpar_a*pow(meanlen_TL_F,wgtpar_b);             //whole wgt in kg
    wgt_g_F=wgt_kg_F/g2kg;                                    //convert wgt in kg to weight in g
    wgt_mt_F=wgt_g_F*g2mt;                                    //convert weight in g to weight in mt
    wgt_klb_F=mt2klb*wgt_mt_F;                               //1000 lb of whole wgt
    wgt_lb_F=mt2lb*wgt_mt_F;                                 //1000 lb of whole wgt

//batchfec = mfexp(batchfecpar_a + batchfecpar_b*meanlen_TL);  // batch fecundity at length [should be batchfec = exp(a+bL) based on Harris 2004]
//fec = batchfec*nbatch/fecpar_scale;                           // annual fecundity at length scaled to fecpar_scale units

FUNCTION get_reprod

    //reprod=elem_prod(prop_f,elem_prod(maturity_f,fec));
reprod=elem_prod(elem_prod(prop_f,maturity_f),wgt_mt_F);
reprodknum=elem_prod(prop_f,maturity_f)/1000.0;

FUNCTION get_length_at_age_dist
  //compute matrix of length at age, based on the normal distribution
    //population
for (iage=1;iage<=nages;iage++)
   {len_cv(iage)=len_cv_val;
    len_sd(iage)=meanlen_TL(iage)*len_cv(iage);
zscore_lzero=(0.0-meanlen_TL(iage))/len_sd(iage);
cprob_lzero=cumd_norm(zscore_lzero);

    //All fishery dependent
//len_cv_L(iage)=mfexp(log_len_cv_L+log_len_cv_dev_L(iage));
    len_cv_L(iage)=len_cv_val_L;
    len_sd_L(iage)=meanlen_TL_L(iage)*len_cv_L(iage);
zscore_lzero_L=(0.0-meanlen_TL_L(iage))/len_sd_L(iage);
cprob_lzero_L=cumd_norm(zscore_lzero_L);

//Females
//len_cv_L(iage)=mfexp(log_len_cv_L+log_len_cv_dev_L(iage));
    len_cv_F(iage)=len_cv_val_F;
    len_sd_F(iage)=meanlen_TL_F(iage)*len_cv_F(iage);
zscore_lzero_F=(0.0-meanlen_TL_F(iage))/len_sd_F(iage);
cprob_lzero_F=cumd_norm(zscore_lzero_F);

    //first length bin
//population
    zscore_len=((lenbins(1)+0.5*lenbins_width)-meanlen_TL(iage)) / len_sd(iage);
    cprob_lenvec(1)=cumd_norm(zscore_len);          //includes any probability mass below zero
    lenprob(iage,1)=cprob_lenvec(1)-cprob_lzero;    //removes any probability mass below zero

//All fishery dependent
    zscore_len_L=((lenbins(1)+0.5*lenbins_width)-meanlen_TL_L(iage)) / len_sd_L(iage);
    cprob_lenvec_L(1)=cumd_norm(zscore_len_L);          //includes any probability mass below zero
    lenprob_L(iage,1)=cprob_lenvec_L(1)-cprob_lzero_L;    //removes any probability mass below zero

//Females
    zscore_len_F=((lenbins(1)+0.5*lenbins_width)-meanlen_TL_F(iage)) / len_sd_F(iage);
    cprob_lenvec_F(1)=cumd_norm(zscore_len_F);          //includes any probability mass below zero
    lenprob_F(iage,1)=cprob_lenvec_F(1)-cprob_lzero_F;    //removes any probability mass below zero

    //most other length bins
    //population
    for (ilen=2;ilen<nlenbins;ilen++)
      {
        zscore_len=((lenbins(ilen)+0.5*lenbins_width)-meanlen_TL(iage)) / len_sd(iage);
cprob_lenvec(ilen)=cumd_norm(zscore_len);
        lenprob(iage,ilen)=cprob_lenvec(ilen)-cprob_lenvec(ilen-1);
      }
```

```
//All fishery dependent
    for (ilen=2;ilen<nlenbins;ilen++)
      {
        zscore_len_L=((lenbins(ilen)+0.5*lenbins_width)-meanlen_TL_L(iage)) / len_sd_L(iage);
cprob_lenvec_L(ilen)=cumd_norm(zscore_len_L);
        lenprob_L(iage,ilen)=cprob_lenvec_L(ilen)-cprob_lenvec_L(ilen-1);
      }

//Females
    for (ilen=2;ilen<nlenbins;ilen++)
      {
        zscore_len_F=((lenbins(ilen)+0.5*lenbins_width)-meanlen_TL_F(iage)) / len_sd_F(iage);
cprob_lenvec_F(ilen)=cumd_norm(zscore_len_F);
        lenprob_F(iage,ilen)=cprob_lenvec_F(ilen)-cprob_lenvec_F(ilen-1);
      }

    //last length bin is a plus group
//population
    zscore_len=((lenbins(nlenbins)-0.5*lenbins_width)-meanlen_TL(iage)) / len_sd(iage);
lenprob(iage,nlenbins)=1.0-cumd_norm(zscore_len);
      lenprob(iage)=lenprob(iage)/(1.0-cprob_lzero);  //renormalize to account for any prob mass below size=0

//All fishery dependent
    zscore_len_L=((lenbins(nlenbins)-0.5*lenbins_width)-meanlen_TL_L(iage)) / len_sd_L(iage);
lenprob_L(iage,nlenbins)=1.0-cumd_norm(zscore_len_L);
      lenprob_L(iage)=lenprob_L(iage)/(1.0-cprob_lzero_L);  //renormalize to account for any prob mass below size=0

//Females
    zscore_len_F=((lenbins(nlenbins)-0.5*lenbins_width)-meanlen_TL_F(iage)) / len_sd_F(iage);
lenprob_F(iage,nlenbins)=1.0-cumd_norm(zscore_len_F);
      lenprob_F(iage)=lenprob_F(iage)/(1.0-cprob_lzero_F);  //renormalize to account for any prob mass below size=0
   }

  //fleet and survey specific length probs, all assumed here to equal the popn
  lenprob_comm=lenprob_L;

  lenprob_HB=lenprob;

FUNCTION get_weight_at_age_landings  ///***in whole weight

  for (iyear=styr; iyear<=endyr; iyear++)
  {
    len_comm_mm(iyear)=meanlen_TL_L;
    wholewgt_comm_klb(iyear)=wgt_klb_L;
    //len_cL_mm(iyear)=meanlen_TL;
    //wholewgt_cL_klb(iyear)=wgt_klb;
    len_HB_mm(iyear)=meanlen_TL_L;
    wholewgt_HB_klb(iyear)=wgt_klb_L;
    len_GR_mm(iyear)=meanlen_TL_L;
    wholewgt_GR_klb(iyear)=wgt_klb_L;
  }


FUNCTION get_spr_F0
  //at mdyr, apply half this yr's mortality, half next yr's
  N_spr_F0(1)=1.0*mfexp(-1.0*M(1)*spawn_time_frac); //at peak spawning time
  N_bpr_F0(1)=1.0;      //at start of year
  for (iage=2; iage<=nages; iage++)
  { N_spr_F0(iage)=N_spr_F0(iage-1)*mfexp(-1.0*(M(iage-1)*(1.0-spawn_time_frac) + M(iage)*spawn_time_frac));
    N_bpr_F0(iage)=N_bpr_F0(iage-1)*mfexp(-1.0*(M(iage-1)));
  }
  N_spr_F0(nages)=N_spr_F0(nages)/(1.0-mfexp(-1.0*M(nages))); //plus group (sum of geometric series)
  N_bpr_F0(nages)=N_bpr_F0(nages)/(1.0-mfexp(-1.0*M(nages)));

  spr_F0=sum(elem_prod(N_spr_F0,reprod));
  bpr_F0=sum(elem_prod(N_bpr_F0,wgt_mt));



FUNCTION get_selectivity
  sel_comm_vec=logistic(agebins, selpar_A50_comm1, selpar_slope_comm1);
  sel_GR_block1=logistic(agebins, selpar_A50_GR1, selpar_slope_GR1);
  sel_GR_block2=logistic(agebins, selpar_A50_GR2, selpar_slope_GR2);
  sel_HB_block1=sel_GR_block1; // Use GR selectivity for HB
  sel_HB_block2=sel_GR_block2; // Use GR selectivity for HB

  //-------- comm --------//
  for (iyear=styr; iyear<=endyr; iyear++)
{sel_comm(iyear) = sel_comm_vec;}

  //---- GR and HB ----//
  //BLOCK 1 for selex
  for (iyear=styr; iyear<=endyr_selex_phase1_GR; iyear++)
   {
    sel_HB(iyear)=sel_HB_block1;
    sel_GR(iyear)=sel_GR_block1;
   }
  //BLOCK 2 for selex
  for (iyear=(endyr_selex_phase1_GR+1); iyear<=endyr; iyear++)//iyear<=endyr_selex_phase2_GR; iyear++)
   {
    sel_HB(iyear)=sel_HB_block2;
    sel_GR(iyear)=sel_GR_block2;
   }
```

```
FUNCTION get_mortality
  Fsum.initialize();
  Fapex.initialize();
  F.initialize();
  //initialization F is avg from first 3 yrs of observed landings
  log_F_dev_init_comm=sum(log_F_dev_comm(styr_comm_L,(styr_comm_L+2)))/3.0;
  //log_F_dev_init_cL=sum(log_F_dev_cL(styr_cL_L,(styr_cL_L+2)))/3.0;
  log_F_dev_init_GR=sum(log_F_dev_GR(styr_GR_L,(styr_GR_L+2)))/3.0;

  for (iyear=styr; iyear<=endyr; iyear++)
  {
    if(iyear>=styr_comm_L & iyear<=endyr_comm_L) //spans full time series
{F_comm_out(iyear)=mfexp(log_avg_F_comm+log_F_dev_comm(iyear));}
    F_comm(iyear)=sel_comm(iyear)*F_comm_out(iyear);
    Fsum(iyear)+=F_comm_out(iyear);


if(iyear>=styr_GR_L & iyear<=endyr_GR_L) //starts in 1981
{F_GR_out(iyear)=mfexp(log_avg_F_GR+log_F_dev_GR(iyear));}
    if (iyear<styr_GR_L)
{F_GR_out(iyear)=mfexp(log_avg_F_GR+log_F_dev_init_GR);}
F_GR(iyear)=sel_GR(iyear)*F_GR_out(iyear);
    Fsum(iyear)+=F_GR_out(iyear);

    //Total F at age
    F(iyear)=F_comm(iyear);  //first in additive series (NO +=)
    //F(iyear)+=F_cL(iyear);
    // F(iyear)+=F_HB(iyear);
    F(iyear)+=F_GR(iyear);

    Fapex(iyear)=max(F(iyear));
    Z(iyear)=M+F(iyear);

   }  //end iyear

FUNCTION get_bias_corr
  var_rec_dev=norm2(log_rec_dev(styr_rec_dev,endyr_rec_dev)-
             sum(log_rec_dev(styr_rec_dev,endyr_rec_dev))/nyrs_rec)
             /(nyrs_rec-1.0);
  //if (set_BiasCor <= 0.0) {BiasCor=mfexp(var_rec_dev/2.0);}   //bias correction based on empirical residuals
  rec_sigma_sq=square(rec_sigma);
  if (set_BiasCor <= 0.0) {BiasCor=mfexp(rec_sigma_sq/2.0);}   //bias correction based on Rsigma
  else {BiasCor=set_BiasCor;}

FUNCTION get_numbers_at_age
//Initialization
  R0=mfexp(log_R0);
  S0=spr_F0*R0;
  R_virgin=SR_eq_func(R0, steep, spr_F0, spr_F0, BiasCor, SR_switch);

  B0=bpr_F0*R_virgin;
  B0_q_DD=R_virgin*sum(elem_prod(N_bpr_F0(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));

  // Commented out code block from Erik's ASPM for red snapper
  F_init_denom=mfexp(log_avg_F_comm+log_F_dev_init_comm)+mfexp(log_avg_F_GR+log_F_dev_init_GR); //+mfexp(log_avg_F_cL+log_F_dev_init_cL)
  F_init_comm_prop= mfexp(log_avg_F_comm+log_F_dev_init_comm)/F_init_denom;
  //F_init_cL_prop= mfexp(log_avg_F_cL+log_F_dev_init_cL)/F_init_denom;
  F_init_GR_prop= mfexp(log_avg_F_GR+log_F_dev_init_GR)/F_init_denom;

  F_initial=sel_comm(styr)*F_init*F_init_comm_prop+
           //sel_cL(styr)*F_init*F_init_cL_prop+
           sel_GR(styr)*F_init*F_init_GR_prop;

//F_initial=sel_initial*F_init;
  Z_initial=M+F_initial;

//Initial equilibrium age structure
  N_spr_initial(1)=1.0*mfexp(-1.0*Z_initial(1)*spawn_time_frac); //at peak spawning time;
  for (iage=2; iage<=nages; iage++)
    {
      N_spr_initial(iage)=N_spr_initial(iage-1)*
                 mfexp(-1.0*(Z_initial(iage-1)*(1.0-spawn_time_frac) + Z_initial(iage)*spawn_time_frac));
    }
  N_spr_initial(nages)=N_spr_initial(nages)/(1.0-mfexp(-1.0*Z_initial(nages))); //plus group
  spr_initial=sum(elem_prod(N_spr_initial,reprod));
  if (styr==styr_rec_dev) {R1=SR_eq_func(R0, steep, spr_F0, spr_initial, 1.0, SR_switch);} //without bias correction (deviation added later)
  else {R1=SR_eq_func(R0, steep, spr_F0, spr_initial, BiasCor, SR_switch);} //with bias correction
  if(R1<10.0) {R1=10.0;} //Avoid unrealistically low popn sizes during search algorithm

//Compute equilibrium age structure for first year
  N_initial_eq(1)=R1;
  for (iage=2; iage<=nages; iage++)
  {
    N_initial_eq(iage)=N_initial_eq(iage-1)*
        mfexp(-1.0*(Z_initial(iage-1)));
  }
  //plus group calculation
  N_initial_eq(nages)=N_initial_eq(nages)/(1.0-mfexp(-1.0*Z_initial(nages))); //plus group

//Add deviations to initial equilibrium N
  N(styr)(2,nages)=elem_prod(N_initial_eq(2,nages),mfexp(log_Nage_dev));

  if (styr==styr_rec_dev) {N(styr,1)=N_initial_eq(1)*mfexp(log_rec_dev(styr_rec_dev));}
  else {N(styr,1)=N_initial_eq(1);}
```

```
  N_mdyr(styr)(1,nages)=elem_prod(N(styr)(1,nages),(mfexp(-1.*(Z_initial(1,nages))*0.5))); //mid year
  N_spawn(styr)(1,nages)=elem_prod(N(styr)(1,nages),(mfexp(-1.*(Z_initial(1,nages))*spawn_time_frac))); //peak spawning time

  SSB(styr)=sum(elem_prod(N_spawn(styr),reprod));
  SSB_knum(styr)=sum(elem_prod(N_spawn(styr),reprodknum));
  B_q_DD(styr)=sum(elem_prod(N(styr)(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));

//Rest of years
  for (iyear=styr; iyear<endyr; iyear++)
  {
    if(iyear<(styr_rec_dev-1)||iyear>(endyr_rec_dev-1)) //recruitment follows S-R curve (with bias correction) exactly
    {
        N(iyear+1,1)=BiasCor*SR_func(R0, steep, spr_F0, SSB(iyear),SR_switch);
        N(iyear+1)(2,nages)=++elem_prod(N(iyear)(1,nages-1),(mfexp(-1.*Z(iyear)(1,nages-1))));
        N(iyear+1,nages)+=N(iyear,nages)*mfexp(-1.*Z(iyear,nages)); //plus group
        N_mdyr(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*0.5))); //mid year
        N_spawn(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*spawn_time_frac))); //peak spawning time
        SSB(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprod));
SSB_knum(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprodknum));
B_q_DD(iyear+1)=sum(elem_prod(N(iyear+1)(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));
    }
    else   //recruitment follows S-R curve with lognormal deviation
    {
        N(iyear+1,1)=SR_func(R0, steep, spr_F0, SSB(iyear),SR_switch)*mfexp(log_rec_dev(iyear+1));
        N(iyear+1)(2,nages)=++elem_prod(N(iyear)(1,nages-1),(mfexp(-1.*Z(iyear)(1,nages-1))));
        N(iyear+1,nages)+=N(iyear,nages)*mfexp(-1.*Z(iyear,nages)); //plus group
        N_mdyr(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*0.5))); //mid year
        N_spawn(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*spawn_time_frac))); //peak spawning time
        SSB(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprod));
SSB_knum(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprodknum));
        B_q_DD(iyear+1)=sum(elem_prod(N(iyear+1)(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));
    }
  }

  //last year (projection) has no recruitment variability
  N(endyr+1,1)=BiasCor*SR_func(R0, steep, spr_F0, SSB(endyr),SR_switch);
  N(endyr+1)(2,nages)=++elem_prod(N(endyr)(1,nages-1),(mfexp(-1.*Z(endyr)(1,nages-1))));
  N(endyr+1,nages)+=N(endyr,nages)*mfexp(-1.*Z(endyr,nages)); //plus group


FUNCTION get_landings_numbers //Baranov catch eqn
  for (iyear=styr; iyear<=endyr; iyear++)
  {
    for (iage=1; iage<=nages; iage++)
    {
      L_comm_num(iyear,iage)=N(iyear,iage)*F_comm(iyear,iage)*
        (1.-mfexp(-1.*Z(iyear,iage)))/Z(iyear,iage);
      //L_cL_num(iyear,iage)=N(iyear,iage)*F_cL(iyear,iage)*
        //(1.-mfexp(-1.*Z(iyear,iage)))/Z(iyear,iage);
      L_GR_num(iyear,iage)=N(iyear,iage)*F_GR(iyear,iage)*
        (1.-mfexp(-1.*Z(iyear,iage)))/Z(iyear,iage);
    }
    pred_comm_L_knum(iyear)=sum(L_comm_num(iyear))/1000.0;
//pred_cL_L_knum(iyear)=sum(L_cL_num(iyear))/1000.0;
    pred_GR_L_knum(iyear)=sum(L_GR_num(iyear))/1000.0;
  }


FUNCTION get_landings_wgt
  for (iyear=styr; iyear<=endyr; iyear++)
  {
    L_comm_klb(iyear)=elem_prod(L_comm_num(iyear),wholewgt_comm_klb(iyear));     //in 1000 lb whole weight
//L_cL_klb(iyear)=elem_prod(L_cL_num(iyear),wholewgt_cL_klb(iyear));     //in 1000 lb whole weight
    // L_HB_klb(iyear)=elem_prod(L_HB_num(iyear),wholewgt_HB_klb(iyear));     //in 1000 lb whole weight
    L_GR_klb(iyear)=elem_prod(L_GR_num(iyear),wholewgt_GR_klb(iyear));     //in 1000 lb whole weight

    pred_comm_L_klb(iyear)=sum(L_comm_klb(iyear));
//pred_cL_L_klb(iyear)=sum(L_cL_klb(iyear));
    // pred_HB_L_klb(iyear)=sum(L_HB_klb(iyear));
    pred_GR_L_klb(iyear)=sum(L_GR_klb(iyear));
  }

FUNCTION get_catchability_fcns
 //Get rate increase if estimated, otherwise fixed above
  if (set_q_rate_phase>0.0)
  {

      for (iyear=styr_HB_cpue; iyear<=endyr_HB_cpue; iyear++)
      {   if (iyear>styr_HB_cpue & iyear <=2003)
          {//q_rate_fcn_HB(iyear)=(1.0+q_rate)*q_rate_fcn_HB(iyear-1); //compound
             q_rate_fcn_HB(iyear)=(1.0+(iyear-styr_HB_cpue)*q_rate)*q_rate_fcn_HB(styr_HB_cpue);  //linear
          }
          if (iyear>2003) {q_rate_fcn_HB(iyear)=q_rate_fcn_HB(iyear-1);}
      }
  } //end q_rate conditional

 //Get density dependence scalar (=1.0 if density independent model is used)
  if (q_DD_beta>0.0)
  {
    B_q_DD+=dzero;
    for (iyear=styr;iyear<=endyr;iyear++)
        {q_DD_fcn(iyear)=pow(B0_q_DD,q_DD_beta)*pow(B_q_DD(iyear),-q_DD_beta);}
          //{q_DD_fcn(iyear)=1.0+4.0/(1.0+mfexp(0.75*(B_q_DD(iyear)-0.1*B0_q_DD))); }
  }
```

```
FUNCTION get_indices
//---Predicted CPUEs------------------------

 //HB  cpue
  q_HB(styr_HB_cpue)=mfexp(log_q_HB);
  for (iyear=styr_HB_cpue; iyear<=endyr_HB_cpue; iyear++)
  {
      N_HB(iyear)=elem_prod(N_mdyr(iyear),sel_HB(iyear));
      pred_HB_cpue(iyear)=q_HB(iyear)*q_rate_fcn_HB(iyear)*q_DD_fcn(iyear)*sum(N_HB(iyear));
      if (iyear<endyr_HB_cpue){q_HB(iyear+1)=q_HB(iyear)*mfexp(q_RW_log_dev_HB(iyear));}
  }

FUNCTION get_length_comps

  //comm lines

  for (iyear=1;iyear<=nyr_comm_lenc_pool;iyear++)
   {pred_comm_lenc_yr(iyear)=(L_comm_num(yrs_comm_lenc_pool(iyear))*lenprob_comm)/sum(L_comm_num(yrs_comm_lenc_pool(iyear)));}

  pred_comm_lenc.initialize();
  for (iyear=1;iyear<=nyr_comm_lenc_pool;iyear++)
    {pred_comm_lenc(1) += nfish_comm_lenc_pool(iyear) * pred_comm_lenc_yr(iyear);}
  pred_comm_lenc(1)=pred_comm_lenc(1)/sum(nfish_comm_lenc_pool);


FUNCTION get_age_comps

  //Recreational
  for (iyear=1;iyear<=nyr_GR_agec;iyear++)
  {
    ErrorFree_GR_agec(iyear)=L_GR_num(yrs_GR_agec(iyear))/sum(L_GR_num(yrs_GR_agec(iyear)));
    pred_GR_agec_allages(iyear)=age_error*ErrorFree_GR_agec(iyear);
    for (iage=1; iage<=nages_agec; iage++) {pred_GR_agec(iyear,iage)=pred_GR_agec_allages(iyear,iage);}
    //for (iage=(nages_agec+1); iage<=nages; iage++) {pred_GR_agec(iyear,nages_agec)+=pred_GR_agec_allages(iyear,iage);} //plus group
  }

////-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_weighted_current
  F_temp_sum=0.0;
  F_temp_sum+=mfexp((selpar_n_yrs_wgted*log_avg_F_comm+
        sum(log_F_dev_comm((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted);

  F_temp_sum+=mfexp((selpar_n_yrs_wgted*log_avg_F_GR+
        sum(log_F_dev_GR((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted);

  F_comm_prop=mfexp((selpar_n_yrs_wgted*log_avg_F_comm+
        sum(log_F_dev_comm((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted)/F_temp_sum;

  F_GR_prop=mfexp((selpar_n_yrs_wgted*log_avg_F_GR+
        sum(log_F_dev_GR((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted)/F_temp_sum;

  log_F_dev_end_comm=sum(log_F_dev_comm((endyr-selpar_n_yrs_wgted+1),endyr))/selpar_n_yrs_wgted;
  log_F_dev_end_GR=sum(log_F_dev_GR((endyr-selpar_n_yrs_wgted+1),endyr))/selpar_n_yrs_wgted;

  F_end_L=sel_comm(endyr)*mfexp(log_avg_F_comm+log_F_dev_end_comm)+
          //sel_cL(endyr)*mfexp(log_avg_F_cL+log_F_dev_end_cL)+
  sel_GR(endyr)*mfexp(log_avg_F_GR+log_F_dev_end_GR);

  F_end=F_end_L;
  F_end_apex=max(F_end);

  sel_wgted_tot=F_end/F_end_apex;
  sel_wgted_L=elem_prod(sel_wgted_tot, elem_div(F_end_L,F_end));

  wgt_wgted_L_denom=F_comm_prop+F_GR_prop;  //+F_HB_prop+F_cL_prop
  wgt_wgted_L_klb=F_comm_prop/wgt_wgted_L_denom*wholewgt_comm_klb(endyr)+
  //F_cL_prop/wgt_wgted_L_denom*wholewgt_cL_klb(endyr)+
  F_GR_prop/wgt_wgted_L_denom*wholewgt_GR_klb(endyr);

FUNCTION get_msy

  //compute values as functions of F
  for(ff=1; ff<=n_iter_msy; ff++)
  {
    //uses fishery-weighted F's
    Z_age_msy=0.0;
    F_L_age_msy=0.0;

    F_L_age_msy=F_msy(ff)*sel_wgted_L;
    Z_age_msy=M+F_L_age_msy;

    N_age_msy(1)=1.0;
    for (iage=2; iage<=nages; iage++)
      {N_age_msy(iage)=N_age_msy(iage-1)*mfexp(-1.*Z_age_msy(iage-1));}
    N_age_msy(nages)=N_age_msy(nages)/(1.0-mfexp(-1.*Z_age_msy(nages)));
    N_age_msy_spawn(1,(nages-1))=elem_prod(N_age_msy(1,(nages-1)),
                                 mfexp((-1.*Z_age_msy(1,(nages-1)))*spawn_time_frac));
    N_age_msy_spawn(nages)=(N_age_msy_spawn(nages-1)*(mfexp(-1.*(Z_age_msy(nages-1)*(1.0-spawn_time_frac) +
                           Z_age_msy(nages)*spawn_time_frac) )))/(1.0-mfexp(-1.*Z_age_msy(nages)));

    spr_msy(ff)=sum(elem_prod(N_age_msy_spawn,reprod));

    R_eq(ff)=SR_eq_func(R0, steep, spr_msy(1), spr_msy(ff), BiasCor, SR_switch);
```

```
    if (R_eq(ff)<dzero) {R_eq(ff)=dzero;}
    N_age_msy*=R_eq(ff);
    N_age_msy_spawn*=R_eq(ff);

    for (iage=1; iage<=nages; iage++)
    {
      L_age_msy(iage)=N_age_msy(iage)*(F_L_age_msy(iage)/Z_age_msy(iage))*
                      (1.-mfexp(-1.*Z_age_msy(iage)));
    }

    SSB_eq(ff)=sum(elem_prod(N_age_msy_spawn,reprod));
SSB_eq_knum(ff)=sum(elem_prod(N_age_msy_spawn,reprodknum));
B_eq(ff)=sum(elem_prod(N_age_msy,wgt_mt));
    L_eq_klb(ff)=sum(elem_prod(L_age_msy,wgt_wgted_L_klb)); //in whole weight
    L_eq_knum(ff)=sum(L_age_msy)/1000.0;
  }

  msy_klb_out=max(L_eq_klb); //msy in whole weight

  for(ff=1; ff<=n_iter_msy; ff++)
  {
   if(L_eq_klb(ff) == msy_klb_out)
      {
        SSB_msy_out=SSB_eq(ff);
        B_msy_out=B_eq(ff);
        R_msy_out=R_eq(ff);
        msy_knum_out=L_eq_knum(ff);
        F_msy_out=F_msy(ff);
        spr_msy_out=spr_msy(ff);
      }
  }
//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_per_recruit_stuff

  //static per-recruit stuff

  for(iyear=styr; iyear<=endyr; iyear++)
  {
    N_age_spr(1)=1.0;
    for(iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z(iyear,iage-1));}
    N_age_spr(nages)=N_age_spr(nages)/(1.0-mfexp(-1.*Z(iyear,nages)));
    N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                mfexp(-1.*Z(iyear)(1,(nages-1))*spawn_time_frac));
    N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                          (mfexp(-1.*(Z(iyear)(nages-1)*(1.0-spawn_time_frac) + Z(iyear)(nages)*spawn_time_frac) )))
                          /(1.0-mfexp(-1.*Z(iyear)(nages)));
    spr_static(iyear)=sum(elem_prod(N_age_spr_spawn,reprod))/spr_F0;
  }

  //compute SSB/R and YPR as functions of F
  for(ff=1; ff<=n_iter_spr; ff++)
  {
    //uses fishery-weighted F's, same as in MSY calculations
    Z_age_spr=0.0;
    F_L_age_spr=0.0;

    F_L_age_spr=F_spr(ff)*sel_wgted_L;
    Z_age_spr=M+F_L_age_spr;

    N_age_spr(1)=1.0;
    for (iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z_age_spr(iage-1));}
    N_age_spr(nages)=N_age_spr(nages)/(1-mfexp(-1.*Z_age_spr(nages)));
    N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                   mfexp((-1.*Z_age_spr(1,(nages-1)))*spawn_time_frac));
    N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                          (mfexp(-1.*(Z_age_spr(nages-1)*(1.0-spawn_time_frac) + Z_age_spr(nages)*spawn_time_frac) )))
                          /(1.0-mfexp(-1.*Z_age_spr(nages)));
    spr_spr(ff)=sum(elem_prod(N_age_spr_spawn,reprod));
    L_spr(ff)=0.0;
    for (iage=1; iage<=nages; iage++)
    {
      L_age_spr(iage)=N_age_spr(iage)*(F_L_age_spr(iage)/Z_age_spr(iage))*
                      (1.-mfexp(-1.*Z_age_spr(iage)));
      L_spr(ff)+=L_age_spr(iage)*wgt_wgted_L_klb(iage)*1000.0; //in lb whole wgt
    }
  }
  spr_ratio=spr_spr/spr_F0;
  F20_dum=min(fabs(spr_ratio-0.2));
  F30_dum=min(fabs(spr_ratio-0.3));
  F40_dum=min(fabs(spr_ratio-0.4));
  for(ff=1; ff<=n_iter_spr; ff++)
  {
      if (fabs(spr_ratio(ff)-0.2)==F20_dum) {F20_out=F_spr(ff);}
  if (fabs(spr_ratio(ff)-0.3)==F30_dum) {F30_out=F_spr(ff);}
  if (fabs(spr_ratio(ff)-0.4)==F40_dum) {F40_out=F_spr(ff);}
  }
  rec=column(N,1);
  rec_mean=sum(rec(styr_rec_spr, endyr_rec_spr))/nyrs_rec_spr;
  R_F30_out=rec_mean;
  F_L_age_spr=F30_out*sel_wgted_L;
  Z_age_spr=M+F_L_age_spr;
```

```
  N_age_spr(1)=R_F30_out;
  for (iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z_age_spr(iage-1));}
  N_age_spr(nages)=N_age_spr(nages)/(1-mfexp(-1.*Z_age_spr(nages)));
  N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                  mfexp((-1.*Z_age_spr(1,(nages-1)))*spawn_time_frac));
  N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                         (mfexp(-1.*(Z_age_spr(nages-1)*(1.0-spawn_time_frac) + Z_age_spr(nages)*spawn_time_frac) )))
                         /(1.0-mfexp(-1.*Z_age_spr(nages)));

  for (iage=1; iage<=nages; iage++)
    {
      L_age_F30(iage)=N_age_spr(iage)*(F_L_age_spr(iage)/Z_age_spr(iage))*
                     (1.-mfexp(-1.*Z_age_spr(iage)));
    }
  SSB_F30_out=sum(elem_prod(N_age_spr_spawn,reprod));
  SSB_F30_knum_out=sum(elem_prod(N_age_spr_spawn,reprodknum));
  B_F30_out=sum(elem_prod(N_age_spr,wgt_mt));
  L_F30_klb_out=sum(elem_prod(L_age_F30,wgt_wgted_L_klb)); //in whole weight
  L_F30_knum_out=sum(L_age_F30)/1000.0;


 //F40 calcs
  rec=column(N,1);
  rec_mean=sum(rec(styr_rec_spr, endyr_rec_spr))/nyrs_rec_spr;
  R_F40_out=rec_mean;
  F_L_age_spr=F40_out*sel_wgted_L;
  Z_age_spr=M+F_L_age_spr;

  N_age_spr(1)=R_F40_out;
  for (iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z_age_spr(iage-1));}
  N_age_spr(nages)=N_age_spr(nages)/(1-mfexp(-1.*Z_age_spr(nages)));
  N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                  mfexp((-1.*Z_age_spr(1,(nages-1)))*spawn_time_frac));
  N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                         (mfexp(-1.*(Z_age_spr(nages-1)*(1.0-spawn_time_frac) + Z_age_spr(nages)*spawn_time_frac) )))
                         /(1.0-mfexp(-1.*Z_age_spr(nages)));

  for (iage=1; iage<=nages; iage++)
    {
      L_age_F40(iage)=N_age_spr(iage)*(F_L_age_spr(iage)/Z_age_spr(iage))*
                     (1.-mfexp(-1.*Z_age_spr(iage)));
    }
  SSB_F40_out=sum(elem_prod(N_age_spr_spawn,reprod));
  SSB_F40_knum_out=sum(elem_prod(N_age_spr_spawn,reprodknum));
  B_F40_out=sum(elem_prod(N_age_spr,wgt_mt));
  L_F40_klb_out=sum(elem_prod(L_age_F40,wgt_wgted_L_klb)); //in whole weight
  L_F40_knum_out=sum(L_age_F40)/1000.0;


//----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_miscellaneous_stuff

//switch here if var_rec_dev <=dzero
  if(var_rec_dev>0.0)
   {sigma_rec_dev=sqrt(var_rec_dev);} //sample SD of predicted residuals (may not equal rec_sigma)
   else{sigma_rec_dev=0.0;}

  len_cv=elem_div(len_sd,meanlen_TL);
  len_cv_L=elem_div(len_sd_L,meanlen_TL_L);
  len_cv_F=elem_div(len_sd_F,meanlen_TL_F);

  //compute total landings- and discards-at-age in 1000 fish and klb whole weight
  L_total_num.initialize();
  L_total_klb.initialize();
  L_total_knum_yr.initialize();
  L_total_klb_yr.initialize();

  for(iyear=styr; iyear<=endyr; iyear++)
  {
        L_total_klb_yr(iyear)=pred_comm_L_klb(iyear)+pred_GR_L_klb(iyear);//+pred_HB_L_klb(iyear)+pred_cL_L_klb(iyear)
        L_total_knum_yr(iyear)=pred_comm_L_knum(iyear)+pred_GR_L_knum(iyear);//+pred_HB_L_knum(iyear)+pred_cL_L_knum(iyear)

        B(iyear)=elem_prod(N(iyear),wgt_mt);
        totN(iyear)=sum(N(iyear));
        totB(iyear)=sum(B(iyear));
  }

  L_total_num=L_comm_num+L_GR_num;//+L_HB_num+L_cL_num   //landings at age in number fish
  L_total_klb=L_comm_klb+L_GR_klb;//+L_HB_klb+L_cL_klb   //landings at age in klb whole weight

  //Time series of interest
  B(endyr+1)=elem_prod(N(endyr+1),wgt_mt);
  totN(endyr+1)=sum(N(endyr+1));
  totB(endyr+1)=sum(B(endyr+1));
  SdS0=SSB/S0;

  Fend_mean_temp=1.0;
  for (iyear=1; iyear<=selpar_n_yrs_wgted; iyear++) {Fend_mean_temp*=Fapex(endyr-iyear+1);}
  Fend_mean=pow(Fend_mean_temp,(1.0/selpar_n_yrs_wgted));
  if(F_msy_out>0)
    {
      FdF_msy=Fapex/F_msy_out;
      FdF_msy_end=FdF_msy(endyr);
```

```
      FdF_msy_end_mean=Fend_mean/F_msy_out;
    }
  if(SSB_msy_out>0)
    {
      SdSSB_msy=SSB/SSB_msy_out;
      SdSSB_msy_end=SdSSB_msy(endyr);
    }

if(F30_out>0)
    {
  FdF30=Fapex/F30_out;
  FdF30_end_mean=Fend_mean/F30_out;
}
  if(SSB_F30_out>0)
    {
      SdSSB_F30=SSB/SSB_F30_out;
  Sdmsst_F30=SSB/(smsy2msst75*SSB_F30_out);
      SdSSB_F30_end=SdSSB_F30(endyr);
  Sdmsst_F30_end=Sdmsst_F30(endyr);
    }

if(F40_out>0)
    {
  FdF40=Fapex/F40_out;
  FdF40_end_mean=Fend_mean/F40_out;
}
  if(SSB_F40_out>0)
    {
      SdSSB_F40=SSB/SSB_F40_out;
  Sdmsst_F40=SSB/(smsy2msst75*SSB_F40_out);
      SdSSB_F40_end=SdSSB_F40(endyr);
  Sdmsst_F40_end=Sdmsst_F40(endyr);
    }
   //fill in log recruitment deviations for yrs they are nonzero
   for(iyear=styr_rec_dev; iyear<=endyr_rec_dev; iyear++)
     {log_rec_dev_output(iyear)=log_rec_dev(iyear);}
   //fill in log Nage deviations for ages they are nonzero (ages2+)
   for(iage=2; iage<=nages; iage++)
     {log_Nage_dev_output(iage)=log_Nage_dev(iage);}

//-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_projection

    switch(Fproj_switch){
       case 1: //F=Fcurrent
          F_reg_proj=Fend_mean;
          break;
       case 2: //F=Fmsy
          F_reg_proj=F_msy_out;
          break;
       case 3: //F=F30
          F_reg_proj=F30_out;
          break;
       case 4: //F=F40
          F_reg_proj=F40_out;
          break;
       default: // no such switch available
          cout << "Error in input: Projection switch Fproj_switch must be set to 1, 2, 3, or 4." << endl;
          cout << "Presently it is set to " << Fproj_switch <<"."<< endl;
          exit(0);
   }

  N_proj(styr_proj)=N(endyr+1); //initial conditions computed previously

  for (iyear=styr_proj; iyear<=endyr_proj; iyear++) //recruitment follows S-R curve (with bias correction) exactly
  {
        if (iyear<styr_regs) {F_proj(iyear)=Fend_mean;}
else {F_proj(iyear)=Fproj_mult*F_reg_proj;}

FL_age_proj=sel_wgted_L*F_proj(iyear);

        Z_proj(iyear)=M+FL_age_proj;//+FD_age_proj;
        N_spawn_proj(iyear)(1,nages)=elem_prod(N_proj(iyear)(1,nages),(mfexp(-1.*(Z_proj(iyear)(1,nages))*spawn_time_frac))); //peak spawning time
SSB_proj(iyear)= sum(elem_prod(N_spawn_proj(iyear),reprod));
        B_proj(iyear)=sum(elem_prod(N_proj(iyear),wgt_mt)); //uses spawning weight

for (iage=1; iage<=nages; iage++)
{L_age_proj(iyear,iage)=N_proj(iyear,iage)*FL_age_proj(iage)*(1.-mfexp(-1.*Z_proj(iyear,iage)))/Z_proj(iyear,iage);
}
        L_knum_proj(iyear)=sum(L_age_proj(iyear))/1000.0;
    L_klb_proj(iyear)=sum(elem_prod(L_age_proj(iyear),wgt_wgted_L_klb));     //in 1000 lb

if (iyear<endyr_proj) {
N_proj(iyear+1,1)=BiasCor*SR_func(R0, steep, spr_F0, SSB_proj(iyear),SR_switch);
N_proj(iyear+1)(2,nages)=++elem_prod(N_proj(iyear)(1,nages-1),(mfexp(-1.*Z_proj(iyear)(1,nages-1))));
N_proj(iyear+1,nages)+=N_proj(iyear,nages)*mfexp(-1.*Z_proj(iyear,nages)); //plus group
}
  }
   R_proj=column(N_proj,1);
//-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------


FUNCTION evaluate_objective_function
  //fval=square(xdum-9.0);
```

```
  fval=0.0;
  fval_data=0.0;
//---likelihoods---------------------------

//---Indices-------------------------------

  f_HB_cpue=0.0;
  f_HB_cpue=lk_lognormal(pred_HB_cpue, obs_HB_cpue, HB_cpue_cv, w_I_HB);
  fval+=f_HB_cpue;
  fval_data+=f_HB_cpue;

//---Landings-------------------------------

  //f_comm_L in 1000 lb whole wgt
  f_comm_L=lk_lognormal(pred_comm_L_klb(styr_comm_L,endyr_comm_L), obs_comm_L(styr_comm_L,endyr_comm_L),
                    comm_L_cv(styr_comm_L,endyr_comm_L), w_L);
  fval+=f_comm_L;
  fval_data+=f_comm_L;

  //f_GR_L in 1000 fish
  f_GR_L=lk_lognormal(pred_GR_L_knum(styr_GR_L,endyr_GR_L), obs_GR_L(styr_GR_L,endyr_GR_L),
                    GR_L_cv(styr_GR_L,endyr_GR_L), w_L);
  fval+=f_GR_L;
  fval_data+=f_GR_L;

//---Length comps-------------------------------

  f_comm_lenc=lk_dirichlet_multinomial(nsamp_comm_lenc, pred_comm_lenc, obs_comm_lenc, nyr_comm_lenc, double(nlenbins), minSS_comm_lenc, log_dm_comm_lc);
  fval+=f_comm_lenc;
  fval_data+=f_comm_lenc;


//---Age comps-------------------------------

//f_GR_agec
  //f_GR_agec=lk_robust_multinomial(nsamp_GR_agec, pred_GR_agec, obs_GR_agec, nyr_GR_agec, double(nages_agec), minSS_GR_agec, w_ac_GR);
  //f_GR_agec=lk_logistic_normal(nsamp_GR_agec, pred_GR_agec, obs_GR_agec, nyr_GR_agec, double(nages_agec), minSS_GR_agec);
  f_GR_agec=lk_dirichlet_multinomial(nsamp_GR_agec, pred_GR_agec, obs_GR_agec, nyr_GR_agec, double(nages_agec), minSS_GR_agec, log_dm_GR_ac);
  fval+=f_GR_agec;
  fval_data+=f_GR_agec;
//-----------Constraints and penalties--------------------------------

  //Light penalty applied to log_Nage_dev for deviation from zero. If not estimated, this penalty equals zero.
  f_Nage_init=norm2(log_Nage_dev);
  fval+=w_Nage_init*f_Nage_init;

  f_rec_dev=0.0;
  //rec_sigma_sq=square(rec_sigma);
  rec_logL_add=nyrs_rec*log(rec_sigma);
  f_rec_dev=(square(log_rec_dev(styr_rec_dev) + rec_sigma_sq/2.0)/(2.0*rec_sigma_sq));
  for(iyear=(styr_rec_dev+1); iyear<=endyr_rec_dev; iyear++)
  {f_rec_dev+=(square(log_rec_dev(iyear)-R_autocorr*log_rec_dev(iyear-1) + rec_sigma_sq/2.0)/
             (2.0*rec_sigma_sq));}
  f_rec_dev+=rec_logL_add;
  fval+=w_rec*f_rec_dev;

  f_rec_dev_early=0.0; //possible extra constraint on early rec deviations
  if (w_rec_early>0.0)
    { if (styr_rec_dev<endyr_rec_phase1)
        {
          for(iyear=styr_rec_dev; iyear<=endyr_rec_phase1; iyear++)
          //{f_rec_dev_early+=(square(log_rec_dev(iyear)-R_autocorr*log_rec_dev(iyear-1) + rec_sigma_sq/2.0)/
          //                   (2.0*rec_sigma_sq)) + rec_logL_add;}
          {f_rec_dev_early+=square(log_rec_dev(iyear));}
        }
  fval+=w_rec_early*f_rec_dev_early;
  }

  f_rec_dev_end=0.0; //possible extra constraint on ending rec deviations
  if (w_rec_end>0.0)
  { if (endyr_rec_phase2<endyr_rec_dev)
        {
          for(iyear=(endyr_rec_phase2+1); iyear<=endyr_rec_dev; iyear++)
          //{f_rec_dev_end+=(square(log_rec_dev(iyear)-R_autocorr*log_rec_dev(iyear-1) + rec_sigma_sq/2.0)/
          //                  (2.0*rec_sigma_sq)) + rec_logL_add;}
          {f_rec_dev_end+=square(log_rec_dev(iyear));}
        }
      fval+=w_rec_end*f_rec_dev_end;
   }

  //Ftune penalty: does not apply in last phase
  f_Ftune=0.0;
  if (w_Ftune>0.0)
  {if (set_Ftune>0.0 && !last_phase()) {f_Ftune=square(Fapex(set_Ftune_yr)-set_Ftune);}
   fval+=w_Ftune*f_Ftune;
  }

  //Penalty if apical F exceeds 3.0
  f_fullF_constraint=0.0;
  if (w_fullF>0.0)
  {for (iyear=styr; iyear<=endyr; iyear++)
        {if(Fapex(iyear)>3.0) {f_fullF_constraint+=(mfexp(Fapex(iyear)-3.0)-1.0);}}
   fval+=w_fullF*f_fullF_constraint;
  }
```

```
 f_HB_RWq_cpue=0.0;
 for (iyear=styr_HB_cpue; iyear<endyr_HB_cpue; iyear++)
     {f_HB_RWq_cpue+=square(q_RW_log_dev_HB(iyear))/(2.0*set_RWq_var);}
 fval+=f_HB_RWq_cpue;

//---Priors---------------------------------------------------
//neg_log_prior arguments: estimate, prior mean, prior var/-CV, pdf type
//Variance input as a negative value is considered to be CV in arithmetic space (CV=-1 implies loose prior)
//pdf type 1=none, 2=lognormal, 3=normal, 4=beta
  f_priors=0.0;
  f_priors+=neg_log_prior(len_cv_val,set_len_cv(5),set_len_cv(6),set_len_cv(7));

  f_priors+=neg_log_prior(steep,set_steep(5),set_steep(6),set_steep(7));
  f_priors+=neg_log_prior(log_R0,set_log_R0(5),set_log_R0(6),set_log_R0(7));
  f_priors+=neg_log_prior(R_autocorr,set_R_autocorr(5),set_R_autocorr(6),set_R_autocorr(7));
  f_priors+=neg_log_prior(rec_sigma,set_rec_sigma(5),set_rec_sigma(6),set_rec_sigma(7));

  f_priors+=neg_log_prior(selpar_A50_comm1,set_selpar_A50_comm1(5), set_selpar_A50_comm1(6), set_selpar_A50_comm1(7));
  f_priors+=neg_log_prior(selpar_slope_comm1,set_selpar_slope_comm1(5), set_selpar_slope_comm1(6), set_selpar_slope_comm1(7));
  //f_priors+=neg_log_prior(selpar_A50_comm2,set_selpar_A50_comm2(5), set_selpar_A50_comm2(6), set_selpar_A50_comm2(7));
  //f_priors+=neg_log_prior(selpar_slope_comm2,set_selpar_slope_comm2(5), set_selpar_slope_comm2(6), set_selpar_slope_comm2(7));
  // f_priors+=neg_log_prior(selpar_A502_comm2,set_selpar_A502_comm2(5), set_selpar_A502_comm2(6), set_selpar_A502_comm2(7));
  // f_priors+=neg_log_prior(selpar_slope2_comm2,set_selpar_slope2_comm2(5), set_selpar_slope2_comm2(6), set_selpar_slope2_comm2(7));
  //f_priors+=neg_log_prior(selpar_A50_comm3,set_selpar_A50_comm3(5), set_selpar_A50_comm3(6), set_selpar_A50_comm3(7));
  //f_priors+=neg_log_prior(selpar_slope_comm3,set_selpar_slope_comm3(5), set_selpar_slope_comm3(6), set_selpar_slope_comm3(7));


  f_priors+=neg_log_prior(selpar_A50_GR1,set_selpar_A50_GR1(5), set_selpar_A50_GR1(6), set_selpar_A50_GR1(7));
  f_priors+=neg_log_prior(selpar_slope_GR1,set_selpar_slope_GR1(5), set_selpar_slope_GR1(6), set_selpar_slope_GR1(7));
  f_priors+=neg_log_prior(selpar_A50_GR2,set_selpar_A50_GR2(5), set_selpar_A50_GR2(6), set_selpar_A50_GR2(7));
  f_priors+=neg_log_prior(selpar_slope_GR2,set_selpar_slope_GR2(5), set_selpar_slope_GR2(6), set_selpar_slope_GR2(7));

   f_priors+=neg_log_prior(log_q_HB,set_log_q_HB(5),set_log_q_HB(6),set_log_q_HB(7));

  f_priors+=neg_log_prior(log_dm_comm_lc,set_log_dm_comm_lc(5),set_log_dm_comm_lc(6),set_log_dm_comm_lc(7));
  //f_priors+=neg_log_prior(log_dm_cL_lc,set_log_dm_cL_lc(5),set_log_dm_cL_lc(6),set_log_dm_cL_lc(7));
  f_priors+=neg_log_prior(log_dm_GR_ac,set_log_dm_GR_ac(5),set_log_dm_GR_ac(6),set_log_dm_GR_ac(7));
  //f_priors+=neg_log_prior(log_dm_GR_lc,set_log_dm_GR_lc(5),set_log_dm_GR_lc(6),set_log_dm_GR_lc(7));

  f_priors+=neg_log_prior(F_init,set_F_init(5),set_F_init(6),set_F_init(7));

  fval+=f_priors;

//----------------------------------------------------------------------------------
//Logistic function: 2 parameters
FUNCTION dvar_vector logistic(const dvar_vector& ages, const dvariable& A50, const dvariable& slope)
  //ages=vector of ages, A50=age at 50% selectivity, slope=rate of increase
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=1./(1.+mfexp(-1.*slope*(ages-A50))); //logistic;
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Logistic-exponential: 4 parameters (but 1 is fixed)
FUNCTION dvar_vector logistic_exponential(const dvar_vector& ages, const dvariable& A50, const dvariable& slope, const dvariable& sigma, const dvariable& joint)
  //ages=vector of ages, A50=age at 50% sel (ascending limb), slope=rate of increase, sigma=controls rate of descent (descending)
  //joint=age to join curves
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=1.0;
  for (iage=1; iage<=nages; iage++)
  {
   if (ages(iage)<joint) {Sel_Tmp(iage)=1./(1.+mfexp(-1.*slope*(ages(iage)-A50)));}
   if (ages(iage)>joint){Sel_Tmp(iage)=mfexp(-1.*square((ages(iage)-joint)/sigma));}
  }
  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Logistic function: 4 parameters
FUNCTION dvar_vector logistic_double(const dvar_vector& ages, const dvariable& A501, const dvariable& slope1, const dvariable& A502, const dvariable& slope2)
  //ages=vector of ages, A50=age at 50% selectivity, slope=rate of increase, A502=age at 50% decrease additive to A501, slope2=slope of decrease
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=elem_prod( (1./(1.+mfexp(-1.*slope1*(ages-A501)))),(1.-(1./(1.+mfexp(-1.*slope2*(ages-(A501+A502)))))) );
  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Jointed logistic function: 6 parameters (increasing and decreasing logistics joined at peak selectivity)
FUNCTION dvar_vector logistic_joint(const dvar_vector& ages, const dvariable& A501, const dvariable& slope1, const dvariable& A502, const dvariable& slope2, const dvariable& satval, const dvariable& joint)
  //ages=vector of ages, A501=age at 50% sel (ascending limb), slope1=rate of increase,A502=age at 50% sel (descending), slope1=rate of increase (ascending),
  //satval=saturation value of descending limb, joint=location in age vector to join curves (may equal age or age + 1 if age-0 is included)
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=1.0;
  for (iage=1; iage<=nages; iage++)
  {
   if (double(iage)<joint) {Sel_Tmp(iage)=1./(1.+mfexp(-1.*slope1*(ages(iage)-A501)));}
   if (double(iage)>joint){Sel_Tmp(iage)=1.0-(1.0-satval)/(1.+mfexp(-1.*slope2*(ages(iage)-A502)));}
  }
  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
```

```
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Double Gaussian function: 6 parameters (as in SS3)
FUNCTION dvar_vector gaussian_double(const dvar_vector& ages, const dvariable& peak, const dvariable& top, const dvariable& ascwid, const dvariable& deswid, const dvariable& init, const dvariable& final)
  //ages=vector of ages, peak=ascending inflection location (as logistic), top=width of plateau, ascwid=ascent width (as log(width))
  //deswid=descent width (as log(width))
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step1(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step2(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step3(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step4(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step5(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step6(ages.indexmin(),ages.indexmax());
  dvar_vector pars_tmp(1,6); dvar_vector sel_tmp_iq(1,2);

  pars_tmp(1)=peak;
  pars_tmp(2)=peak+1.0+(0.99*ages(nages)-peak-1.0)/(1.0+mfexp(-top));
  pars_tmp(3)=mfexp(ascwid);
  pars_tmp(4)=mfexp(deswid);
  pars_tmp(5)=1.0/(1.0+mfexp(-init));
  pars_tmp(6)=1.0/(1.0+mfexp(-final));

  sel_tmp_iq(1)=mfexp(-(square(ages(1)-pars_tmp(1))/pars_tmp(3)));
  sel_tmp_iq(2)=mfexp(-(square(ages(nages)-pars_tmp(2))/pars_tmp(4)));

  sel_step1=mfexp(-(square(ages-pars_tmp(1))/pars_tmp(3)));
  sel_step2=pars_tmp(5)+(1.0-pars_tmp(5))*(sel_step1-sel_tmp_iq(1))/(1.0-sel_tmp_iq(1));
  sel_step3=mfexp(-(square(ages-pars_tmp(2))/pars_tmp(4)));
  sel_step4=1.0+(pars_tmp(6)-1.0)*(sel_step3-1.0)/(sel_tmp_iq(2)-1.0);
  sel_step5=1.0/ (1.0+mfexp(-(20.0* elem_div((ages-pars_tmp(1)), (1.0+sfabs(ages-pars_tmp(1)))) )));
  sel_step6=1.0/(1.0+mfexp(-(20.0*elem_div((ages-pars_tmp(2)),(1.0+sfabs(ages-pars_tmp(2)))) )));

  Sel_Tmp=elem_prod(sel_step2,(1.0-sel_step5))+
          elem_prod(sel_step5,((1.0-sel_step6)+ elem_prod(sel_step4,sel_step6)) );

  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Spawner-recruit function (Beverton-Holt or Ricker)
FUNCTION dvariable SR_func(const dvariable& R0, const dvariable& h, const dvariable& spr_F0, const dvariable& SSB, int func)
  //R0=virgin recruitment, h=steepness, spr_F0=spawners per recruit @ F=0, SSB=spawning biomass
  //func=1 for Beverton-Holt, 2 for Ricker
  RETURN_ARRAYS_INCREMENT();
  dvariable Recruits_Tmp;
  switch(func) {
    case 1: //Beverton-Holt
      Recruits_Tmp=((0.8*R0*h*SSB)/(0.2*R0*spr_F0*(1.0-h)+(h-0.2)*SSB));
    break;
    case 2: //Ricker
      Recruits_Tmp=((SSB/spr_F0)*mfexp(h*(1-SSB/(R0*spr_F0))));
    break;
  }
  RETURN_ARRAYS_DECREMENT();
  return Recruits_Tmp;

//-----------------------------------------------------------------------------------
//Spawner-recruit equilibrium function (Beverton-Holt or Ricker)
FUNCTION dvariable SR_eq_func(const dvariable& R0, const dvariable& h, const dvariable& spr_F0, const dvariable& spr_F, const dvariable& BC, int func)
  //R0=virgin recruitment, h=steepness, spr_F0=spawners per recruit @ F=0, spr_F=spawners per recruit @ F, BC=bias correction
  //func=1 for Beverton-Holt, 2 for Ricker
  RETURN_ARRAYS_INCREMENT();
  dvariable Recruits_Tmp;
  switch(func) {
    case 1: //Beverton-Holt
      Recruits_Tmp=(R0/((5.0*h-1.0)*spr_F))*(BC*4.0*h*spr_F-spr_F0*(1.0-h));
    break;
    case 2: //Ricker
      Recruits_Tmp=R0/(spr_F/spr_F0)*(1.0+log(BC*spr_F/spr_F0)/h);
    break;
  }
  RETURN_ARRAYS_DECREMENT();
  return Recruits_Tmp;

//-----------------------------------------------------------------------------------
//compute multinomial effective sample size for a single yr
FUNCTION dvariable multinom_eff_N(const dvar_vector& pred_comp, const dvar_vector& obs_comp)
  //pred_comp=vector of predicted comps, obscomp=vector of observed comps
  dvariable EffN_Tmp; dvariable numer; dvariable denom;
  RETURN_ARRAYS_INCREMENT();
  numer=sum( elem_prod(pred_comp,(1.0-pred_comp)) );
  denom=sum( square(obs_comp-pred_comp) );
  if (denom>0.0) {EffN_Tmp=numer/denom;}
  else {EffN_Tmp=-missing;}
  RETURN_ARRAYS_DECREMENT();
  return EffN_Tmp;

//-----------------------------------------------------------------------------------
//Likelihood contribution: lognormal
FUNCTION dvariable lk_lognormal(const dvar_vector& pred, const dvar_vector& obs, const dvar_vector& cv, const dvariable& wgt_dat)
  //pred=vector of predicted vals, obs=vector of observed vals, cv=vector of CVs in arithmetic space, wgt_dat=constant scaling of CVs
```

```
  //small_number is small value to avoid log(0) during search
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  dvar_vector var(cv.indexmin(),cv.indexmax()); //variance in log space
  var=log(1.0+square(cv/wgt_dat));   // convert cv in arithmetic space to variance in log space
  LkvalTmp=sum(0.5*elem_div(square(log(elem_div((pred+small_number),(obs+small_number)))),var) );
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//-----------------------------------------------------------------------------------
//Likelihood contribution: multinomial
FUNCTION dvariable lk_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const double& minSS, const dvariable& wgt_dat)
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, minSS=min N threshold, wgt_dat=scaling of N's
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  LkvalTmp=0.0;
  for (int ii=1; ii<=ncomp; ii++)
  {if (nsamp(ii)>=minSS)
    {LkvalTmp-=wgt_dat*nsamp(ii)*sum(elem_prod((obs_comp(ii)+small_number),
               log(elem_div((pred_comp(ii)+small_number), (obs_comp(ii)+small_number)))));
    }
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//-----------------------------------------------------------------------------------
//Likelihood contribution: robust multinomial
FUNCTION dvariable lk_robust_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS, const dvariable& wgt
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold, wgt_dat=scaling of N's
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  LkvalTmp=0.0;
  dvar_matrix Eprime=elem_prod((1.0-obs_comp), obs_comp)+0.1/mbin; //E' of Francis 2011, p.1131
  dvar_vector nsamp_wgt=nsamp*wgt_dat;
  //cout<<nsamp_wgt<<endl;
  for (int ii=1; ii<=ncomp; ii++)
  {if (nsamp(ii)>=minSS)
    {LkvalTmp+= sum(0.5*log(Eprime(ii))-log(small_number+mfexp(elem_div((-square(obs_comp(ii)-pred_comp(ii))) , (Eprime(ii)*2.0/nsamp_wgt(ii)) ))) );
    }
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//-----------------------------------------------------------------------------------
//Likelihood contribution: Dirichlet-multinomial
FUNCTION dvariable lk_dirichlet_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS, const dvariable&
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold, wgt_dat=scaling of N's
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.00001;
  LkvalTmp=0.0;
  dvar_vector nsamp_adjust=nsamp*mfexp(log_dir_par);
   //dvar_vector nsamp_adjust=mfexp(log_dir_par);
  for (int ii=1; ii<=ncomp; ii++)
  {
if (nsamp(ii)>=minSS)
    {
LkvalTmp-=gammln(nsamp_adjust(ii))-gammln(nsamp(ii)+nsamp_adjust(ii));
LkvalTmp-=sum(gammln(nsamp(ii)*obs_comp(ii)+nsamp_adjust(ii)*pred_comp(ii)+small_number));
LkvalTmp+=sum(gammln(nsamp_adjust(ii)*pred_comp(ii)+small_number));
    }
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

// //Likelihood contribution: Dirichlet-multinomial
// FUNCTION dvariable lk_dirichlet_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS, const dvariabl
  // //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold, wgt_dat=scaling of N's
  // RETURN_ARRAYS_INCREMENT();
  // dvariable LkvalTmp;
  // LkvalTmp=0.0;
  // dvar_vector nsamp_adjust=nsamp*mfexp(log_dir_par);
  // //dvar_vector nsamp_adjust=mfexp(log_dir_par);
  // for (int ii=1; ii<=ncomp; ii++)
  // {
// if (nsamp(ii)>=minSS)
    // {
// LkvalTmp-=gammln(nsamp_adjust(ii))-gammln(nsamp(ii)+nsamp_adjust(ii));
// LkvalTmp-=sum(gammln(nsamp(ii)*obs_comp(ii)+nsamp_adjust(ii)*pred_comp(ii)));
        // LkvalTmp+=sum(gammln(nsamp_adjust(ii)*pred_comp(ii)));
    // }
  // }
  // RETURN_ARRAYS_DECREMENT();
  // return LkvalTmp;


//-----------------------------------------------------------------------------------
//Likelihood contribution: logistic normal (aka multivariate logistic in iSCAM; logistic normal in Francis' terminology)
FUNCTION dvariable lk_logistic_normal(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS)
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
```

```
  dvariable small_number=0.0001;
  LkvalTmp=0.0;
  dvar_matrix nu=pred_comp+0.0;
  dvar_matrix pred_plus=pred_comp+small_number;
  dvar_matrix obs_plus=obs_comp+small_number;

  dvariable nu_mean;
  dvariable nu_sum_sq;
  dvariable tau_hat_sq;
  dvariable year_count; //keeps track of years included in likelihood (i.e., that meet the sample size requirement)

  LkvalTmp=0.0;
  nu_sum_sq=0.0;
  year_count=0.0;
  for (int ii=1; ii<=ncomp; ii++)
  {if (nsamp(ii)>=minSS)
    {
year_count+=1.0;
nu_mean=sum( log(obs_plus(ii))-log(pred_plus(ii))  )/mbin; //year-specific mean log residual
for (int jj=1; jj<=mbin;jj++)
{
nu(ii,jj) = log(obs_plus(ii,jj)) - log(pred_plus(ii,jj)) - nu_mean;
nu_sum_sq += square(nu(ii,jj));
}
    }
  }
  if (year_count>0.0)
  {
  tau_hat_sq = nu_sum_sq/((mbin-1.0)*year_count);
  LkvalTmp = (mbin-1.0)*year_count*log(tau_hat_sq);
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//-----------------------------------------------------------------------------------
//-----------------------------------------------------------------------------------
//Likelihood contribution: priors
FUNCTION  dvariable neg_log_prior(dvariable pred, const double& prior, dvariable var, int pdf)
  //prior=prior point estimate, var=variance (if negative, treated as CV in arithmetic space), pred=predicted value, pdf=prior type (1=none, 2=lognormal, 3=normal, 4=beta)
    dvariable LkvalTmp;
    dvariable alpha, beta, ab_iq;
    dvariable big_number=1e10;
    LkvalTmp=0.0;
    // compute generic pdf's
    switch(pdf) {
        case 1: //option to turn off prior
          LkvalTmp=0.0;
          break;
        case 2: // lognormal
          if(prior<=0.0) cout << "YIKES: Don't use a lognormal distn for a negative prior" << endl;
          else if(pred<=0) LkvalTmp=big_number=1e10;
          else {
            if(var<0.0) var=log(1.0+var*var) ;      // convert cv to variance on log scale
            LkvalTmp= 0.5*( square(log(pred/prior))/var + log(var) );
          }
        break;
        case 3: // normal
          if(var<0.0 && prior!=0.0) var=square(var*prior);       // convert cv to variance on observation scale
          else if(var<0.0 && prior==0.0) var=-var;               // cv not really appropriate if prior value equals zero
          LkvalTmp= 0.5*( square(pred-prior)/var + log(var) );
          break;
        case 4: // beta
          if(var<0.0) var=square(var*prior);          // convert cv to variance on observation scale
          if(prior<=0.0 || prior>=1.0) cout << "YIKES: Don't use a beta distn for a prior outside (0,1)" << endl;
          ab_iq=prior*(1.0-prior)/var - 1.0; alpha=prior*ab_iq; beta=(1.0-prior)*ab_iq;
          if(pred>=0 && pred<=1) LkvalTmp= (1.0-alpha)*log(pred)+(1.0-beta)*log(1.0-pred)-gammln(alpha+beta)+gammln(alpha)+gammln(beta);
          else LkvalTmp=big_number;
          break;
        default: // no such prior pdf currently available
          cout << "The prior must be either 1(lognormal), 2(normal), or 3(beta)." << endl;
          cout << "Presently it is " << pdf << endl;
          exit(0);
    }
    return LkvalTmp;

//-----------------------------------------------------------------------------------
//SDNR: age comp likelihood (assumes fits are done with the robust multinomial function)
FUNCTION dvariable sdnr_multinomial(const double& ncomp, const dvar_vector& ages, const dvar_vector& nsamp,
                                    const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const dvariable& wgt_dat)
  //ncomp=number of years of data, ages=vector of ages, nsamp=vector of N's,
  //pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, wgt_dat=likelihood weight for data source
  RETURN_ARRAYS_INCREMENT();
  dvariable SdnrTmp;
  dvar_vector o(1,ncomp);
  dvar_vector p(1,ncomp);
  dvar_vector ose(1,ncomp);
  dvar_vector res(1,ncomp);
  SdnrTmp=0.0;
  for (int ii=1; ii<=ncomp; ii++)
  {
    o(ii)=sum(elem_prod(ages,obs_comp(ii)));
    p(ii)=sum(elem_prod(ages,pred_comp(ii)));
    ose(ii)=sqrt((sum(elem_prod(square(ages),pred_comp(ii)))-square(p(ii)))/(nsamp(ii)*wgt_dat));
  }
  res=elem_div((o-p),ose);
```

```
  SdnrTmp=sqrt(sum(square(res-(sum(res)/ncomp))/(ncomp-1.0)));
  RETURN_ARRAYS_DECREMENT();
  return SdnrTmp;

//-----------------------------------------------------------------------------------
//SDNR: lognormal likelihood
FUNCTION dvariable sdnr_lognormal(const dvar_vector& pred, const dvar_vector& obs, const dvar_vector& cv, const dvariable& wgt_dat)
  //nyr=number of years of data, pred=vector of predicted data, obs=vector of observed data, cv=vector of cv's, wgt_dat=likelihood weight for data source
  RETURN_ARRAYS_INCREMENT();
  dvariable SdnrTmp;
  dvariable small_number=0.00001;
  dvariable n;
  dvar_vector res(cv.indexmin(),cv.indexmax());
  SdnrTmp=0.0;
  res=elem_div(log(elem_div(obs+small_number,pred+small_number)),sqrt(log(1+square(cv/wgt_dat))));
  n=cv.indexmax()-cv.indexmin()+1;
  SdnrTmp=sqrt(sum(square(res-(sum(res)/n))/(n-1.0)));
  RETURN_ARRAYS_DECREMENT();
  return SdnrTmp;

//-----------------------------------------------------------------------------------
REPORT_SECTION

  if (last_phase())
  {
      cout<<"start report"<<endl;
       //cout<<"xdum = "<<xdum<<endl;
  get_weighted_current();
       cout<<"got weighted"<<endl;
      get_msy();
       cout<<"got msy"<<endl;
      get_per_recruit_stuff();
       cout<<"got per recruit"<<endl;
      get_miscellaneous_stuff();
       cout<<"got misc stuff"<<endl;
  get_projection();
   cout<<"got projection"<<endl;

      grad_max=objective_function_value::pobjfun->gmax;
      time(&finish);
  elapsed_time=difftime(finish,start);
  hour=long(elapsed_time)/3600;
  minute=long(elapsed_time)%3600/60;
  second=(long(elapsed_time)%3600)%60;
  cout<<endl<<endl<<"*******************************************"<<endl;
  cout<<"--Start time: "<<ctime(&start)<<endl;
  cout<<"--Finish time: "<<ctime(&finish)<<endl;
  cout<<"--Runtime: ";
  cout<<hour<<" hours, "<<minute<<" minutes, "<<second<<" seconds"<<endl;
  cout << "--TotalLikelihood: " << fval << endl;
      cout<<"--Final gradient: "<<objective_function_value::pobjfun->gmax << endl;
  cout<<"*******************************************"<<endl;

      cout <<endl;
      cout << "><>--><>--><>--><>--><>--><>--><>--><>--><>--><>"  <<endl;
      cout << "BC Fmsy=" << F_msy_out<< "   BC SSBmsy=" << SSB_msy_out <<endl;
      cout <<"F status="<<FdF_msy_end<<endl;
      cout <<"Pop status="<<SdSSB_msy_end<<endl;
      cout << "h="<<steep<<"   R0="<<R0<<endl;
      //cout << "xdum " << xdum << endl;
      cout << "><>--><>--><>--><>--><>--><>--><>--><>--><>--><>"  <<endl;

      report << "TotalLikelihood " << fval << endl;
      report << "N" << endl;
      report << N<<endl;
      report << "F" << endl;
      report << F <<endl;
      // report << "prob_belowsizelim_block3" << endl;
  // report<<prob_belowsizelim_block3<<endl;

      sdnr_I_HB=sdnr_lognormal(pred_HB_cpue, obs_HB_cpue, HB_cpue_cv, w_I_HB);

      //##############################################################################################
      //##  Passing parameters to vector for bounds check plotting
      //##############################################################################################
       Linf_out(8)=Linf; Linf_out(1,7)=set_Linf;
       K_out(8)=K; K_out(1,7)=set_K;
       t0_out(8)=t0; t0_out(1,7)=set_t0;
       len_cv_val_out(8)=len_cv_val; len_cv_val_out(1,7)=set_len_cv;

   Linf_L_out(8)=Linf_L; Linf_L_out(1,7)=set_Linf_L;
       K_L_out(8)=K_L; K_L_out(1,7)=set_K_L;
       t0_L_out(8)=t0_L; t0_L_out(1,7)=set_t0_L;
       len_cv_val_L_out(8)=len_cv_val_L; len_cv_val_L_out(1,7)=set_len_cv_L;

   Linf_F_out(8)=Linf_F; Linf_F_out(1,7)=set_Linf_F;
       K_F_out(8)=K_F; K_F_out(1,7)=set_K_F;
       t0_F_out(8)=t0_F; t0_F_out(1,7)=set_t0_F;
       len_cv_val_F_out(8)=len_cv_val_F; len_cv_val_F_out(1,7)=set_len_cv_F;

       log_R0_out(8)=log_R0; log_R0_out(1,7)=set_log_R0;
       M_constant_out(8)=M_constant; M_constant_out(1,7)=set_M_constant;
       steep_out(8)=steep; steep_out(1,7)=set_steep;
       rec_sigma_out(8)=rec_sigma; rec_sigma_out(1,7)=set_rec_sigma;
       R_autocorr_out(8)=R_autocorr; R_autocorr_out(1,7)=set_R_autocorr;
```

```
 log_dm_comm_lc_out(8)=log_dm_comm_lc; log_dm_comm_lc_out(1,7)=set_log_dm_comm_lc;
 log_dm_GR_ac_out(8)=log_dm_GR_ac; log_dm_GR_ac_out(1,7)=set_log_dm_GR_ac;

     selpar_A50_comm1_out(8)=selpar_A50_comm1; selpar_A50_comm1_out(1,7)=set_selpar_A50_comm1;
     selpar_slope_comm1_out(8)=selpar_slope_comm1; selpar_slope_comm1_out(1,7)=set_selpar_slope_comm1;

 selpar_A50_GR1_out(8)=selpar_A50_GR1; selpar_A50_GR1_out(1,7)=set_selpar_A50_GR1;
     selpar_slope_GR1_out(8)=selpar_slope_GR1; selpar_slope_GR1_out(1,7)=set_selpar_slope_GR1;
 selpar_A50_GR2_out(8)=selpar_A50_GR2; selpar_A50_GR2_out(1,7)=set_selpar_A50_GR2;
     selpar_slope_GR2_out(8)=selpar_slope_GR2; selpar_slope_GR2_out(1,7)=set_selpar_slope_GR2;

     log_q_HB_out(8)=log_q_HB; log_q_HB_out(1,7)=set_log_q_HB;

     log_avg_F_comm_out(8)=log_avg_F_comm; log_avg_F_comm_out(1,7)=set_log_avg_F_comm;
 log_avg_F_GR_out(8)=log_avg_F_GR; log_avg_F_GR_out(1,7)=set_log_avg_F_GR;
     F_init_out(8)=F_init; F_init_out(1,7)=set_F_init;

     log_rec_dev_out(styr_rec_dev, endyr_rec_dev)=log_rec_dev;
     log_F_dev_comm_out(styr_comm_L,endyr_comm_L)=log_F_dev_comm;
 log_F_dev_GR_out(styr_GR_L,endyr_GR_L)=log_F_dev_GR;

 #include "co22_make_Robject4.cxx"   // write the R-compatible report

} //endl last phase loop
```

SEDAR

Southeast Data, Assessment, and Review

SEDAR 58

Atlantic Cobia

SECTION IV: Addendum

December 2019

SEDAR
4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

Document History

November, 2019 Original release.

December, 2019 Assessment Report Addendum. This release incorporates the corrections made during the Review Workshop, and should be considered the revised final assessment report. All complementary analyses, including sensitivities, ensemble modeling, and the projections have been generated with the model agreed upon during the Review Workshop.

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1 Data Review and Update

In this benchmark assessment, the start year is 1986 and the terminal year is 2017. The composition data and non-hindcasted landings data start in 1986, and the Assessment Panel decided to start the model in the year when the best data become available. The Panel's decision was also based on model runs that demonstrated the fact that including earlier years of hindcasted landings data did not affect model results. Data sources from SEDAR28 were also considered here; however, all data were re–examined and evaluated using current methodologies, including data prior to 2011 (the terminal year of SEDAR28). The input data for this assessment are described below, with focus on modifications from recommendations of the Data Workshop and those used in the last assessment:

1.1 Data Review

In this benchmark assessment, the Beaufort Assessment Model (BAM) was fitted to data sources similar to those used in the SEDAR28 benchmark with some modifications and additions.

- Landings: Commercial (all gears), and General recreational (headboat, charterboat, and private boat modes).
- Discards: Commercial (handline and nets), General recreational (all modes).
- Index of abundance: Headboat CPUE
- Length compositions of landings: Commercial handline
- Age compositions of landings: General recreational

In addition to data fitted by the model, this assessment utilized life-history information that was treated as input. Such inputs, some of which remained the same for this assessment as were used in the last assessment, were provided by the life history working group: natural mortality, female maturity at age, sex ratio, and somatic growth. The discard mortality rates were compiled by the discard mortality working group.

1.2 Data Update

The following is a summarization of the data differences between this benchmark assessment and the last (SEDAR28). Data available for this assessment are summarized in Tables 1–5.

- Discards and discard mortality: The discard mortality working group provide a gillnet discard mortality rate of 0.55, compared to 0.51 in SEDAR28. Commercial and recreational discards were updated through 2017. The estimates for commercial and recreational discards are either model- or ratio-based, therefore the entire time series of estimates were provided.
- Indices of abundance: As per the data workshop recommendations, neither the SCDNR index of abundance, nor the MRFSS index of abundance were used in this assessment, though they were in the SEDAR28 assessment. The headboat index is the sole index used in this benchmark assessment.
- Size/age compositions landings: Commercial and general recreational composition data were corrected and updated through 2017, the terminal year of the assessment, though general recreational length compositions and commercial age compositions were not used. All of the updated composition data are subject to the same minimum sample size used in SEDAR28 (n=30 trips for lengths and n=10 trips for ages) though sample sizes (i.e., trip numbers) were not available for several years and states. The number of fish sampled represented the sample size for general recreational compositions, as often a single fish is caught per trip.

- Growth curves: Additional growth curves were requested by the Assessment Panel, and the analyst and Life History Working Group chairperson conducted the analyses. The Panel requested a female–only and a landings–only growth curve. The landings–only growth curve is meant to represent the average size of the fish captured by the fleet, therefore the fitting procedure did not adjust for the size limit. The females–only growth curve is meant to be used to calculate the female biomass, and therefore needs to reflect the population. Size correction methodology was used for the female–only curve to account for fishery dependent observations (lengths) being truncated by the size limit.
- The iterative reweighting method used in SEDAR28 was not used for composition data, as the Dirichlet multinomial distribution was used. The Dirichlet multinomial is a self-weighting distribution, thus removing the need for weights on the composition data. The index was weighted using the iterative reweighting procedure.
- The Charnov et al. (2013) method was used to calculate natural mortality. The Charnov et al. method is a meta–analysis that includes data from multiple studies that generate methods to estimate natural mortality. The Lorenzen method (Lorenzen 1996) used in SEDAR28 is one method used in the Charnov et al. meta–analysis.

1.2.1 Discard Mortality

The discard mortalities for all the gears were revisited by the discard mortality working group. The group reviewed five data sources from state and federal government agencies. After discussion the observed immediate discard mortality for gillnet gears was 55%. The working group recommended an upper bound of 77% and a lower bound of 36% discard mortality as was recommended during SEDAR28. For lines, the group noted that the overall discard mortality of cobia was relatively low. Estimates of discard mortality ranged from 0% to 12.4%. The group determined that a 0% lower bound estimate was not realistic and therefore adopted the lower bound of 2% from SEDAR28. The group decided that 5% was a reasonable discard mortality estimate based on results from additional data sources and the discard mortality estimate from SEDAR28.

1.2.2 Recreational Landings and Discards

Estimates were available from the recalibrated MRIP data, and were used as input for the landings and discards for all recreational modes except headboat through 2017. Headboat landings were provided through 2017, and headboat discards were calculated using a model-based approach. Headboat and general recreational landings and discards were combined into one general recreational fleet, by applying the discard mortality rate to live discards and combining the result with the landings to create one time series of removals for the general recreational fleet.

1.2.3 Commercial Landings and Discards

The commercial discards were revised for the entire time series, as it is a model-based approach, and provided through 2017. Commercial landings were updated through 2017. Commercial landings and discards were combined into one time series, consistent with SEDAR28, by applying the discard mortality rate to live discards and combining the result with the landings for one time series of removals for the commercial fleet.

1.2.4 Indices of Abundance

The fishery-dependent index was considered in light of new management measures effected since the last assessment. Closures for the recreational season have been intermittent since 2015. The change in closures since SEDAR28 clearly affects catch per effort, and it likely invalidates catch per effort as a meaningful index of abundance. Thus, the headboat index was only updated through 2015 for this assessment. This index was the only index of abundance used in the assessment.

1.2.5 Length Compositions

Length compositions for both fleets were corrected and updated through 2017. The Assessment Panel considered several possible applications of length composition data. The Panel considered including general recreational length compositions in years with no age composition data, or when the age data were sparse. However, no growth curve is estimated internally, and the quality of the age compositions is such that the length compositions were not needed to supplement, and thus they were not used in the assessment. For the commercial fleet, length compositions were inadequate to produce annual length compositions. Therefore, the Assessment Panel agreed to pool the commercial length compositions across years into a single composition.

1.2.6 Age Compositions

The commercial age compositions were discussed by the Assessment Panel, in light of the fact that the samples for ageing were not randomly sampled. The Assessment Panel decided to not use the commercial age compositions, as they did not represent the fleet. The general recreational age compositions were discussed at both the data workshop and during the assessment process. The majority of the samples are from carcass collection programs in Virginia and South Carolina. The general recreational age samples from SEDAR28 were largely carcass samples as well, therefore the discussion focused on whether the samples were different from each state. In order to account for differences, the Assessment Panel decided to weight the age samples by landings in order to provide an age composition representative of the entire fleet across states.

2 Stock Assessment Methods

This assessment updates the primary model applied during the SEDAR28 benchmark for cobia. The methods are reviewed below, and any changes since the SEDAR28 benchmark are noted.

2.1 Overview

This assessment used the Beaufort Assessment Model (BAM, Williams and Shertzer 2015), which applies an integrated catch-age formulation, implemented with the AD Model Builder software (Fournier et al. 2012). In essence, the model simulates a population forward in time while including fishing processes (Quinn and Deriso 1999; Shertzer et al. 2014). Quantities to be estimated are systematically varied until characteristics of the simulated population match available data on the real population. The model is similar in structure to Stock Synthesis (Methot and Wetzel 2013). Versions of BAM have been used in previous SEDAR assessments of reef fishes in the U.S. South Atlantic such as red porgy, tilefish, blueline tilefish, gag, greater amberjack, snowy grouper, vermilion snapper, and red snapper.

2.2 Data Sources

The catch-age model included data from two fleets that caught cobia in southeastern U.S. waters north of the Georgia Florida border: commercial and general recreational. The model was fitted to data on annual removals (in units of 1000 lb whole weight for commercial and 1000 fish for general recreational), which comprised landings and dead discards. Dead discards were computed using the discard mortalities provided at the Data Workshop. The model was also fitted to pooled length compositions of commercial landings, annual age compositions of general recreational landings, and a fishery-dependent index (headboat). Data used in the model are tabulated in §1 of this report.

2.3 Model Configuration

Model structure and equations of the BAM are detailed in Williams and Shertzer (2015). The assessment time period was 1986–2017. A general description of the assessment model follows.

2.3.1 Stock dynamics

In the assessment model, new biomass was acquired through growth and recruitment, while abundance of existing cohorts experienced exponential decay from fishing and natural mortality. The population was assumed closed to immigration and emigration. The model included age classes $1 - 12^{+}$, where the oldest age class 12^{+} allowed for the accumulation of fish (i.e., plus group).

2.3.2 Initialization

Initial (1986) abundance at age was estimated in the model as follows. First, the equilibrium age structure was computed for ages 2–12 based on natural and initial fishing mortality (F_{init}), where F_{init} is an estimated parameter. Second, lognormal deviations around that equilibrium age structure were estimated. The deviations were lightly penalized, such that the initial abundance of each age could vary from equilibrium if suggested by early composition data, but remain estimable if data were uninformative. Given the initial abundance of ages 2–12, initial (1986) abundance of age-1 fish was computed using the same methods as for recruits in other years (described below).

2.3.3 Growth

Mean size at age of the population (total length, TL) was modeled with the von Bertalanffy equation (Figure 1), and weight at age (whole weight, WW) was modeled as a function of total length. Parameters of growth and conversions (TL-WW) were estimated by the Life History Working Group and were treated as input to the assessment model. The von Bertalanffy parameter estimates for the population from the DW were $L_\infty = 1262$, $K = 0.31$, and $t_0 = -0.53$. However, the Panel decided to use two modified growth curves instead; one to fit to landings (landings only with no size limit correction), and one to calculate spawning stock biomass (females only with a size limit correction) For the landings–only growth curve, $L_\infty = 1287$, $K = 0.26$, and $t_0 = -1.74$, and for the females–only growth curve, $L_\infty = 1334$, $K = 0.32$, and $t_0 = -0.49$. For fitting length composition data, the distribution of size at age was assumed normal with coefficient of variation (CV) estimated by the assessment model. A constant CV, rather than constant standard deviation, was suggested by the size at age data. Only the CV for the landings–only curve is estimated within the model.

2.3.4 Natural mortality rate

The natural mortality rate (M) was assumed constant over time, but decreasing with age. The form of M as a function of age was based on Charnov et al. (2013). The Charnov et al. (2013) approach relates the natural mortality at age to the von Bertalanffy growth equation parameters (of the whole population) and length at age: $\mathrm{M}_a = K \times [L_a/L_\infty]^{-1.5}$, where L_∞ and K are von Bertalanffy parameters and L_a is length at age.

2.3.5 Female maturity and Spawning stock

Female maturity was modeled with a logistic function; the age at 50% female maturity was estimated to be ~ 1 year. No new data on maturity were available for this assessment, therefore the values from SEDAR28 were applied. Spawning stock was modeled as biomass of mature females measured at the time of peak spawning. For cobia, peak spawning was considered to occur mid–June.

2.3.6 Recruitment

In this assessment, steepness was not estimable, even when applying a prior distribution to inform the estimation (Shertzer and Conn 2012). Likelihood profiles showed no minimum in the likelihood surface either, therefore the Panel concluded that the stock–recruit relationship is not well–defined. In the assessment, annual recruitment was estimated as deviations around an overall average. Expected recruitment of age-1 fish was predicted from the fixed average with annual variation in recruitment assumed to occur with lognormal deviations beginning in 1986.

2.3.7 Landings

The model included time series of landings from two fleets: commercial (all gear) and general recreational (headboat, charterboat, and private boats combined). Landings were modeled with the Baranov catch equation (Baranov 1918) and were fitted in units of weight (1000 lb whole weight for commercial and 1000 fish for recreational). Observed landings were provided back to the first assessment year (1986) for each fleet.

2.3.8 Discards

Live and dead commercial discards were provided from 1993 to 2017. Live commercial discards were reduced to dead discards using the gear-specific mortality rates, as suggested by the Panel described in §1.2.1, then the dead discards were combined with landings to produce one removal time series. Live discards from the general recreational fleet were available from 1986-2017, and the single removals time series was computed similarly to what was done for the commercial fleet.

2.3.9 Fishing

For each time series of landings, the assessment model estimated a separate full fishing mortality rate (F). Age-specific rates were then computed as the product of full F and selectivity at age. Apical F was computed as the maximum of F at age summed across fleets.

2.3.10 Selectivities

Selectivity curves were estimated using a parametric approach. This approach applies plausible structure on the shape of the selectivity curves, and achieves greater parsimony than occurs with unique parameters for each age. Selectivities of landings from all fleets were modeled as flat-topped, using a two-parameter logistic function. The selectivity of the fishery-dependent index was the same as that of the general recreational fleet before the size limit regulation.

Age and length composition data are critical for estimating selectivity parameters, and ideally, a model would have sufficient composition data from each fleet over time to estimate distinct selectivities in each time block assumed in the model. The commercial length compositions informed the commercial fleet selectivity, and only one time block was modeled due to lack of regulatory change in the fleet. The general recreational age compositions informed the general recreational fleet selectivities. Two time blocks were modeled due to reports from stakeholders and state scientists that fishing behaviors changed in 2007. The Panel requested multiple runs with different pivotal years for selectivity time blocks (2005–2009), and 2007 was the pivotal year that resulted in the best overall likelihood and best general age composition likelihood. The use of a second time block for the selectivity of the general recreational fleet is a departure from the assumption of time–invariant selectivity in SEDAR28.

2.3.11 Indices of abundance

The model was fit to a fishery–dependent index standardized from headboat logbooks (1991–2015). The predicted index is conditional on selectivity of the general recreational fleet and was computed from abundance at the midpoint of the year.

2.3.12 Catchability

In the BAM, catchability scales indices of relative abundance to estimated population abundance at large. Several options for time-varying catchability were implemented in the BAM following recommendations of the 2009 SEDAR procedural workshop on catchability (SEDAR Procedural Guidance 2009). In particular, the BAM allows for density dependence, linear trends, and random walk, as well as time-invariant catchability. For cobia, catchability of the index was assumed to be constant, as the Panel decided there was little reason to think catchability for cobia on headboats has changed since 1986.

2.3.13 Biological reference points

Biological reference points (benchmarks) were calculated based on the fishing rate that would allow a stock to attain 40% of the maximum spawning potential which would have been obtained in the absence of fishing mortality. Computed benchmarks included $L_{\mathrm{F}40\%}$, fishing mortality rate at $L_{\mathrm{F}40\%}$ ($F_{40\%}$), and spawning stock at $L_{\mathrm{F}40\%}$ ($\mathrm{SSB}_{\mathrm{F}40\%}$)(Gabriel and Mace 1999). In this assessment, spawning stock measures biomass of mature females. These benchmarks are conditional on the estimated selectivity functions and the relative contributions of each fleet's fishing mortality. The selectivity pattern used here was the effort-weighted selectivities at age, with effort from each fishery estimated as the full F averaged over the last three years of the assessment.

2.3.14 Fitting criterion

The fitting criterion was a penalized likelihood approach in which observed landings were fit closely, and observed composition data and the abundance index were fit to the degree that they were compatible. Landings and index data were fitted using lognormal likelihoods. Length and age composition data were fitted using the Dirichlet-multinomial distribution, with sample size represented by the annual number of fish, adjusted by an estimated variance inflation factor.

The SEDAR28 benchmark fit composition data using the multinomial distribution, and many SEDAR assessments since then have applied a robust version of the multinomial likelihood, as recommended by Francis (2011). More recent work has questioned use of the multinomial distribution in stock assessment models (Francis 2014), and of the alternative distributions, two appear most promising, the Dirichlet-multinomial and logistic-normal (Francis 2017; Thorson et al. 2017). Both are self-weighting and therefore iterative re-weighting (e.g., Francis (2011)) is unnecessary, and both better account for intra-haul correlations (i.e., fish caught in the same set are more alike in length or age than fish caught in a different set). The Dirichlet-multinomial allows for observed zeros (the logistic-normal does not), and has recently been implemented in Stock Synthesis (Methot and Wetzel 2013). This assessment used the Dirichlet-multinomial distribution in the base run.

The model includes the capability for each component of the likelihood to be weighted by user-supplied values. When applied to landings and indices, these weights modified the effect of the input CVs. In this application to cobia, CVs of landings (in arithmetic space) were assumed equal to 0.05 to achieve a close fit to these data while allowing some imprecision. In practice, the small CVs are a matter of computational convenience, as they help achieve a close fit to the landings, while avoiding having to solve the Baranov equation iteratively (which is complex when there are multiple fisheries). Weights on the index were adjusted iteratively, starting from initial weights in an attempt to achieve standard deviations of normalized residuals (SDNRs) near 1.0.

The compound objective function also included several penalties or prior distributions, applied to CV of growth (based on the empirical estimate), $F_{\text{initratio}}$ (prior of 1.0), and selectivity parameters. Penalties or priors were applied to maintain parameter estimates near reasonable values, and to prevent the optimization routine from drifting into parameter space with negligible gradient in the likelihood.

2.3.15 Configuration of base run

The base run was configured as described above. However, the base run configuration was not considered to represent all uncertainty. Sensitivities, retrospective analyses, and ensemble modeling was conducted to better characterize the uncertainty in base run point estimates.

2.3.16 Sensitivity analyses

Sensitivity runs were chosen to investigate issues that arose specifically with this benchmark assessment. They were intended to demonstrate directionality of results with changes in inputs or simply to explore model behavior, and not all were considered equally plausible. Sensitivity runs vary from the base run as follows.

- S1: Start model in 1950 to match SEDAR28 start year.
- S2: Include length compositions for the general recreational fleet.
- S3: Use the life history values from SEDAR28. Runs 3a–3e incrementally and additively incorporate each value: length–weight relationship, time of spawn, sex ratio, growth curve, and natural mortality.

- S4: Remove the headboat index.
- S5: Smooth the peak in general recreational removals in 1996 (used the geometric mean of 2 years before and after peak).
- S6: Shift general recreational landings down 3 fold.
- S7: Used the bounds of ensemble parameters that would reach upper bound of status. Runs 7a–c are each parameter, or set of parameters, separately: Landings and discards +1SD, and the upper bound of discard mortality; the lower bound of M using the von Bertalanffy parameters bounds; and the index +1SD.
- S8: Used the bounds of ensemble parameters that would reach lower bound of status. Runs 8a–c are each parameter, or set of parameters, separately: Landings and discards -1SD, and the lower bound of discard mortality; the upper bound of M using the von Bertalanffy parameters bounds; and the index -1SD.
- S9: Runs a–e are the 5 retrospective peels. Retrospective analyses, or peels, were run by incrementally dropping one year at a time for five iterations making the terminal years 2016, 2015, 2014, 2013, and 2012.
- S10: Shift general recreational landings up 3 fold.

2.4 Parameters Estimated

The model estimated annual fishing mortality rates of each fleet (66 parameters), selectivity parameters (6 parameters), Dirichlet-multinomial variance inflation factors (2 parameters), a catchability coefficient associated with the index (1 parameter), initial mean recruitment (1 parameter), initial fishing mortality (1 parameter), variance of the recruitment deviations (1 parameter), annual recruitment deviations (31 parameters), deviations in the initial age structure (15 parameters), and CV of size at age for the landings growth curve (1 parameter).

2.5 Per Recruit and Equilibrium Analyses

Yield per recruit and spawning potential ratio were computed as functions of F, as were equilibrium landings and spawning biomass. Equilibrium landings were also computed as functions of biomass B, which itself is a function of F. As in computation of MSY proxy-related benchmarks (described in §2.6), per recruit and equilibrium analyses applied the most recent selectivity patterns averaged across fleets, weighted by each fleet's F from the last three years of the assessment (2015–2017).

2.6 Benchmark/Reference Point Methods

In this assessment of cobia, the quantities $F_{40\%}$, $\mathrm{SSB}_{\mathrm{F}40\%}$, $B_{\mathrm{F}40\%}$, and $L_{\mathrm{F}40\%}$ were estimated as proxies for MSY–based reference points. Steepness was not reliably estimable, so the stock-recruit relationship was not used to identify a maximum yield. Instead, an average level of recruitment was assumed, while estimating deviations around the mean. $F_{40\%}$ was used by consensus of the Panel to generate fishing benchmarks. However, because the stock-recruitment relationship was not estimated, assumptions about recruitment are required to generate biomass benchmarks. Here, equilibrium recruitment was assumed equal to expected recruitment (arithmetic average). On average, expected recruitment is higher than that estimated directly from the spawner-recruit curve, because of lognormal deviation in recruitment. Thus, in this assessment, the method of benchmark estimation accounted for lognormal deviation by including a bias correction in equilibrium average recruitment. The bias correction (ς) was computed from the variance (σ_R^2) of recruitment deviation in log space: $\varsigma = \exp(\sigma_R^2/2)$. Then, equilibrium recruitment (R_{eq}) is the product of R_0 (virgin recruitment) and the bias correction. The R_{eq} and mortality schedule imply an equilibrium age structure and an average sustainable yield (ASY). The estimate of $F_{40\%}$ is the F giving the highest ASY, and the estimate of $L_{\mathrm{F}40\%}$ is that ASY. The value of $F_{40\%}$ is the F giving 40% spawning potential ratio. The estimates of $L_{\mathrm{F}40\%}$ and $\mathrm{SSB}_{\mathrm{F}40\%}$ follow from the corresponding equilibrium age structure and recruitment.

Estimates of $L_{\mathrm{F}40\%}$ and related benchmarks are conditional on selectivity pattern. The selectivity pattern used here was an average of terminal-year selectivities from each fleet, where each fleet-specific selectivity was weighted in proportion to its corresponding estimate of F averaged over the last three years (2015–2017). If the selectivities or relative fishing mortalities among fleets were to change, so would the estimates of $L_{\mathrm{F}40\%}$ and related benchmarks.

The maximum fishing mortality threshold (MFMT) is proposed to be set to $F_{40\%}$, and the minimum stock size threshold (MSST) as $\mathrm{MSST} = 75\%\mathrm{SSB}_{\mathrm{F}40\%}$. Overfishing is defined as $F >$ MFMT and overfished as SSB $<$ MSST. Current status of the stock is represented by SSB in the latest assessment year (2017), and current status of the fishery is represented by the geometric mean of F from the latest three years (2015–2017).

2.7 Uncertainty and Measures of Precision

For the base run of the catch-age model (BAM), uncertainty in results and precision of estimates was computed thoroughly through an ensemble modeling approach (Scott et al. 2016) using a mixed Monte Carlo and bootstrap framework (Efron and Tibshirani 1993; Manly 1997). Monte Carlo and bootstrap methods are often used to characterize uncertainty in ecological studies, and the mixed approach has been applied successfully in stock assessment (Restrepo et al. 1992; Legault et al. 2001; SEDAR 2004; 2009; 2010). The approach is among those recommended for use in SEDAR assessments (SEDAR Procedural Guidance 2010).

The approach translates uncertainty in model input into uncertainty in model output, by fitting the assessment model many times with different values of "observed" data and key input parameters. A chief advantage of the ensemble modeling approach is that the resulting ensemble model describes a range of possible outcomes, so that uncertainty is characterized more thoroughly than it could be by any single fit or handful of sensitivity runs. A minor disadvantage of the approach is that computational demands are relatively high, though parallel computing can somewhat mitigate those demands.

In this assessment, the BAM was successively re-fit in $n = 4000$ trials that differed from the original inputs by bootstrapping on data sources, and by Monte Carlo sampling of several key input parameters. The value of $n = 4000$ was chosen because at least 3000 runs were desired, and it was anticipated that not all runs would be valid. Of the 4000 trials, approximately 0.975% were discarded, based on a 0.5% trim on $R0$ or because the model did not properly converge. This left $n = 3961$ trials used to characterize uncertainty, which was sufficient for convergence of standard errors in management quantities.

The ensemble model should be interpreted as providing an approximation to the uncertainty associated with each output. The results are approximate as all runs are given equal weight in the results, yet some might provide better fits to data than others.

2.7.1 Bootstrap of observed data

To include uncertainty in time series of observed landings, discards, and the index of abundance, multiplicative lognormal errors were applied through a parametric bootstrap. To implement this approach in the ensemble modeling, random variables ($x_{s,y}$) were drawn for each year y of time series s from a normal distribution with mean 0 and variance $\sigma^2_{s,y}$ [that is, $x_{s,y} \sim N(0, \sigma^2_{s,y})$]. Annual observations were then perturbed from their original values ($\hat{O}_{s,y}$),

$$O_{s,y} = \hat{O}_{s,y}[\exp(x_{s,y} - \sigma^2_{s,y}/2)] \tag{1}$$

The term $\sigma^2_{s,y}/2$ is a bias correction that centers the multiplicative error on the value of 1.0. Standard deviations in log space were computed from CVs in arithmetic space, $\sigma_{s,y} = \sqrt{\log(1.0 + CV^2_{s,y})}$. As used for fitting the base run, CVs of commercial landings in most years were assumed to be 0.05. The CVs for recreational landings and both commercial and recreational discards were those provided by the data providers(see Table 3). The CVs of indices of abundance were those provided by the data providers (see Table 4).

Uncertainty in age and length compositions were included by drawing new distributions for each year of each data source, following a multinomial sampling process. Ages (or lengths) of individual fish were drawn at random with replacement using the cell probabilities of the original data. For each year of each data source, the number of individuals sampled was the same as in the original data (number of fish), and the effective sample sizes used for fitting (number of trips) was unmodified.

2.7.2 Monte Carlo sampling

In each successive fit of the model, several parameters were fixed (i.e., not estimated) at values drawn at random from distributions described below.

Natural mortality A point estimate of natural mortality at age was provided by the Life History Working Group, though no uncertainty was provided. Because natural mortality is inherently uncertain, the Panel attempted to vary M in the ensemble modeling approach in a way consistent with Charnov et al. (2013). The model in Charnov et al. (2013) is based on a linear regression in log space of the relationship between M and von Bertalanffy growth parameters. Charnov et al. (2013) provides estimates of the standard error of the slope and intercept of that regression. In this step of the ensemble modeling, we used those estimates of uncertainty to regenerate a new slope and intercept, assuming normal distributions, from which we calculated a new natural mortality vector at age for each of the 4000 models. However, at the Review Workshop, the Review Panel determined the resulting level of uncertainty in natural mortality was too small. The Panel recommended double the variance on the estimate of natural mortality be used in the ensemble model.

Discard mortalities Similarly, discard mortalities (δ) were subjected to Monte Carlo variation as follows. The discard mortality working group provided point estimates and an upper and lower bound for each gear type. A new value for commercial and recreational lines discard mortality was drawn for each model from a uniform distribution (range [0.02, 0.12]) with center equal to the point estimate ($\delta = 0.05$). Similarly, a new value for commercial gillnet discard mortality was drawn for each model from a uniform distribution (range [0.36, 0.77]) with center equal to the point estimate ($\delta = 0.55$).

Recreational Landings and Discards CVs The recreational landings and all discards were initially allowed to vary based on the CVs provided. However, the Review Panel recommended the CVs on the commercial fleet discards be capped at 3, because the CVs provided were unreasonably high. Once the landings and discards time series were drawn for each fleet and gear, the discards were decremented by the selected value for discard mortality relevant to the gear, and the result was added to the landings for each fleet.

2.8 Projections—Probabilistic Analysis

Projections were run to predict stock status in years after the assessment, 2018–2024, as requested in the TORs.

The structure of the projection model was the same as that of the assessment model, and parameter estimates were those from the assessment. Any time-varying quantities, such as selectivity, were fixed to the most recent values of the assessment period. A single selectivity curve was applied to calculate landings computed by averaging selectivities across fleets using geometric mean Fs from the last three years of the assessment period, similar to computation of MSY benchmarks (§2.6).

Expected values of SSB (time of peak spawning), F, recruits, and landings were represented by deterministic projections using parameter estimates from the base run. These projections were built on the estimated spawner-recruit relationship with bias correction, and were thus consistent with estimated benchmarks in the sense that long-term fishing at $F_{40\%}$ would yield $L_{\mathrm{F40\%}}$ from a stock size at $\mathrm{SSB}_{\mathrm{F40\%}}$. Uncertainty in future time series was quantified through stochastic projections that extended the ensemble model fits of the stock assessment model.

2.8.1 Initialization of projections

Although the terminal year of the assessment is 2017, the assessment model computes abundance at age (N_a) at the start of 2018. For projections, those estimates were used to initialize N_a. However, the assessment has no information to inform the strength of 2018 recruitment, and thus it computes 2018 recruits (N_1) as the expected value, that is, without deviation from the estimate of mean recruitment, and corrected to be unbiased in arithmetic space. In the stochastic projections, lognormal stochasticity was applied to these abundances after adjusting them to be unbiased in log space, with variability based on the estimate of σ_R. Thus, the initial abundance in year one (2018) of projections included this variability in N_1. The deterministic projections were not adjusted in this manner, because deterministic recruitment follows mean recruitment.

Fishing rates that define the projections were assumed to start in 2020. Because the assessment period ended in 2017, the projections required an initialization period (2018 and 2019). L_{current} (an average of the last three years of the assessment, 2015-2017) was assumed during the interim period.

2.8.2 Uncertainty of projections

To characterize uncertainty in future stock dynamics, stochasticity was included in replicate projections, each an extension of a single assessment fit from the ensemble. Thus, projections carried forward uncertainties in natural mortality and discard mortality, as well as in estimated quantities such as spawner-recruit parameters (R_0 and σ_R, selectivity curves, and in initial (start of 2018) abundance at age.

Initial and subsequent recruitment values were generated with stochasticity using a Monte Carlo procedure, in which the estimated recruitment of each model within the ensemble is used to compute mean annual recruitment values ($\bar{R}_y$). Variability is added to the mean values by choosing multiplicative deviations at random from a lognormal distribution,

$$R_y = \bar{R}_y \exp(\epsilon_y). \tag{2}$$

Here ϵ_y is drawn from a normal distribution with mean 0 and standard deviation σ_R, where σ_R is the standard deviation from the relevant ensemble model component.

The procedure generated 20,000 replicate projections of models within the ensemble drawn at random (with replacement). In cases where the same model run was drawn, projections would still differ as a result of stochasticity in projected recruitment streams. Central tendencies were represented by the deterministic projections of the base run, as well as by medians of the stochastic projections. Precision of projections was represented graphically by the 5^{th} and 95^{th} percentiles of the replicate projections.

2.8.3 Projection scenarios

The TORs for this assessment described three projections scenarios: $F = F_{40\%}$, $F = 75\% F_{40\%}$, and $F = F_{\text{current}}$. In each, the landings in the interim period (2018–2019) were calculated based on F_{current}.

- Scenario 1: $F = F_{\text{current}}$, with L_{current} assumed for the interim period.
- Scenario 2: $F = F_{40\%}$, with L_{current} assumed for the interim period.
- Scenario 3: $F = 75\% F_{40\%}$, with L_{current} assumed for the interim period.

3 Stock Assessment Results

3.1 Measures of Overall Model Fit

The Beaufort Assessment Model (BAM) fit well to the available data. Predicted length compositions from the commercial fishery were reasonably close to observed data, as were predicted age compositions (Figure 2). The model was configured to fit observed commercial and recreational landings closely (Figures 3–4). The fit to the index of abundance generally captured the observed trend but not all annual fluctuations (Figure 5).

3.2 Parameter Estimates

Estimates of all parameters from the catch-age model are shown in Appendix B. Estimates of management quantities and some key parameters, such as those of the spawner-recruit model, are reported in sections below.

3.3 Stock Abundance and Recruitment

Estimated abundance at age shows little trend, though the last few years are some of the lowest in the time series (Figure 6; Table 6). Total estimated abundance at the end of the assessment period showed a sharp decline since 2013. Annual number of recruits is shown in Table 6 (age-1 column) and in Figure 7. In the most recent decade, a notably strong year class (age-1 fish) was predicted to have occurred in 2010, but the most recent four years had lower than average recruitment.

3.4 Total and Spawning Biomass

Estimated biomass at age, as well as total biomass and spawning biomass followed a similar pattern as abundance at age (Figures 8 and 9 ; Tables 7 and 8).

3.5 Selectivity

Selectivities of landings from commercial and recreational fleets are shown in Figures 10–11. In the general recreational fleet, the selectivity shifted toward younger ages with the reported change in fisher behavior. In the most recent years, full selection occurred near age-4 for both fleets.

Average selectivities of landings were computed from F-weighted selectivities in the most recent period of regulations (Figure 12). These average selectivities were used to compute benchmarks. All selectivities from the most recent period, including average selectivities, are tabulated in Table 9.

3.6 Fishing Mortality and Landings

The estimated fishing mortality rates (F) generally increased through the assessment time period, with a previous peak in 1996 (Figure 13). The general recreational fleet has been the largest contributor to total F (Table 10). Estimates of total F at age are shown in Table 11. Table 12 shows total landings at age in numbers, and Table 13 in weight. In general, the majority of estimated landings were from the general recreational fleet (Figures 14, 15; Tables 14, 15).

3.7 Spawner-Recruitment Parameters

The spawner-recruit relationship with fixed steepness, from which we estimate deviations from the average recruitment, is shown in Figure 16 depicted graphically by recruits per spawner as a function of spawners. Values of recruitment-related parameters were as follows: unfished age-1 recruitment $\widehat{R_0} = 1,559,065$, and standard deviation of recruitment residuals in log space $\widehat{\sigma_R} = 0.53$. Uncertainty in these quantities was estimated through the ensemble modeling (Figure 17).

3.8 Per Recruit and Equilibrium Analyses

Yield per recruit and spawning potential ratio were computed as functions of F (Figure 18). Per recruit analyses applied the most recent selectivity patterns averaged across fleets, weighted by F from the last three years (2015–2017).

As in per recruit analyses, equilibrium landings and spawning biomass were computed as functions of F (Figure 19). By definition, the F that provides 40% SPR is $F_{40\%}$, and the corresponding landings and spawning biomass are $L_{\mathrm{F40\%}}$ and $\mathrm{SSB}_{\mathrm{F40\%}}$.

3.9 Benchmarks / Reference Points

As described in §2.6, biological reference points (benchmarks) were derived analytically assuming equilibrium dynamics, corresponding to the expected recruitment (Figure16). Reference points estimated were $F_{40\%}$, $L_{\mathrm{F40\%}}$, $B_{\mathrm{F40\%}}$ and $\mathrm{SSB}_{\mathrm{F40\%}}$. Standard deviations of benchmarks were approximated as those from ensemble model (§2.7).

Estimates of benchmarks are summarized in Table 16. Point estimates of $L_{\mathrm{F40\%}}$-related quantities were $F_{40\%} = 0.69$ (y^{-1}), $L_{\mathrm{F40\%}} = 4617$ (klb), $B_{\mathrm{F40\%}} = 0.18$ (mt), and $\mathrm{SSB}_{\mathrm{F40\%}} = 3507$ (mt). Distributions of these benchmarks from the ensemble model are shown in Figure 20.

3.9.1 Status of the Stock and Fishery

The estimated time series of spawning stock biomass showed little overall trend, though the terminal year is the lowest in the time series (Figure 9). Current stock status was estimated in the base run to be $\mathrm{SSB}_{2017}/\mathrm{MSST} = 2.58$ and $\mathrm{SSB}_{2017}/\mathrm{SSB}_{\mathrm{F40\%}} = 1.94$ (Table 16 and Figure 21), indicating that the stock is not overfished. Uncertainty from the ensemble modeling suggested that the estimate of SSB relative to both $\mathrm{SSB}_{\mathrm{F40\%}}$ and SSB/MSST is robust (Figures 22, 23). More specifically, about 99.7% of ensemble modeling runs indicate the stock is above MSST, while only 0.3% of the models in the ensemble indicated an overfished status. Age structure estimated by the base run showed slightly fewer younger fish in the last decade than the (equilibrium) age structure expected at $L_{\mathrm{F40\%}}$ (Figure 24), however the rest of the age structure is above expected values in the terminal year (2017).

The estimated time series of fishing mortality rate has a slightly increasing trend, though the peak year was 1996 (Figure 13). Current fishery status in the terminal year, with current F represented by the geometric mean from 2015–2017, was estimated by the base run to be $F_{2015-2017}/F_{40\%} = 0.18$ (Table 16 and Figures 22 and 23). The results of the ensemble model are consistent with those results, as only 3.3% of models within the ensemble estimate the stock is undergoing overfishing.

3.9.2 Comparison to previous assessment

When estimates from this assessment are compared to estimates from the SEDAR28 assessment for cobia, a notable difference is the magnitude of the biomass and spawning stock biomass estimates (Figure 41). In this assessment, updated and recalibrated MRIP estimates of general recreational landings and discards were used. Those estimates are several times higher per year than the estimates used in SEDAR28, and are the result of an improvement in the estimation of recreational effort (for details of how the MRIP is an improvement of MRFSS, see https://www.fisheries.noaa.gov/recreational-fishing-data/how-marine-recreational-information-program-has-improved). Regardless of the magnitude of biomass and SSB, the status benchmarks remain on similar scales (Figure 40). The time trends in abundance, recruitment, and relative status are very similar between this assessment and the last as well (e.g. Figures 40 and 41). Natural mortality estimates provided by the Data Workshop were higher than used for SEDAR28. The higher natural mortality (0.97–0.31 in this assessment compared to 0.56–0.24 in SEDAR28) leads the model to estimate a more productive stock. Length and age composition data are fit better using the Dirichlet-multinomial distribution in this assessment (Figures 2 in both reports), as is the headboat index of abundance using the iterative reweighting process.

3.10 Sensitivity and Retrospective Analyses

Sensitivity runs, described in §2.3, were used for exploring data or model issues that arose during the assessment process, for evaluating implications of assumptions in the base assessment model, and for interpreting ensemble model results in terms of expected effects of input parameters (Figures 25–34). Sensitivity runs are a tool for better understanding model behavior, and therefore should not be used as the basis for management. All runs are not considered equally plausible in the sense of alternative states of nature. Time series of $F/F_{40\%}$ and $\mathrm{SSB}/\mathrm{SSB}_{\mathrm{F40\%}}$ demonstrate sensitivity to natural mortality (Figure 31) and the SEDAR28 life history inputs (Figure 27). The majority of the runs agreed with the status indicated by the base run (Figure 34, Table 17). Results appeared to be most sensitive to natural mortality.

Retrospective analyses did not suggest any patterns of substantial over- or underestimation in terminal-year estimates starting in 2017 (Figures 35 and 36).

3.11 Projections

Projections based on $F = F_{40\%}$, which is higher than F_{current} drove the stock towards $L_{\mathrm{F40\%}}$ values (Figures 37 and 38, Tables 18 and 19). The 75%$F_{40\%}$ projection was similar to the $F = F_{40\%}$ scenario (Figure 39, Table 20).

4 Discussion

4.1 Comments on the Assessment

Estimated benchmarks played a central role in this assessment; Values of $\text{SSB}_{\text{F40\%}}$ and $F_{40\%}$ were used to gauge the status of the stock and fishery. Computation of benchmarks was conditional on selectivity, and if selectivity patterns change again in the future, for example as a result of new size limits or different relative catch allocations among sectors, estimates of benchmarks would likely change as well.

The base run of the BAM indicated that the stock is not overfished ($\text{SSB}_{2017}/\text{MSST} = 2.58$), and that overfishing is not occurring ($F_{2015-2017}/F_{40\%} = 0.18$). The ensemble model indicated that the stock status is most likely above MSST with 99.7% of the runs indicating the stock is not overfished. Only about 0.3% of the ensemble model runs indicate that the stock is experiencing overfishing. The decreasing trend for biomass is dependent on what appears to be below average recruitment in the last four years of the assessment. The stock has been declining over the last few years of the assessment, and this decline will likely continue if recruitment remains low.

The recent low recruitment in 2014 did not continue into the terminal year of the assessment. No mechanism for the recent low recruitment has been identified, and periodic low recruitment events are estimated throughout the time series. Input from the stakeholders suggests the recent low recruitment was short lived, which is consistent with modeling results. Multiple years of low recruitment would likely negatively affect the stock status, however monitoring the age compositions into the future will provide the data needed to make that determination.

In addition to more years of data, this benchmark assessment included several modifications to previous data. First, MRIP recalibrated data were used. Next, the SCDNR and MRFSS indices were excluded after the value of all three indices was re-evaluated. All composition data were updated and any needed corrections were made, including the exclusion of commercial age compositions due to non-random sampling.

In general, fishery dependent indices of abundance may not track actual abundance well, because of factors such as hyperstability. Furthermore, this issue can be exacerbated by management measures. In this assessment, fishery dependent indices were not extended beyond 2015, because of the seasonal closures. Such regulations change fisher behavior, thus altering the portion of the population or habitat represented by the logbook data that would be used to create an index of abundance. As such management measures become more common in the southeast U.S., the continued utility of fishery dependent indices in SEDAR stock assessments will be questionable. This situation amplifies the importance of fishery independent sampling.

4.2 Comments on the Projections

As usual, projections should be interpreted in light of the model assumptions and key aspects of the data. Some major considerations are the following:

- In general, projections of fish stocks are highly uncertain, particularly in the long term (e.g., beyond 5 years).
- Although projections included many major sources of uncertainty, they did not include structural (model) uncertainty. That is, projection results are conditional on one set of functional forms used to describe population dynamics, selectivity, recruitment, etc.
- Fisheries were assumed to continue fishing at their estimated current proportions of total effort, using the estimated current selectivity patterns. New management regulations that alter those proportions or selectivities would likely affect projection results.

- The projections assumed that the estimated level of recruitment applies in the future and that past residuals represent future uncertainty in recruitment. If future recruitment is characterized by runs of large or small year classes, possibly due to environmental or ecological conditions, stock trajectories may be affected. In this assessment, the lowest recruitment occurred in the terminal four years, and if this is not reversed, the stock projections are overly optimistic.
- Projections apply the Baranov catch equation to relate F and landings using a one-year time step, as in the assessment. The catch equation implicitly assumes that mortality occurs throughout the year. This assumption is violated when seasonal closures are in effect, introducing additional and unquantified uncertainty into the projection results.

4.3 Research Recommendations

- Develop a fishery independent sampling program for abundance of cobia and other coastal migratory species. Fishery dependent abundance indices used in this assessment were uncertain in part due to the lack of an effective sampling methodology.
- Implement a systematic age sampling program for the general recreational sector. Age samples were important in this assessment for identifying strong year classes but sample sizes were relatively small and disparate in time and space.
- Better characterize reproductive parameters including age at maturity, batch fecundity, spawning seasonality, and spawning frequency.
- Age-dependent natural mortality was estimated by indirect methods for this assessment of cobia. Telemetry- and conventional-tag programs for cobia should be maintained as they may prove useful for estimating mortality.
- Better characterize the migratory dynamics of the stock and the degree of fidelity to spawning areas.

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6 Tables

Table 1. Life-history characteristics at age, including average body length and weight (mid-year), proportion females mature, and natural mortality at age. The CV of length was estimated by the assessment model; other values were treated as input.

Age	Total length (mm)	Total length (in)	CV length	Whole wgt (kg)	Whole wgt (lb)	Fem. mat.	prop. fem.	M
1	589.4	23.2	0.12	2.02	4.44	0.0	0.58	0.97
2	768.7	30.3	0.12	4.82	10.62	0.5	0.58	0.65
3	900.2	35.4	0.12	8.09	17.82	1.0	0.58	0.51
4	996.6	39.2	0.12	11.29	24.89	1.0	0.58	0.44
5	1067.4	42.0	0.12	14.14	31.17	1.0	0.58	0.40
6	1119.2	44.1	0.12	16.52	36.42	1.0	0.58	0.37
7	1157.3	45.6	0.12	18.43	40.64	1.0	0.58	0.35
8	1185.2	46.7	0.12	19.93	43.94	1.0	0.58	0.34
9	1205.7	47.5	0.12	21.08	46.48	1.0	0.58	0.33
10	1220.7	48.1	0.12	21.96	48.40	1.0	0.58	0.33
11	1231.7	48.5	0.12	22.61	49.85	1.0	0.58	0.32
12	1239.8	48.8	0.12	23.10	50.93	1.0	0.58	0.32
13	1245.7	49.0	0.12	23.47	51.73	1.0	0.58	0.32
14	1250.0	49.2	0.12	23.74	52.33	1.0	0.58	0.31
15	1253.2	49.3	0.12	23.93	52.77	1.0	0.58	0.31
16	1255.6	49.4	0.12	24.08	53.09	1.0	0.58	0.31

Table 2. Observed time series of landings (L) and discards (D) combined for the commercial (comm) and general recreational (GR) fleets. Landings are in units of 1000 lb whole weight for commercial landings and discards, and in units of 1000 fish for general recreational landings and discards.

Year	LD.comm	LD.GR
1986	25.734	33.608
1987	40.740	24.930
1988	28.588	12.236
1989	33.453	22.420
1990	44.357	18.605
1991	43.816	23.670
1992	35.933	23.900
1993	39.606	15.991
1994	47.118	13.865
1995	67.648	28.148
1996	62.684	94.424
1997	63.618	20.741
1998	43.700	12.650
1999	27.541	27.283
2000	43.652	14.963
2001	42.593	13.445
2002	45.518	18.645
2003	39.367	55.201
2004	37.783	33.440
2005	29.256	59.899
2006	34.953	53.614
2007	32.733	38.877
2008	35.021	30.785
2009	48.003	57.067
2010	58.689	54.608
2011	36.050	36.904
2012	46.204	50.826
2013	54.060	70.214
2014	70.952	59.131
2015	87.942	115.314
2016	92.754	83.032
2017	68.402	50.597

Table 3. Landings (L), Discards (D, l-D represents live discards and d-D represents dead discards), and CVs used in the ensemble model for the commercial (Comm) and general recreational (GR) fleets. Landings and discards from commercial handline (HL) and commercial gillnet (GN) gear are combined into one commercial removals time series.

Year	GR L	Comm L	Comm HL D	Comm GN d-D	Comm GN l-D	GR D	GR L CVs	Comm L CVs	GR D CVs	Comm D CVs
1986	33.152	25.734	0.000	0.000	0.000	9.1120	0.120	0.10	0.00	0.000
1987	24.893	40.740	0.000	0.000	0.000	0.7360	0.010	0.10	0.46	0.000
1988	11.923	28.588	0.000	0.000	0.000	6.2730	0.100	0.10	0.23	0.000
1989	21.732	33.453	0.000	0.000	0.000	13.767	0.210	0.10	0.12	0.000
1990	18.057	44.357	0.000	0.000	0.000	10.958	0.070	0.10	0.16	0.000
1991	21.504	43.816	0.000	0.000	0.000	43.331	0.110	0.10	0.22	0.000
1992	23.164	35.933	0.000	0.000	0.000	14.733	0.190	0.10	0.19	0.000
1993	15.766	39.526	1.605	0.000	0.000	4.4930	0.160	0.05	0.45	3.00
1994	12.256	47.020	1.959	0.000	0.000	32.179	0.170	0.05	0.05	3.00
1995	27.713	67.557	1.814	0.000	0.000	8.7060	0.340	0.05	0.28	3.00
1996	94.123	62.591	1.856	0.000	0.000	6.0250	0.030	0.05	0.34	3.00
1997	18.938	63.522	1.911	0.000	0.000	36.062	0.050	0.05	0.04	3.00
1998	11.241	43.622	1.563	0.000	0.000	28.186	0.340	0.05	0.18	3.00
1999	23.794	27.474	1.346	0.000	0.000	69.798	0.460	0.05	0.19	3.00
2000	13.665	43.580	1.449	0.000	0.000	25.953	0.280	0.05	0.21	3.00
2001	11.672	42.513	1.592	0.000	0.000	35.464	0.340	0.05	0.16	3.00
2002	16.864	44.375	1.417	0.000	1.950	35.623	0.170	0.05	0.11	3.00
2003	51.969	39.310	1.130	0.000	0.000	64.647	0.500	0.05	0.11	3.00
2004	31.635	32.916	1.040	4.815	0.000	36.095	0.110	0.05	0.17	3.00
2005	57.370	28.884	1.051	0.195	0.226	50.579	0.220	0.05	0.09	3.00
2006	50.908	34.708	1.175	0.186	0.000	54.111	0.230	0.05	0.10	3.00
2007	36.360	31.663	1.194	0.000	1.837	50.351	0.070	0.05	0.08	3.00
2008	28.859	33.876	1.186	0.584	0.913	38.513	0.030	0.05	0.05	3.00
2009	52.657	42.423	1.216	2.911	4.742	88.200	0.170	0.05	0.15	3.00
2010	50.607	56.661	1.040	0.999	1.776	80.012	0.140	0.05	0.09	3.00
2011	31.487	34.222	0.882	0.745	1.889	108.35	0.230	0.05	0.09	3.00
2012	46.387	42.811	0.797	0.999	4.280	88.767	0.020	0.05	0.19	3.00
2013	66.204	53.605	0.869	0.000	0.749	80.211	0.230	0.05	0.28	3.00
2014	52.472	70.064	0.839	0.846	0.000	133.19	0.220	0.05	0.10	3.00
2015	110.42	84.901	0.763	0.000	5.460	97.899	0.120	0.05	0.11	3.00
2016	75.779	92.535	0.776	0.000	0.328	145.07	0.040	0.05	0.10	3.00
2017	39.661	68.365	0.738	0.000	0.000	218.73	0.160	0.05	0.23	3.00

Table 4. Observed index of abundance and CVs from headboats (HB).

Year	HB	HB CV
1991	1.02	0.29
1992	0.95	0.29
1993	0.83	0.23
1994	0.72	0.20
1995	1.14	0.23
1996	0.46	0.19
1997	0.64	0.30
1998	0.78	0.24
1999	0.82	0.21
2000	0.77	0.25
2001	0.70	0.29
2002	1.17	0.28
2003	0.88	0.24
2004	0.89	0.23
2005	1.09	0.23
2006	0.86	0.26
2007	1.59	0.34
2008	1.37	0.18
2009	1.08	0.21
2010	1.00	0.34
2011	0.83	0.28
2012	1.09	0.25
2013	2.04	0.26
2014	1.23	0.21
2015	1.04	0.23
2016	.	.
2017	.	.

Table 5. Sample sizes (number of fish) of length compositions (len) or age compositions (age) by fleet. Data sources are commercial lines (comm) and general recreational (GR).

Year	len.comm	age.GR
1986	.	22
1987	.	18
1988	.	.
1989	.	62
1990	.	80
1991	.	13
1992	.	12
1993	.	.
1994	.	.
1995	.	10
1996	.	31
1997	.	13
1998	.	.
1999	1449	124
2000	.	111
2001	.	52
2002	.	26
2003	.	.
2004	.	.
2005	.	57
2006	.	63
2007	.	203
2008	.	225
2009	.	265
2010	.	293
2011	.	246
2012	.	269
2013	.	445
2014	.	487
2015	.	484
2016	.	386
2017	.	273

Table 6. Estimated total abundance at age (1000 fish) at start of year.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1986	1325.98	307.11	198.34	99.58	141.86	111.43	28.29	31.10	24.90	11.59	9.15	7.20	5.58	4.28	3.27	7.30	2316.96
1987	1591.40	502.45	159.92	117.51	61.15	87.61	70.16	18.14	20.13	16.28	7.58	6.05	4.75	3.69	2.85	7.05	2676.73
1988	2580.01	603.04	261.68	94.87	72.59	38.18	55.87	45.57	11.89	13.34	10.78	5.07	4.04	3.18	2.49	6.69	3809.29
1989	1216.10	977.83	314.40	156.10	59.75	46.86	25.28	37.71	31.06	8.19	9.18	7.50	3.52	2.81	2.23	6.45	2904.98
1990	1611.97	460.84	509.38	186.70	96.73	37.50	30.05	16.52	24.87	20.69	5.46	6.18	5.05	2.37	1.91	5.90	3022.12
1991	2117.04	610.89	240.16	303.17	116.72	61.66	24.48	19.99	11.09	16.87	14.04	3.74	4.23	3.46	1.64	5.41	3554.59
1992	883.41	802.28	318.31	142.81	188.88	73.95	39.97	16.17	13.33	7.47	11.37	9.55	2.54	2.88	2.38	4.85	2520.14
1993	676.16	334.79	418.07	189.35	89.04	119.82	48.00	26.43	10.80	8.99	5.04	7.74	6.51	1.73	1.98	4.97	1949.43
1994	1967.37	256.27	174.54	249.36	119.25	57.48	79.32	32.39	18.01	7.43	6.19	3.50	5.38	4.52	1.22	4.88	2987.13
1995	846.57	745.64	133.61	104.16	157.44	77.34	38.26	53.83	22.20	12.47	5.14	4.33	2.45	3.76	3.20	4.31	2214.71
1996	2126.31	320.78	388.27	79.21	64.31	98.31	49.33	24.85	35.31	14.71	8.26	3.44	2.90	1.64	2.54	5.07	3225.25
1997	681.65	804.96	166.08	222.92	43.47	32.72	49.72	25.28	12.85	18.44	7.68	4.36	1.82	1.53	0.87	4.06	2078.42
1998	1232.22	258.30	419.17	98.49	137.86	27.23	20.94	32.41	16.64	8.55	12.26	5.16	2.93	1.22	1.04	3.34	2277.75
1999	2775.09	467.00	134.64	249.85	61.94	88.82	17.99	14.10	22.04	11.43	5.87	8.51	3.58	2.03	0.85	3.07	3866.82
2000	2081.51	1051.58	243.21	79.82	153.86	38.45	56.25	11.60	9.18	14.50	7.52	3.90	5.65	2.38	1.36	2.63	3763.39
2001	1268.42	788.85	548.09	144.88	50.08	98.72	25.28	37.70	7.85	6.28	9.91	5.19	2.69	3.90	1.66	2.79	3002.30
2002	1490.75	480.73	411.26	326.90	91.26	32.35	65.40	17.07	25.71	5.41	4.32	6.90	3.61	1.87	2.74	3.12	2969.41
2003	2906.73	564.98	250.58	245.04	205.15	58.56	21.27	43.83	11.56	17.57	3.70	2.99	4.76	2.49	1.31	4.09	4344.60
2004	517.92	1101.26	293.90	147.61	147.42	122.31	35.43	13.09	27.24	7.25	11.03	2.34	1.89	3.02	1.60	3.46	2436.76
2005	3248.90	196.26	573.54	174.28	90.99	91.67	77.62	22.90	8.54	17.95	4.78	7.34	1.56	1.26	2.03	3.40	4523.02
2006	2085.47	1230.80	102.05	336.99	103.79	53.28	54.35	46.79	13.94	5.25	11.03	2.97	4.56	0.97	0.79	3.40	4056.43
2007	1459.89	790.11	640.24	60.10	202.55	61.77	32.17	33.38	29.02	8.73	3.29	6.98	1.88	2.88	0.62	2.68	3336.28
2008	2439.09	553.38	411.85	373.02	36.26	126.91	39.88	21.19	22.21	19.50	5.87	2.23	4.74	1.27	1.98	2.26	4061.62
2009	1466.50	924.56	288.56	242.10	229.45	23.18	83.60	26.80	14.38	15.23	13.37	4.06	1.55	3.28	0.89	2.96	3340.46
2010	1475.54	555.87	481.65	166.22	142.48	140.15	14.59	53.68	17.38	9.42	9.97	8.84	2.69	1.02	2.19	2.58	3084.27
2011	4715.81	559.29	289.57	277.75	98.07	87.26	88.44	9.39	34.90	11.41	6.19	6.62	5.87	1.78	0.69	3.20	6196.22
2012	2287.82	1787.55	291.56	169.11	168.40	61.77	56.63	58.56	6.28	23.58	7.71	4.22	4.51	4.00	1.23	2.67	4935.60
2013	2778.18	867.18	931.29	168.12	99.74	103.10	38.97	36.45	38.06	4.12	15.48	5.11	2.80	2.99	2.68	2.61	5096.90
2014	448.71	1053.05	451.73	535.49	98.55	60.68	64.63	24.92	23.54	24.83	2.69	10.20	3.37	1.84	1.99	3.52	2809.76
2015	1659.67	170.08	548.76	262.49	321.25	61.40	38.95	42.32	16.48	15.73	16.59	1.82	6.88	2.27	1.26	3.76	3169.71
2016	1237.97	629.05	88.49	308.30	146.32	185.56	36.54	23.65	25.96	10.21	9.74	10.38	1.14	4.31	1.44	3.17	2722.22
2017	1795.71	469.21	327.33	49.98	173.94	85.57	111.81	22.46	14.68	16.28	6.40	6.17	6.58	0.72	2.76	2.95	3092.56
2018	1795.71	680.62	244.34	187.79	29.17	105.33	53.39	71.17	14.44	9.54	10.57	4.20	4.05	4.31	0.48	3.78	3218.90

Table 7. Estimated biomass at age (1000 lb) at start of year

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1986	5892.5	3261.1	3535.3	2478.4	4421.2	4057.8	1149.5	1366.4	1157.2	560.9	456.4	366.6	288.8	223.8	172.6	387.8	29776.3
1987	7072.0	5335.4	2850.6	2924.7	1905.7	3190.5	2851.2	797.0	935.9	788.2	377.7	308.0	245.8	192.9	150.6	374.6	30300.3
1988	11465.1	6403.3	4664.3	2361.2	2262.2	1390.5	2270.1	2002.2	552.9	645.5	537.5	258.2	209.2	166.4	131.4	355.4	35675.7
1989	5404.2	10383.1	5603.9	3885.0	1862.2	1706.6	1027.4	1656.8	1443.6	396.4	457.7	381.8	182.3	147.3	117.9	342.6	34999.1
1990	7163.3	4893.6	9079.5	4646.7	3014.6	1365.8	1221.4	725.8	1156.1	1001.6	272.1	314.6	261.0	124.1	101.0	313.5	35653.8
1991	9407.8	6486.9	4280.7	7545.5	3637.6	2245.4	994.7	878.3	515.7	816.8	699.7	190.5	218.9	181.0	86.6	287.3	38473.1
1992	3925.8	8519.1	5673.6	3554.3	5886.6	2692.9	1624.1	710.3	619.7	361.8	566.6	486.6	131.6	150.8	125.4	257.3	35286.1
1993	3004.7	3555.0	7451.8	4712.6	2775.2	4363.2	1950.7	1161.4	501.8	435.2	251.3	394.4	336.6	90.6	104.5	263.9	31353.0
1994	8742.7	2721.2	3111.2	6206.2	3716.6	2093.3	3223.4	1423.3	837.3	359.8	308.6	178.6	278.4	236.8	64.2	259.3	33760.5
1995	3762.0	7917.7	2381.4	2592.4	4906.8	2816.6	1554.9	2365.1	1031.8	603.6	256.4	220.5	126.8	196.9	168.7	228.6	31130.2
1996	9449.0	3406.4	6920.8	1971.6	2004.4	3580.1	2004.4	1092.2	1641.1	711.9	411.8	175.3	149.9	85.8	134.3	269.2	34007.6
1997	3029.2	8547.5	2960.4	5548.2	1354.7	1191.6	2020.5	1110.9	597.5	892.7	382.9	222.0	93.9	80.0	46.1	215.4	28293.5
1998	5475.8	2742.8	7471.5	2451.3	4296.6	991.4	851.0	1424.2	773.6	413.6	611.1	262.8	151.5	63.7	54.7	177.5	28213.0
1999	12332.0	4958.9	2400.0	6218.4	1930.6	3234.6	730.8	619.5	1024.5	553.4	292.6	433.2	185.2	106.3	45.2	162.9	35228.1
2000	9249.9	11166.4	4335.0	1986.6	4795.1	1400.2	2285.8	509.7	426.8	701.7	374.8	198.6	292.3	124.3	71.9	139.8	38059.1
2001	5636.8	8376.5	9769.3	3605.9	1560.9	3594.9	1027.4	1656.6	364.9	303.8	494.1	264.3	139.3	204.1	87.5	147.9	37234.3
2002	6624.7	5104.6	7330.4	8135.9	2844.4	1177.9	2657.7	750.2	1194.9	261.7	215.6	351.2	187.0	98.1	144.6	165.8	37244.7
2003	12917.1	5999.2	4466.3	6098.6	6393.6	2132.5	864.4	1926.0	537.0	850.8	184.3	152.1	246.3	130.5	69.0	217.2	43185.0
2004	2301.6	11693.8	5238.6	3673.8	4594.4	4453.8	1439.8	575.4	1265.9	351.0	549.8	119.3	97.9	157.9	84.2	183.4	36781.0
2005	14437.6	2084.0	10223.1	4337.6	2835.8	3338.5	3154.2	1006.2	397.1	869.1	238.3	373.9	80.7	65.9	107.1	180.3	43729.1
2006	9267.6	13069.4	1819.0	8387.3	3234.6	1940.3	2208.4	2056.0	647.7	254.2	550.1	151.2	235.9	50.7	41.7	180.6	44094.4
2007	6487.5	8389.9	11411.8	1495.8	6312.5	2249.4	1307.3	1466.7	1348.6	422.4	164.0	355.6	97.2	151.0	32.6	142.2	41834.7
2008	10839.0	5876.2	7341.0	9283.9	1129.9	4621.6	1620.4	931.0	1032.2	943.8	292.3	113.8	245.2	66.6	104.3	119.9	44561.2
2009	6516.9	9817.4	5143.4	6025.7	7150.9	843.9	3397.1	1177.5	668.4	737.0	666.5	206.8	80.0	171.7	47.0	157.4	42807.8
2010	6557.0	5902.4	8585.2	4137.0	4440.6	5103.7	592.8	2358.5	807.8	456.1	497.1	450.4	139.1	53.6	115.7	136.7	40333.6
2011	20956.5	5938.8	5161.5	6912.6	3056.5	3177.5	3593.8	412.7	1622.2	552.5	308.4	336.9	303.6	93.3	36.2	169.5	52632.5
2012	10166.6	18981.4	5196.7	4208.8	5248.3	2249.6	2301.4	2573.0	291.9	1141.1	384.3	215.0	233.5	209.4	64.8	142.0	53608.3
2013	12345.9	9208.3	16599.7	4184.2	3108.5	3754.5	1583.6	1601.4	1769.2	199.5	771.6	260.4	144.8	156.7	141.5	138.9	55968.8
2014	1994.1	11181.8	8051.9	13327.6	3071.5	2209.7	2626.1	1095.0	1094.2	1202.0	134.0	519.4	174.4	96.6	105.2	187.2	47070.7
2015	7375.3	1806.0	9781.3	6533.0	10011.9	2235.9	1582.9	1859.6	766.1	761.3	827.2	92.4	356.0	119.0	66.4	199.7	44374.0
2016	5501.4	6679.6	1577.4	7673.0	4560.3	6757.4	1484.8	1039.3	1206.4	494.3	485.7	528.7	58.9	225.3	75.8	168.4	38516.3
2017	7979.9	4982.2	5834.5	1244.1	5421.2	3116.2	4543.3	987.0	682.6	787.9	319.2	314.4	340.2	37.7	145.3	156.5	36891.9
2018	7979.9	7227.2	4355.2	4673.8	909.2	3835.8	2169.6	3127.0	671.1	461.4	526.9	213.8	209.4	225.8	25.1	200.6	36812.4

Table 8. Estimated time series and status indicators. Fishing mortality rate is apical F. Total biomass (B, mt) is at the start of the year, and spawning biomass (SSB mature female biomass, and SSBknum in 1000s of mature females) at the time of peak spawning (end of March). The $MSST_{\mathrm{F40}}$ is defined by $\mathrm{MSST} = 0.75 SSB_{\mathrm{F40}}$. *Prop.fem is proportion of age-2^{+} population that is female.*

Year	F	F/F_{40}	B	B/B_{unfished}	SSB	SSBknum	$SSB/SSBB_{\mathrm{F40}}$	$SSB/MSST_{\mathrm{F40}}$	Prop.fem
1986	0.0949	0.1368	13506	0.665	5952	393	1.70	2.26	0.58
1987	0.0820	0.1182	13744	0.677	5345	380	1.52	2.03	0.58
1988	0.0433	0.0624	16182	0.797	5503	424	1.57	2.09	0.58
1989	0.0761	0.1098	15875	0.782	6302	541	1.80	2.40	0.58
1990	0.0580	0.0836	16172	0.796	6795	540	1.94	2.58	0.58
1991	0.0651	0.0939	17451	0.859	6731	517	1.92	2.56	0.58
1992	0.0637	0.0919	16006	0.788	7048	562	2.01	2.68	0.58
1993	0.0435	0.0627	14222	0.700	6989	511	1.99	2.66	0.58
1994	0.0379	0.0547	15313	0.754	6263	416	1.79	2.38	0.58
1995	0.0818	0.1179	14120	0.695	6069	451	1.73	2.31	0.58
1996	0.3196	0.4609	15426	0.759	5569	411	1.59	2.12	0.58
1997	0.0782	0.1128	12834	0.632	5427	449	1.55	2.06	0.58
1998	0.0456	0.0657	12797	0.630	5607	423	1.60	2.13	0.58
1999	0.0890	0.1284	15979	0.787	5296	391	1.51	2.01	0.58
2000	0.0504	0.0727	17263	0.850	6026	521	1.72	2.29	0.58
2001	0.0428	0.0617	16889	0.832	7143	610	2.04	2.72	0.58
2002	0.0504	0.0727	16894	0.832	7349	569	2.10	2.79	0.58
2003	0.1358	0.1959	19588	0.964	6978	522	1.99	2.65	0.58
2004	0.0869	0.1253	16684	0.821	7381	616	2.10	2.81	0.58
2005	0.1567	0.2260	19835	0.977	7220	533	2.06	2.74	0.58
2006	0.1379	0.1989	20001	0.985	7198	604	2.05	2.74	0.58
2007	0.0676	0.0974	18976	0.934	8043	670	2.29	3.06	0.58
2008	0.0475	0.0685	20213	0.995	8031	616	2.29	3.05	0.58
2009	0.0931	0.1342	19417	0.956	8045	634	2.29	3.06	0.58
2010	0.0904	0.1304	18295	0.901	7932	602	2.26	3.02	0.58
2011	0.0623	0.0898	23874	1.175	7468	548	2.13	2.84	0.58
2012	0.0907	0.1308	24316	1.197	8657	780	2.47	3.29	0.58
2013	0.0971	0.1400	25387	1.250	9978	847	2.84	3.79	0.58
2014	0.0733	0.1057	21351	1.051	10171	828	2.90	3.87	0.58
2015	0.1490	0.2149	20128	0.991	9111	638	2.60	3.46	0.58
2016	0.1366	0.1970	17471	0.860	7515	523	2.14	2.86	0.58
2017	0.1017	0.1467	16734	0.824	6795	481	1.94	2.58	0.58
2018	.	.	16698	0.822	.	.	.	.	0.58

Table 9. Selectivity at age for the commercial fleet (comm), general recreational fleet (GR), and landings averaged across fisheries (L.avg). TL is total length. For time-varying selectivities, values shown are from the terminal assessment year.

Age	TL(mm)	TL(in)	comm	GR	L.avg
1	589.4	23.2	0.029	0.000	0.001
2	768.7	30.3	0.171	0.019	0.023
3	900.2	35.4	0.583	0.444	0.448
4	996.6	39.2	0.904	0.971	0.969
5	1067.4	42.0	0.985	0.999	0.999
6	1119.2	44.1	0.998	1.000	1.000
7	1157.3	45.6	1.000	1.000	1.000
8	1185.2	46.7	1.000	1.000	1.000
9	1205.7	47.5	1.000	1.000	1.000
10	1220.7	48.1	1.000	1.000	1.000
11	1231.7	48.5	1.000	1.000	1.000
12	1239.8	48.8	1.000	1.000	1.000
13	1245.7	49.0	1.000	1.000	1.000
14	1250.0	49.2	1.000	1.000	1.000
15	1253.2	49.3	1.000	1.000	1.000
16	1255.6	49.4	1.000	1.000	1.000

Table 10. Estimated time series of fully selected fishing mortality rates for the commercial fleet (F.comm) and the general recreational fleet (F.GR). Also shown is apical F, the maximum F at age summed across fleets.

Year	F.comm	F.GR	Apical F
1986	0.002	0.093	0.095
1987	0.003	0.079	0.082
1988	0.002	0.041	0.043
1989	0.002	0.074	0.076
1990	0.002	0.056	0.058
1991	0.002	0.063	0.065
1992	0.002	0.062	0.064
1993	0.002	0.041	0.043
1994	0.003	0.035	0.038
1995	0.004	0.078	0.082
1996	0.004	0.316	0.320
1997	0.004	0.074	0.078
1998	0.003	0.043	0.046
1999	0.002	0.087	0.089
2000	0.003	0.048	0.050
2001	0.002	0.040	0.043
2002	0.002	0.048	0.050
2003	0.002	0.134	0.136
2004	0.002	0.085	0.087
2005	0.001	0.155	0.157
2006	0.002	0.136	0.138
2007	0.002	0.066	0.068
2008	0.002	0.046	0.047
2009	0.002	0.091	0.093
2010	0.003	0.088	0.090
2011	0.002	0.061	0.062
2012	0.002	0.089	0.091
2013	0.002	0.095	0.097
2014	0.003	0.071	0.073
2015	0.003	0.146	0.149
2016	0.004	0.132	0.137
2017	0.004	0.098	0.102
2018	.	.	.

Table 11. Estimated instantaneous fishing mortality rate (per yr) at age

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1986	0.000	0.003	0.013	0.048	0.082	0.093	0.094	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095
1987	0.000	0.002	0.012	0.042	0.071	0.080	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082
1988	0.000	0.001	0.007	0.022	0.038	0.042	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
1989	0.000	0.002	0.011	0.039	0.066	0.074	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076
1990	0.000	0.002	0.009	0.030	0.050	0.057	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
1991	0.000	0.002	0.010	0.033	0.056	0.064	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
1992	0.000	0.002	0.009	0.032	0.055	0.062	0.063	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064
1993	0.000	0.001	0.007	0.022	0.038	0.042	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
1994	0.000	0.001	0.006	0.020	0.033	0.037	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
1995	0.000	0.003	0.013	0.042	0.071	0.080	0.081	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082
1996	0.001	0.008	0.045	0.160	0.276	0.312	0.318	0.319	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320
1997	0.000	0.003	0.012	0.041	0.068	0.076	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078
1998	0.000	0.002	0.007	0.024	0.040	0.045	0.045	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046
1999	0.000	0.002	0.013	0.045	0.077	0.087	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089
2000	0.000	0.002	0.008	0.026	0.044	0.049	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
2001	0.000	0.001	0.007	0.022	0.037	0.042	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
2002	0.000	0.002	0.008	0.026	0.044	0.049	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
2003	0.001	0.004	0.019	0.068	0.117	0.132	0.135	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136
2004	0.000	0.002	0.013	0.044	0.075	0.085	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087
2005	0.001	0.004	0.022	0.078	0.135	0.153	0.156	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157	0.157
2006	0.001	0.004	0.019	0.069	0.119	0.134	0.137	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138
2007	0.000	0.002	0.030	0.065	0.067	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
2008	0.000	0.001	0.021	0.046	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
2009	0.000	0.002	0.042	0.090	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093	0.093
2010	0.000	0.002	0.041	0.088	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
2011	0.000	0.001	0.028	0.060	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
2012	0.000	0.002	0.041	0.088	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091
2013	0.000	0.002	0.043	0.094	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097
2014	0.000	0.002	0.033	0.071	0.073	0.073	0.073	0.073	0.073	0.073	0.073	0.073	0.073	0.073	0.073	0.073
2015	0.000	0.003	0.067	0.144	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149
2016	0.000	0.003	0.061	0.132	0.136	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137
2017	0.000	0.002	0.046	0.099	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102

Table 12. Estimated total landings at age in numbers (1000 fish)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1986	0.35	0.57	2.08	3.76	9.22	8.26	2.16	2.39	1.92	0.90	0.71	0.56	0.43	0.33	0.26	0.57
1987	0.39	0.87	1.52	3.89	3.46	5.64	4.65	1.21	1.35	1.09	0.51	0.41	0.32	0.25	0.19	0.48
1988	0.36	0.58	1.36	1.69	2.21	1.32	1.99	1.64	0.43	0.48	0.39	0.18	0.15	0.12	0.09	0.24
1989	0.27	1.53	2.74	4.79	3.14	2.81	1.56	2.35	1.94	0.51	0.58	0.47	0.22	0.18	0.14	0.41
1990	0.30	0.59	3.54	4.43	3.91	1.73	1.43	0.79	1.20	0.99	0.26	0.30	0.24	0.12	0.09	0.29
1991	0.42	0.85	1.84	8.02	5.28	3.18	1.30	1.07	0.60	0.91	0.76	0.20	0.23	0.19	0.09	0.29
1992	0.17	1.07	2.34	3.68	8.37	3.73	2.08	0.85	0.70	0.39	0.60	0.51	0.13	0.15	0.13	0.26
1993	0.10	0.33	2.21	3.39	2.72	4.16	1.72	0.95	0.39	0.33	0.18	0.28	0.24	0.06	0.07	0.18
1994	0.27	0.24	0.85	3.96	3.19	1.75	2.48	1.02	0.57	0.24	0.20	0.11	0.17	0.14	0.04	0.16
1995	0.23	1.39	1.33	3.48	8.90	4.97	2.53	3.59	1.49	0.84	0.35	0.29	0.16	0.25	0.22	0.29
1996	1.83	1.95	13.38	9.54	12.89	22.22	11.45	5.81	8.30	3.46	1.95	0.81	0.68	0.39	0.60	1.20
1997	0.18	1.49	1.61	7.18	2.36	2.02	3.15	1.62	0.83	1.18	0.50	0.28	0.12	0.10	0.06	0.26
1998	0.20	0.29	2.42	1.87	4.42	0.99	0.79	1.23	0.63	0.32	0.47	0.20	0.11	0.05	0.04	0.13
1999	0.70	0.82	1.34	8.88	3.79	6.19	1.29	1.02	1.60	0.83	0.43	0.62	0.26	0.15	0.06	0.23
2000	0.35	1.25	1.52	1.66	5.43	1.55	2.33	0.48	0.38	0.61	0.32	0.16	0.24	0.10	0.06	0.11
2001	0.18	0.79	2.91	2.57	1.51	3.38	0.89	1.34	0.28	0.22	0.36	0.19	0.10	0.14	0.06	0.10
2002	0.24	0.54	2.50	6.77	3.22	1.30	2.71	0.71	1.08	0.23	0.18	0.29	0.15	0.08	0.12	0.13
2003	1.08	1.48	3.73	13.09	18.77	6.10	2.28	4.73	1.25	1.91	0.40	0.33	0.52	0.27	0.14	0.45
2004	0.13	1.92	2.88	5.13	8.81	8.33	2.48	0.93	1.93	0.52	0.79	0.17	0.14	0.22	0.11	0.25
2005	1.35	0.57	9.69	10.65	9.52	10.91	9.51	2.83	1.06	2.23	0.60	0.92	0.19	0.16	0.25	0.43
2006	0.78	3.23	1.54	18.25	9.63	5.63	5.91	5.13	1.53	0.58	1.22	0.33	0.50	0.11	0.09	0.38
2007	0.07	0.88	14.94	3.09	10.92	3.38	1.78	1.85	1.62	0.49	0.18	0.39	0.11	0.16	0.03	0.15
2008	0.10	0.46	6.80	13.58	1.39	4.92	1.56	0.83	0.88	0.77	0.23	0.09	0.19	0.05	0.08	0.09
2009	0.10	1.42	9.23	16.94	16.84	1.73	6.28	2.02	1.09	1.16	1.02	0.31	0.12	0.25	0.07	0.23
2010	0.11	0.87	15.01	11.31	10.17	10.16	1.07	3.94	1.28	0.70	0.74	0.66	0.20	0.08	0.16	0.19
2011	0.23	0.59	6.24	13.19	4.89	4.41	4.51	0.48	1.80	0.59	0.32	0.34	0.30	0.09	0.04	0.17
2012	0.15	2.67	9.09	11.55	12.06	4.49	4.16	4.32	0.47	1.75	0.57	0.31	0.34	0.30	0.09	0.20
2013	0.19	1.38	31.03	12.26	7.62	8.00	3.05	2.87	3.01	0.33	1.23	0.41	0.22	0.24	0.21	0.21
2014	0.03	1.38	11.47	29.76	5.75	3.59	3.86	1.50	1.42	1.50	0.16	0.62	0.20	0.11	0.12	0.21
2015	0.18	0.42	27.77	28.70	36.79	7.14	4.57	4.99	1.95	1.86	1.97	0.22	0.82	0.27	0.15	0.45
2016	0.15	1.49	4.13	31.06	15.45	19.89	3.95	2.57	2.83	1.11	1.07	1.14	0.12	0.47	0.16	0.35
2017	0.17	0.85	11.46	3.81	13.90	6.94	9.15	1.85	1.21	1.34	0.53	0.51	0.55	0.06	0.23	0.25

Table 13. Estimated total landings at age in whole weight (1000 lb)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1986	3.14	8.67	45.38	105.11	308.75	315.58	91.02	108.58	92.40	44.87	36.78	29.65	23.44	18.30	14.15	31.87
1987	3.58	13.36	33.26	108.91	115.87	215.77	196.28	55.06	64.96	54.81	26.47	21.65	17.35	13.72	10.73	26.76
1988	3.24	8.93	29.74	47.24	73.87	50.54	84.01	74.36	20.63	24.14	20.25	9.76	7.94	6.36	5.04	13.66
1989	2.46	23.45	59.72	133.94	105.32	107.46	65.86	106.59	93.33	25.68	29.87	25.01	11.98	9.74	7.83	22.80
1990	2.69	9.08	77.17	124.01	131.09	66.07	60.15	35.87	57.41	49.84	13.64	15.83	13.18	6.31	5.14	16.03
1991	3.84	13.09	40.05	224.51	176.88	121.51	54.80	48.56	28.65	45.46	39.25	10.71	12.37	10.30	4.94	16.43
1992	1.52	16.34	51.08	103.11	280.20	142.77	87.67	38.48	33.73	19.73	31.14	26.82	7.28	8.40	7.01	14.42
1993	0.87	5.06	48.18	94.92	91.00	159.20	72.45	43.30	18.80	16.34	9.50	14.97	12.82	3.48	4.02	10.18
1994	2.42	3.70	18.54	110.85	106.82	66.81	104.71	46.40	27.43	11.81	10.21	5.92	9.27	7.94	2.16	8.74
1995	2.06	21.36	29.02	97.48	298.21	190.05	106.76	162.97	71.44	41.87	17.93	15.46	8.92	13.97	11.99	16.30
1996	16.64	29.85	291.89	266.89	431.78	849.34	482.99	263.95	398.46	173.18	100.93	43.11	36.96	21.33	33.46	67.26
1997	1.64	22.81	35.23	200.90	78.97	77.07	132.98	73.37	39.65	59.35	25.65	14.92	6.34	5.43	3.14	14.72
1998	1.79	4.40	52.90	52.40	148.00	37.93	33.13	55.65	30.37	16.27	24.23	10.45	6.04	2.57	2.20	7.18
1999	6.32	12.64	29.27	248.55	126.86	236.67	54.45	46.32	76.96	41.65	22.19	32.96	14.13	8.17	3.48	12.60
2000	3.21	19.08	33.17	46.60	182.03	59.07	98.16	21.96	18.48	30.45	16.39	8.71	12.86	5.52	3.20	6.23
2001	1.66	12.14	63.45	71.91	50.45	129.19	37.58	60.81	13.46	11.23	18.40	9.88	5.22	7.71	3.31	5.62
2002	2.19	8.34	54.58	189.42	107.86	49.70	114.15	32.34	51.76	11.36	9.43	15.41	8.23	4.35	6.44	7.39
2003	9.78	22.61	81.46	366.36	628.84	233.12	96.16	214.98	60.24	95.60	20.87	17.27	28.07	14.99	7.94	25.07
2004	1.17	29.42	62.78	143.63	294.99	318.37	104.78	42.02	92.90	25.81	40.74	8.87	7.30	11.87	6.35	13.86
2005	12.22	8.80	211.40	298.06	319.02	417.20	401.07	128.38	50.92	111.62	30.84	48.56	10.51	8.66	14.10	23.80
2006	7.05	49.57	33.51	510.63	322.66	215.12	249.18	232.79	73.69	28.98	63.17	17.42	27.27	5.90	4.87	21.16
2007	0.65	13.50	326.08	86.44	365.75	129.20	74.95	84.12	77.68	24.38	9.53	20.74	5.68	8.90	1.93	8.43
2008	0.95	7.08	148.41	380.06	46.42	188.25	65.88	37.87	42.17	38.62	12.06	4.70	10.17	2.79	4.38	5.05
2009	0.90	21.77	201.38	474.19	564.01	65.99	265.07	91.92	52.41	57.88	52.74	16.42	6.37	13.78	3.79	12.70
2010	1.03	13.27	327.50	316.64	340.77	388.28	45.01	179.14	61.62	34.85	38.29	34.80	10.78	4.18	9.06	10.74
2011	2.11	9.02	136.26	369.05	163.66	168.67	190.40	21.87	86.35	29.47	16.58	18.17	16.42	5.09	1.98	9.30
2012	1.35	40.89	198.45	323.30	404.06	171.67	175.28	196.04	22.34	87.49	29.69	16.66	18.16	16.41	5.09	11.18
2013	1.71	21.08	677.22	342.98	255.34	305.70	128.68	130.18	144.44	16.32	63.59	21.53	12.02	13.10	11.86	11.66
2014	0.28	21.10	250.25	832.83	192.54	137.34	162.92	67.95	68.20	75.06	8.44	32.79	11.04	6.16	6.73	12.01
2015	1.61	6.38	606.12	803.14	1232.42	272.77	192.71	226.49	93.71	93.29	102.11	11.45	44.25	14.90	8.33	25.14
2016	1.33	22.83	90.08	869.36	517.66	760.33	166.73	116.73	136.09	55.86	55.30	60.40	6.73	26.03	8.78	19.55
2017	1.56	13.02	250.19	106.55	465.55	265.30	386.05	83.89	58.26	67.38	27.51	27.17	29.50	3.29	12.74	13.75

Table 14. Estimated time series of landings in numbers (1000 fish) for the commercial fleet (L.comm) and general recreational (L.GR))

Year	L.comm	L.GR	Total
1986	0.80	33.65	34.45
1987	1.31	24.95	26.26
1988	0.99	12.24	13.23
1989	1.20	22.44	23.64
1990	1.59	18.62	20.20
1991	1.54	23.69	25.23
1992	1.24	23.92	25.16
1993	1.32	16.00	17.32
1994	1.52	13.87	15.39
1995	2.17	28.15	30.32
1996	2.14	94.32	96.46
1997	2.21	20.71	22.93
1998	1.51	12.64	14.15
1999	0.96	27.25	28.21
2000	1.59	14.96	16.56
2001	1.57	13.45	15.01
2002	1.61	18.64	20.25
2003	1.37	55.16	56.54
2004	1.31	33.41	34.72
2005	1.04	59.82	60.86
2006	1.25	53.57	54.83
2007	1.19	38.86	40.04
2008	1.24	30.79	32.03
2009	1.66	57.15	58.80
2010	2.01	54.64	56.65
2011	1.27	36.92	38.19
2012	1.70	50.81	52.52
2013	2.03	70.21	72.24
2014	2.51	59.18	61.68
2015	2.94	115.30	118.24
2016	2.96	83.00	85.96
2017	2.22	50.60	52.81
.	.	.	.

Table 15. Estimated time series of landings in whole weight (1000 lb) for the commercial fleet (L.comm) and general recreational (L.GR).

Year	L.comm	L.GR	Total
1986	25.74	1251.95	1277.69
1987	40.75	937.80	978.55
1988	28.59	451.12	479.71
1989	33.46	797.59	831.05
1990	44.36	639.15	683.51
1991	43.82	807.53	851.35
1992	35.94	833.76	869.70
1993	39.61	565.48	605.09
1994	47.12	496.62	543.74
1995	67.65	1038.15	1105.79
1996	62.68	3445.34	3508.02
1997	63.61	728.56	792.17
1998	43.70	441.79	485.49
1999	27.54	945.68	973.22
2000	43.65	521.47	565.12
2001	42.59	459.45	502.04
2002	45.52	627.41	672.93
2003	39.37	1883.99	1923.36
2004	37.78	1167.08	1204.86
2005	29.26	2065.92	2095.17
2006	34.95	1828.02	1862.97
2007	32.73	1205.26	1237.99
2008	35.02	959.83	994.86
2009	48.00	1853.31	1901.31
2010	58.69	1757.28	1815.97
2011	36.05	1208.33	1244.38
2012	46.20	1671.88	1718.09
2013	54.06	2103.35	2157.41
2014	70.95	1814.68	1885.63
2015	87.94	3646.88	3734.82
2016	92.75	2821.04	2913.80
2017	68.40	1743.32	1811.72
.	.	.	.

Table 16. Estimated status indicators, benchmarks, and related quantities from the base run of the Beaufort Assessment Model, conditional on estimated current selectivities averaged across fleets. Median values and standard deviations (SD) approximated from the ensemble model are also provided. Rate estimates (F) are in units of y^{-1}*; status indicators are dimensionless; and biomass estimates are whole weight in units of metric tons or pounds, as indicated. Spawning stock biomass (SSB) is measured as mature female biomass.*

Quantity	Units	Estimate	Median	SD
$F_{40\%}$	y^{-1}	0.69	0.65	0.19
$B_{\mathrm{F40\%}}$	mt	12523	11028	9140
$\mathrm{SSB}_{\mathrm{F40\%}}$	mt	3507	3199	1872
MSST	mt	2631	2658	1007
$L_{\mathrm{F40\%}}$	1000 lb	4617	4010	3428
$Lknum_{\mathrm{F40\%}}$	1000 fish	176.461	151	141
$R_{\mathrm{F40\%}}$	1000 age-1 fish	1781121	1525734	1688
$F_{2015-2017}/F_{40\%}$	—	0.18	0.24	0.28
$\mathrm{SSB}_{2017}/\mathrm{MSST}$	—	2.58	2.41	0.51
$\mathrm{SSB}_{2017}/\mathrm{SSB}_{\mathrm{F40\%}}$	—	1.94	1.81	0.38

Table 17. Results from sensitivity runs of the Beaufort catch-age model. Current F represented by geometric mean of last two assessment years.

Run	Description	$F_{40\%}$	$SSB_{F40\%}$ (mt)	LFforty(1000 lb)	LFforty(1000s)	$F_{current}/f_{40\%}$	$SSB_{2017}/SSB_{F40\%}$	R0(1000)
Base	—	0.693	3507.39	4617	176	0.18	1.94	1559
S1	early start year	0.696	3387.54	4460	170	0.19	1.91	1450
S2	Include length comps	0.714	2951.28	3886	149	0.22	1.88	1220
S3	S28 LH values all	0.319	1846.34	1967	61	0.92	1.21	326
S4	S28 l-w	0.695	4213.39	5546	175	0.18	1.95	1552
S5	S28 + time of spawn	0.725	3717.09	4868	154	0.27	1.46	1353
S6	S28 and sex ratio	0.724	3694.84	5613	178	0.18	1.95	1552
S7	S28 and growth	0.627	3009.4	4491	168	0.2	1.97	1591
S8	S28 and M	0.341	1899.46	2004	63	0.86	1.24	326
S9	Remove index	0.707	3339.82	4397	168	0.23	1.63	1491
S10	smooth MRIP peaks	0.693	3154.33	4153	159	0.17	1.96	1403
S11	lower GR landings	0.682	1225.51	1615	62	0.19	1.94	547
S12	upper GR landings	0.698	10293.18	13544	516	0.18	1.95	4595
S13	Upper values of ensemble parms	0.908	6588.87	10039	399	0.07	2.23	4157
S14	Lower values of ensemble parms	0.502	1958.7	2124	77	0.43	1.55	565
S15	Upper Ensemble L/D/DiscM	0.691	3903.01	5138	197	0.17	1.99	1742
S16	Upper Ensemble Index	0.502	2511.75	2724	99	0.42	1.58	724
S17	Lower Ensemble L/D/DiscM	0.693	3487.61	4591	175	0.18	1.94	1557
S18	Lower Ensemble Index	0.693	2712.45	3571	137	0.19	1.91	1211
S19	Upper Ensemble M	0.91	5839.93	8897	354	0.08	2.2	3683
S20	Lower Ensemble M	0.694	3498.23	4606	176	0.18	1.95	1562
S21	alt. maturity	0.616	3330.01	4436	167	0.21	1.93	1559

*Table 18. Projection results with fishing mortality rate fixed at $F = F_{\text{current}}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000*lb*). The extension* b *indicates expected values (deterministic) from the base run; the extension* med *indicates median values from the stochastic projections.*

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1796	1399	0.16	0.22	6647	5333	82	87	2820	2908
2019	1796	1377	0.19	0.24	6060	5117	84	91	2820	2908
2020	1796	1389	0.10	0.15	6089	5112	46	58	1479	1817
2021	1796	1382	0.10	0.15	6306	5225	49	60	1553	1857
2022	1796	1385	0.10	0.15	6478	5327	51	62	1612	1905
2023	1796	1380	0.10	0.15	6606	5394	53	63	1653	1944
2024	1796	1383	0.10	0.15	6697	5443	54	64	1683	1967

Table 19. Projection results with fishing mortality rate fixed at $F = F_{40\%}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb*). The extension* b *indicates expected values (deterministic) from the base run; the extension* med *indicates median values from the stochastic projections.*

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1796	1399	0.16	0.22	6647	5333	82	87	2820	2908
2019	1796	1377	0.19	0.24	6060	5117	84	91	2820	2908
2020	1796	1389	0.69	0.65	5046	4361	254	212	8041	6507
2021	1796	1382	0.69	0.65	4109	3618	205	171	5945	4980
2022	1796	1385	0.69	0.65	3751	3338	188	156	5141	4315
2023	1796	1380	0.69	0.65	3616	3234	181	151	4836	4082
2024	1796	1383	0.69	0.65	3566	3201	179	149	4722	3981

Table 20. Projection results with fishing mortality rate fixed at $F = 75\%F_{40\%}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb*). The extension* b *indicates expected values (deterministic) from the base run; the extension* med *indicates median values from the stochastic projections.*

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1796	1399	0.16	0.22	6647	5333	82	87	2820	2908
2019	1796	1377	0.19	0.24	6060	5117	84	91	2820	2908
2020	1796	1389	0.52	0.49	5326	4591	202	168	6426	5188
2021	1796	1382	0.52	0.49	4602	4041	176	147	5222	4341
2022	1796	1385	0.52	0.49	4277	3804	165	137	4680	3921
2023	1796	1380	0.52	0.49	4132	3697	160	133	4437	3739
2024	1796	1383	0.52	0.49	4069	3656	158	131	4329	3659

7 Figures

Figure 1. Mean length at age (mm) and estimated upper and lower 95% confidence intervals of the population.

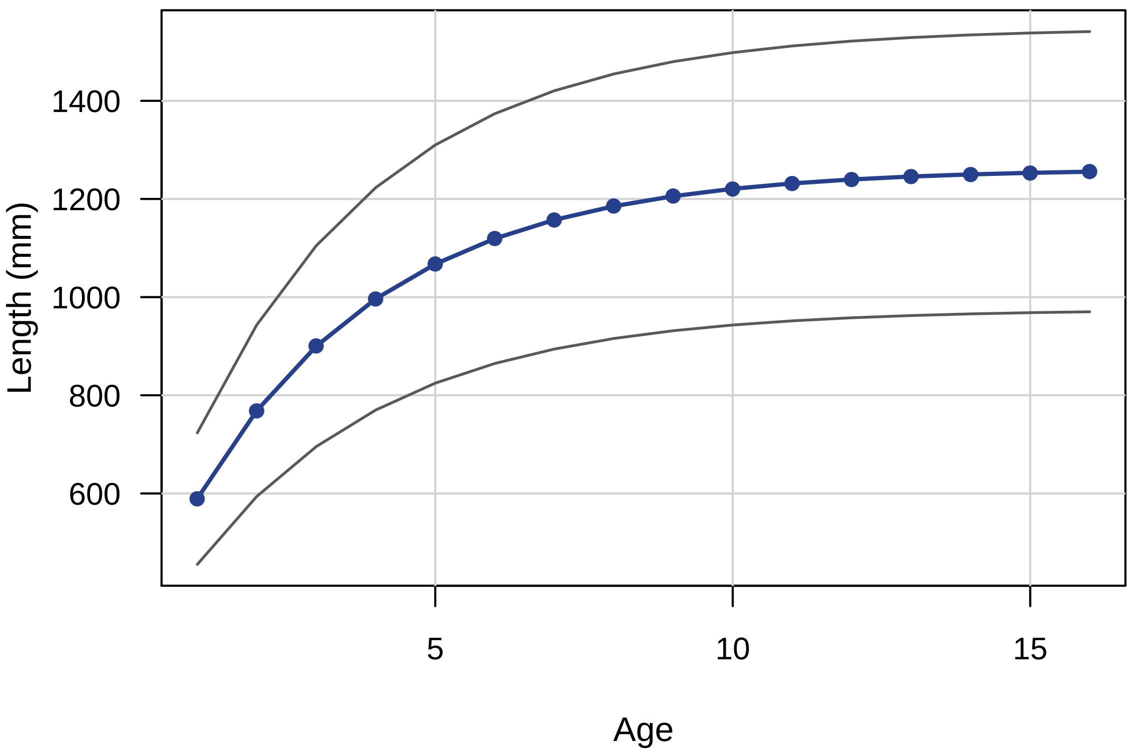


Figure 2. Observed (open circles) and estimated (solid line) annual length and age compositions by fleet from the base run. In panels indicating the data set, lcomp refers to length compositions, acomp to age compositions, comm to the commercial fleet, and GR to the general recreational fleet. N indicates the number of fish samples taken. For the commercial fleet, length compositions from 1986–2017 were pooled.

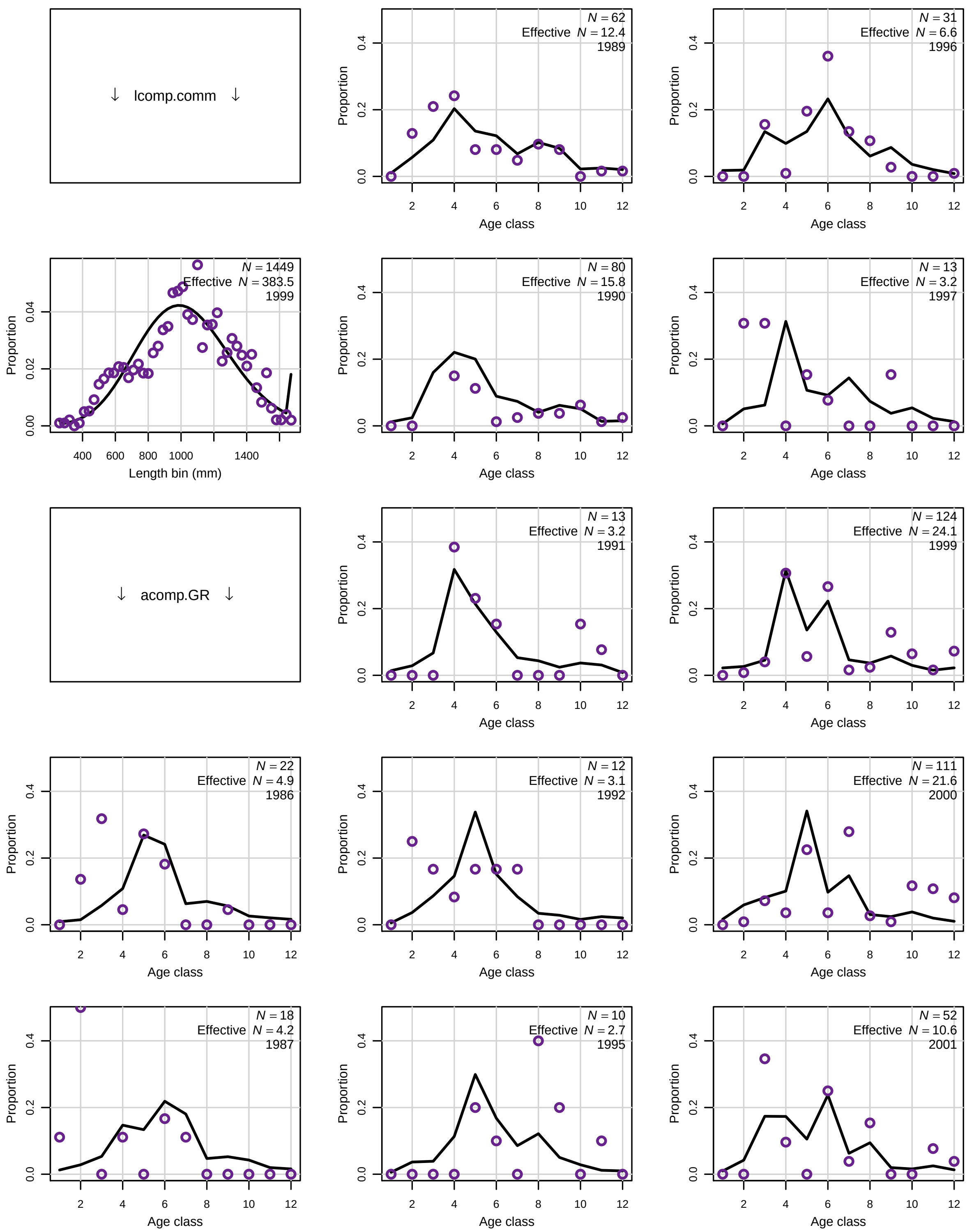


Figure 2. (cont.) Observed (open circles) and estimated (solid line) annual length and age compositions by fleet or survey from the base run.

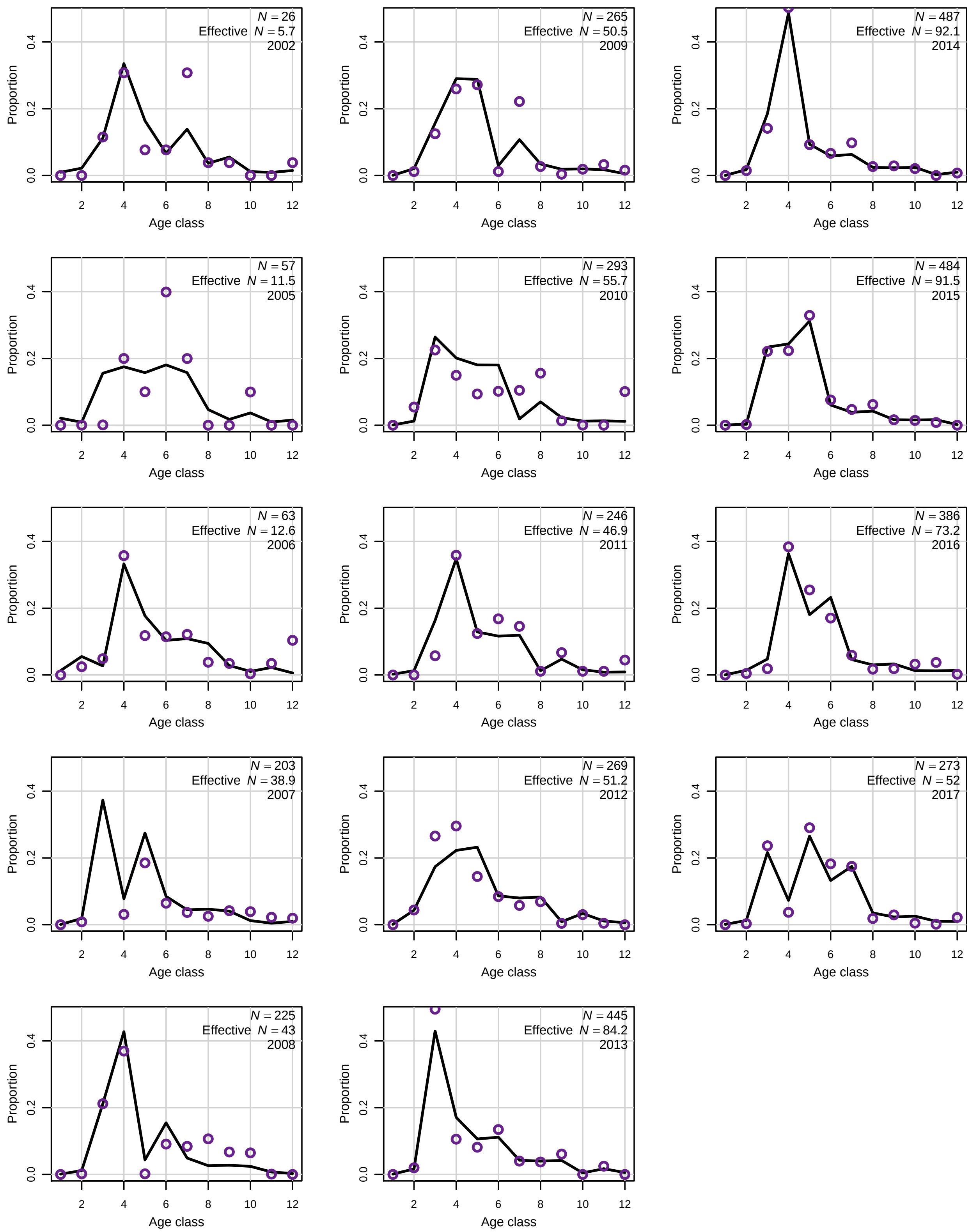


Figure 3. Observed (open circles) and estimated (line, solid circles) commercial landings (1000 lb whole weight).

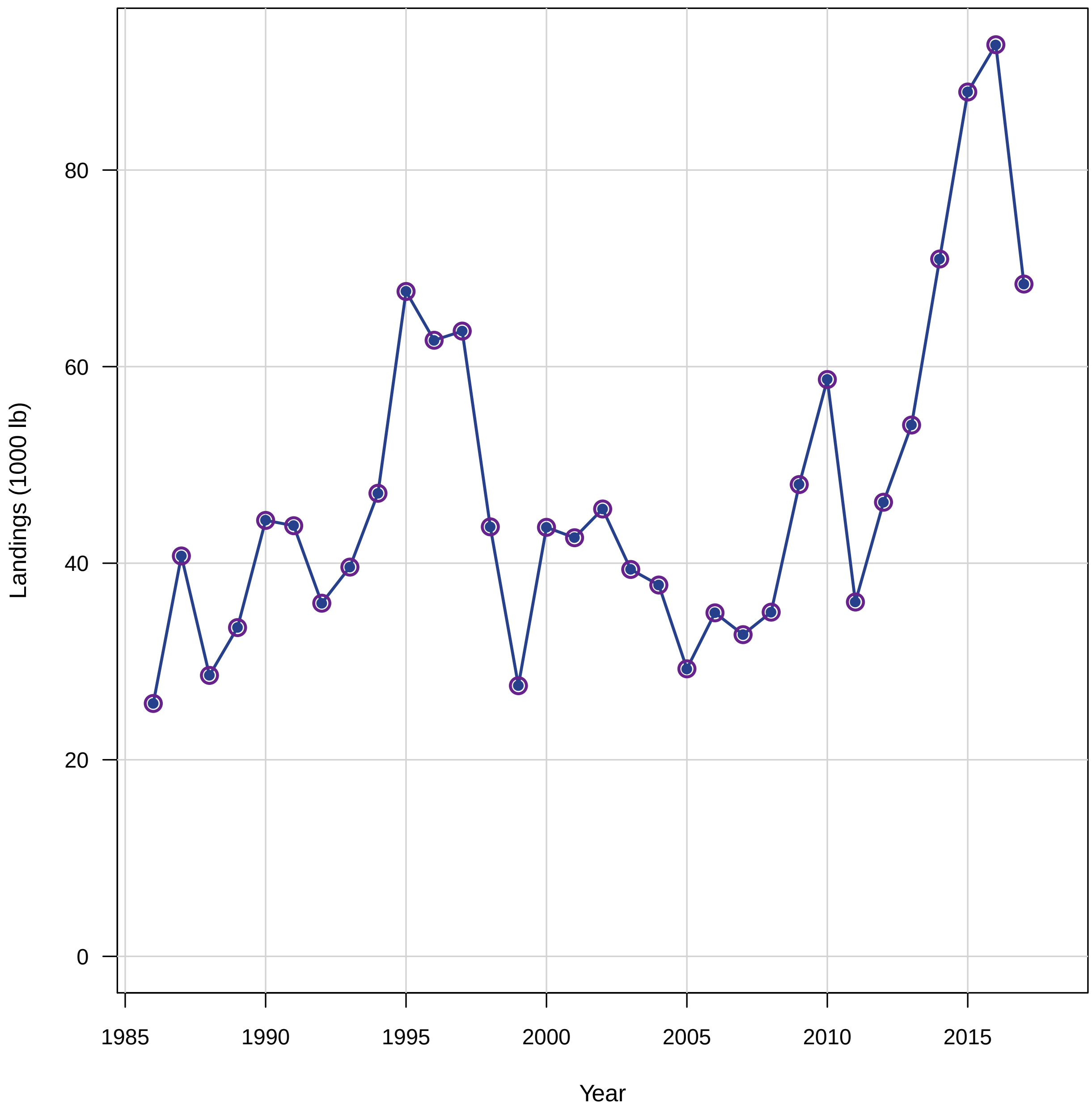


Figure 4. Observed (open circles) and estimated (line, solid circles) general recreational landings (1000 fish).

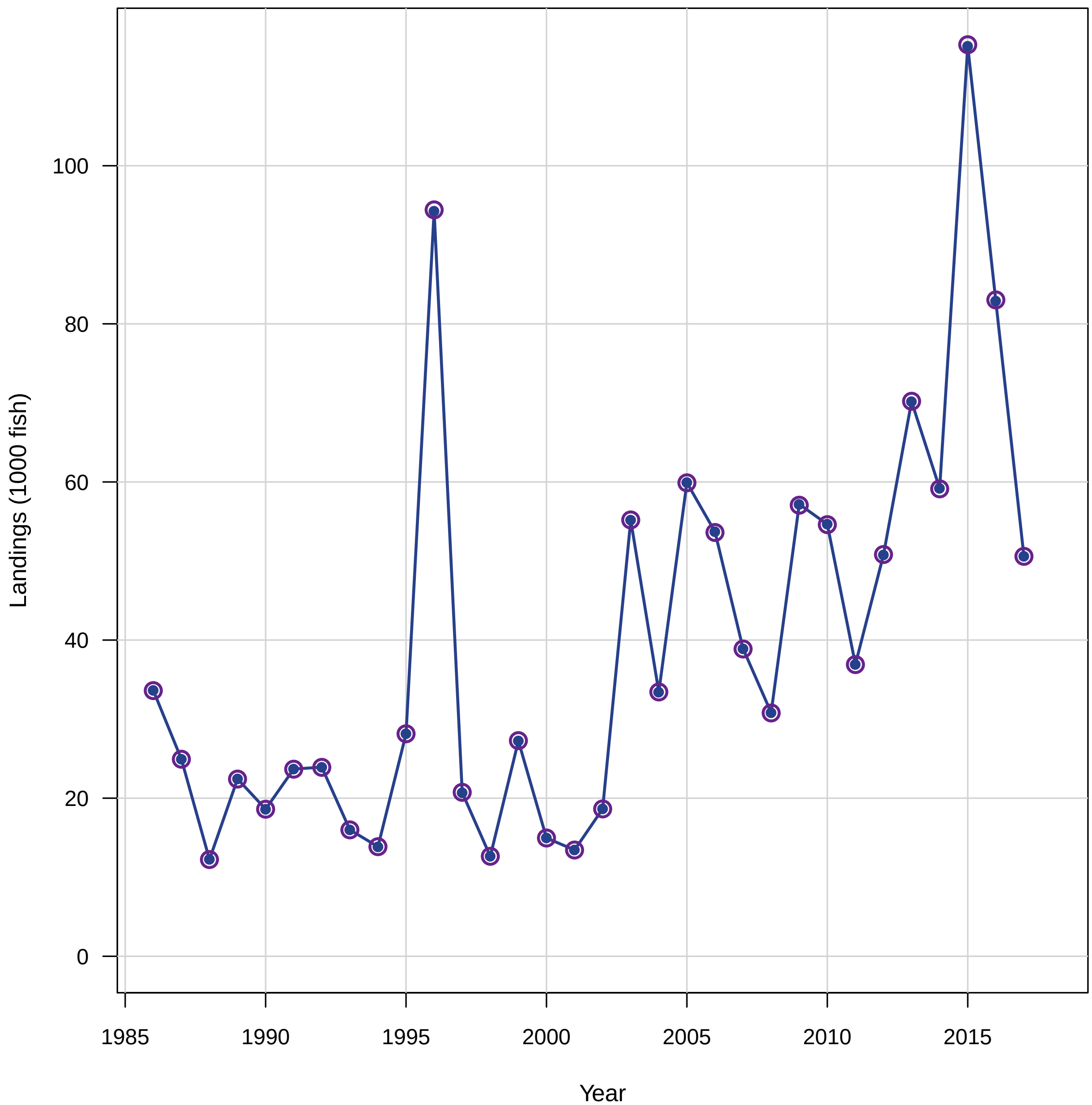


Figure 5. Observed (open circles) and estimated (line, solid circles) index of abundance from the headboat fleet.

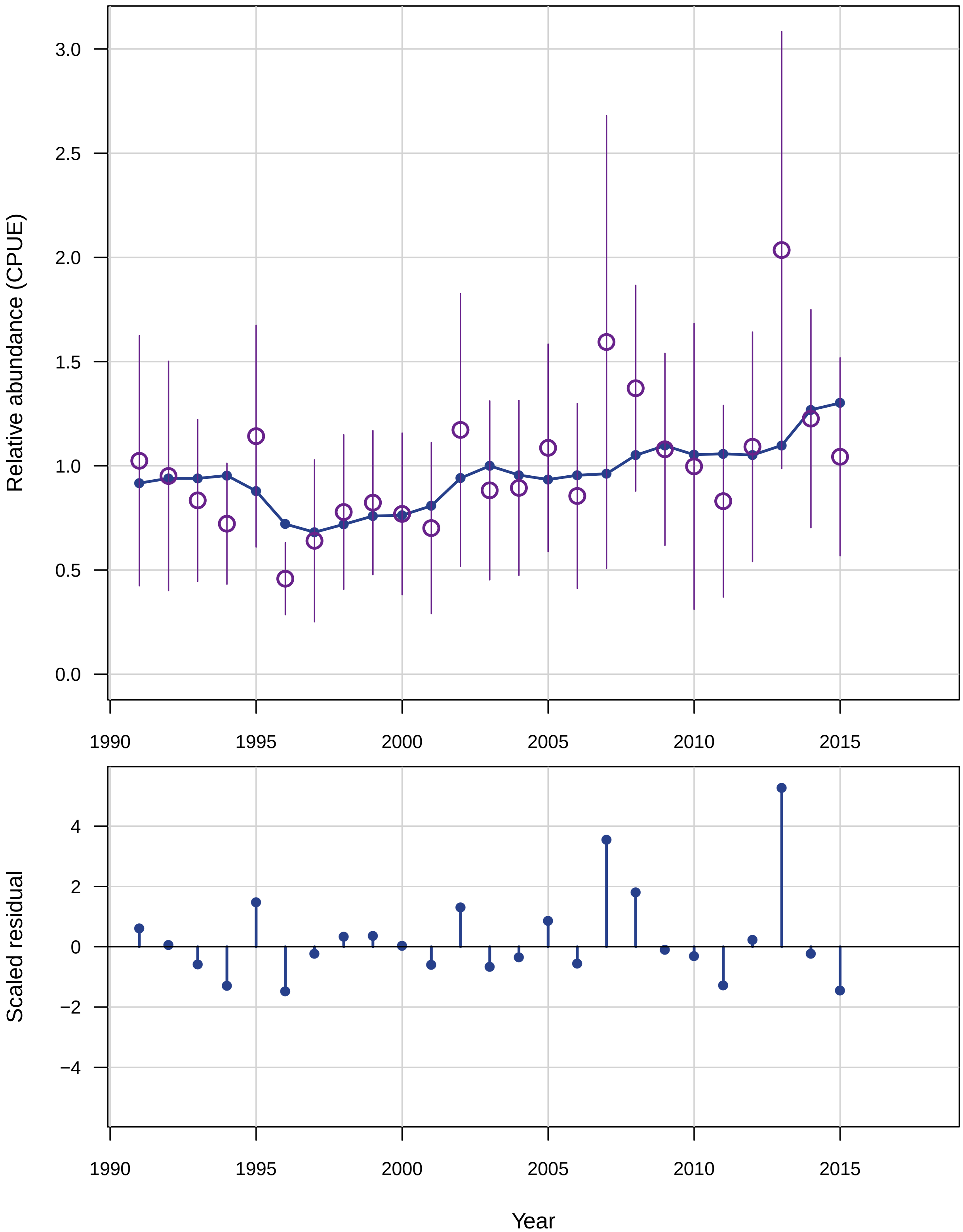


Figure 6. Estimated abundance at age at start of year.

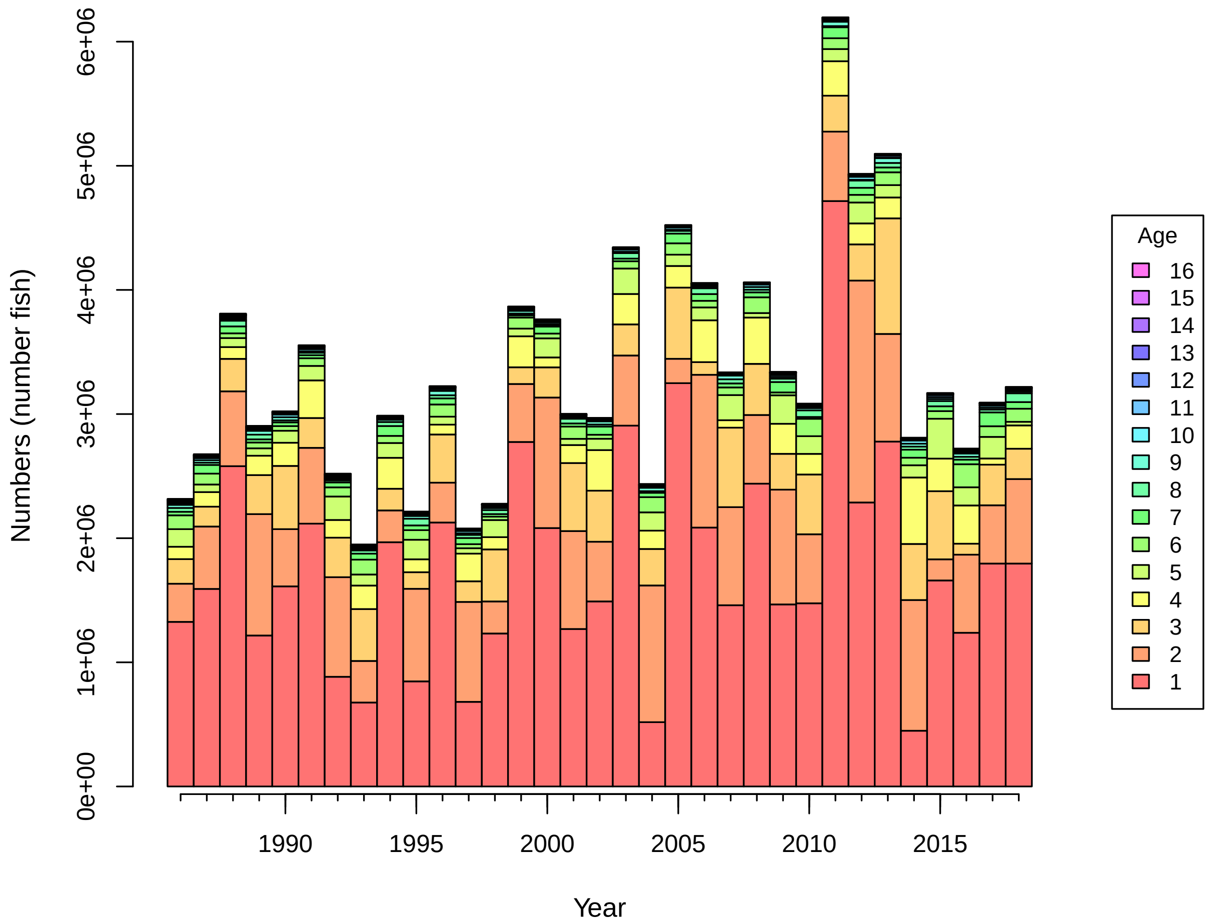


Figure 7. Top panel: Estimated recruitment of age-1 fish. Horizontal dashed line indicates $R_{F40\%}$. Bottom panel: log recruitment residuals.

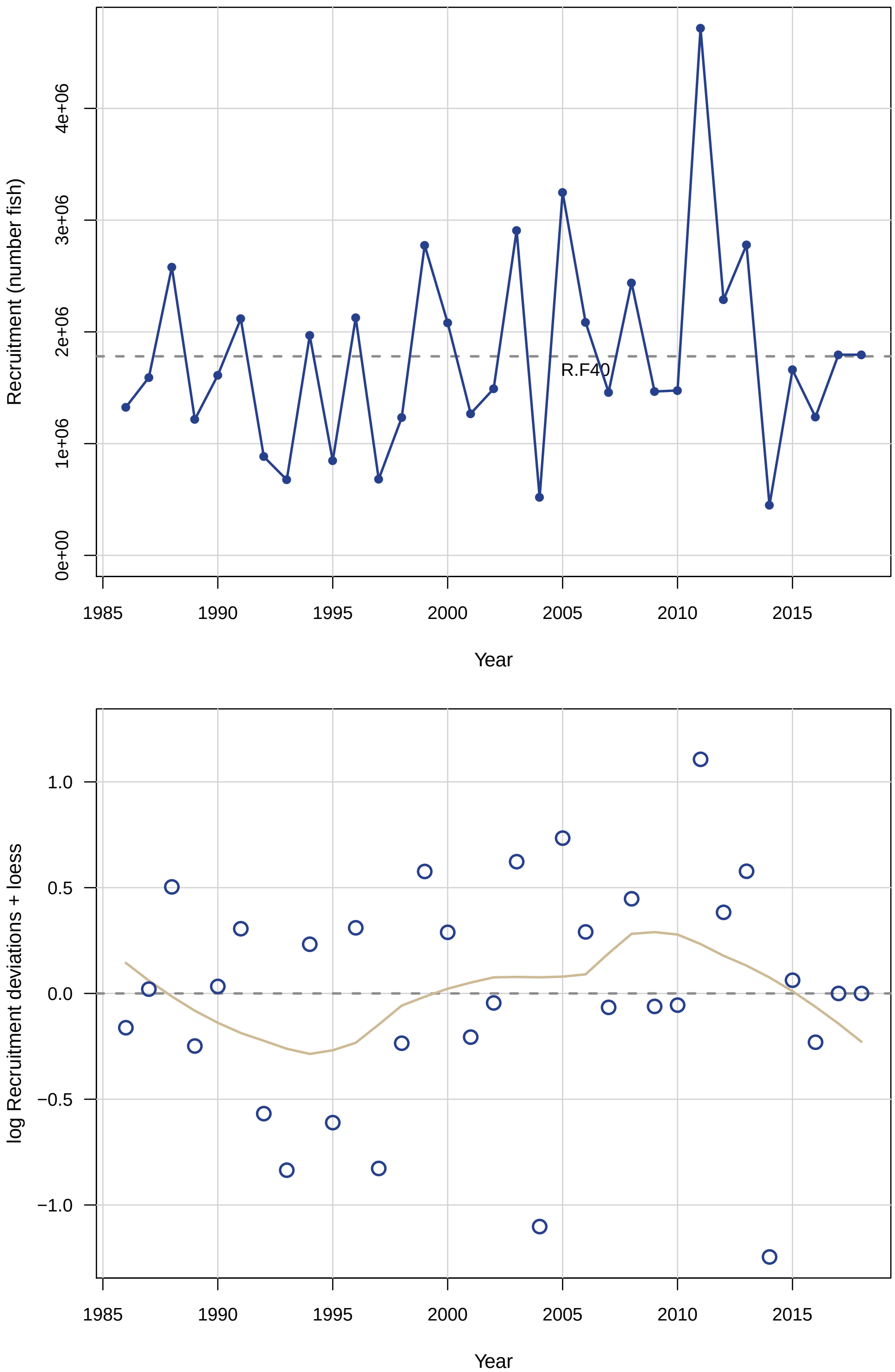


Figure 8. Estimated biomass at age at start of year.

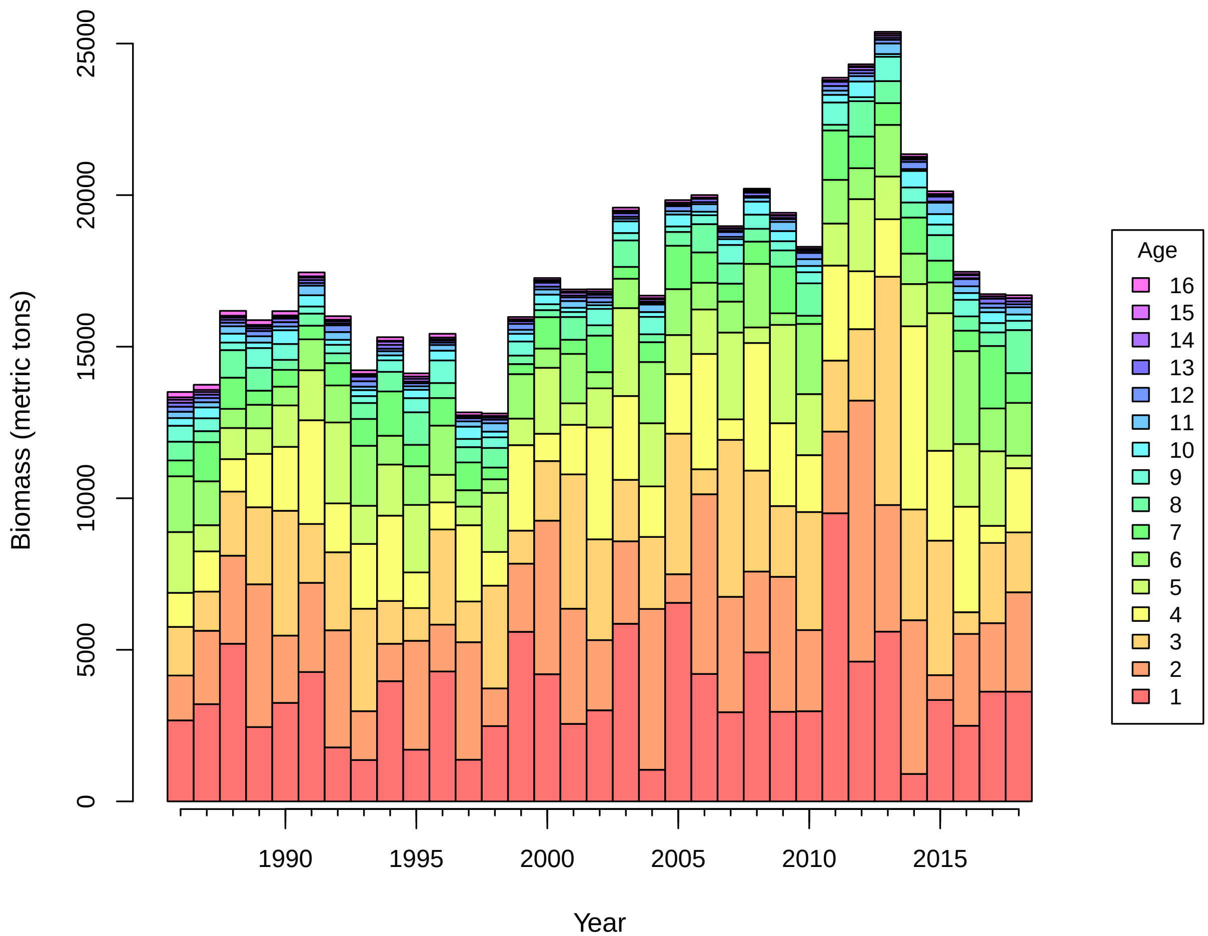


Figure 9. Top panel: Estimated total biomass (metric tons) at start of year. Horizontal dashed line indicates $B_{\mathrm{F40\%}}$*. Bottom panel: Estimated spawning stock (mature female biomass) at time of peak spawning.*

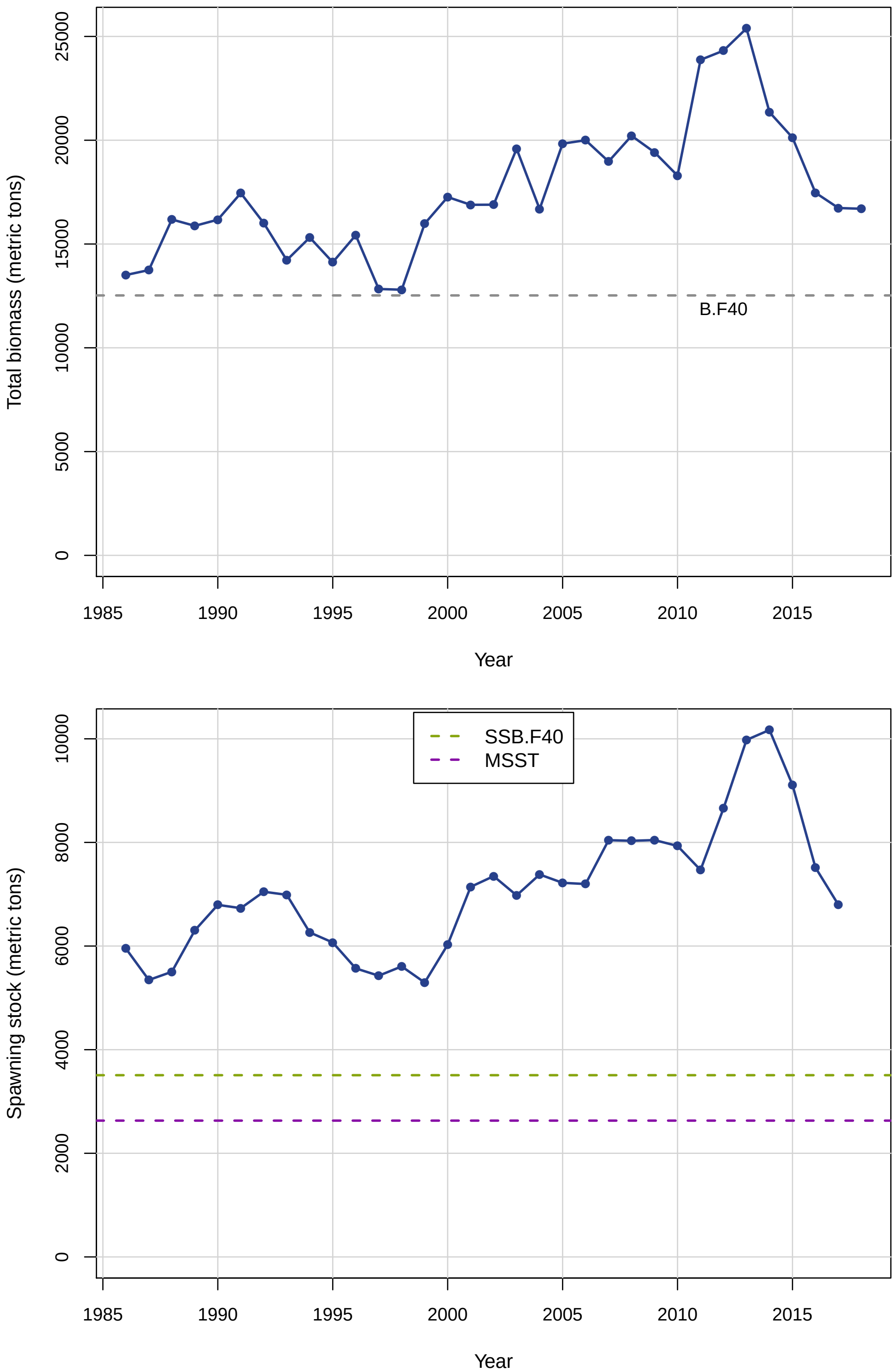


Figure 10. Estimated selectivity of the commercial fleet. Years indicated on plot signify the first year of a time block.

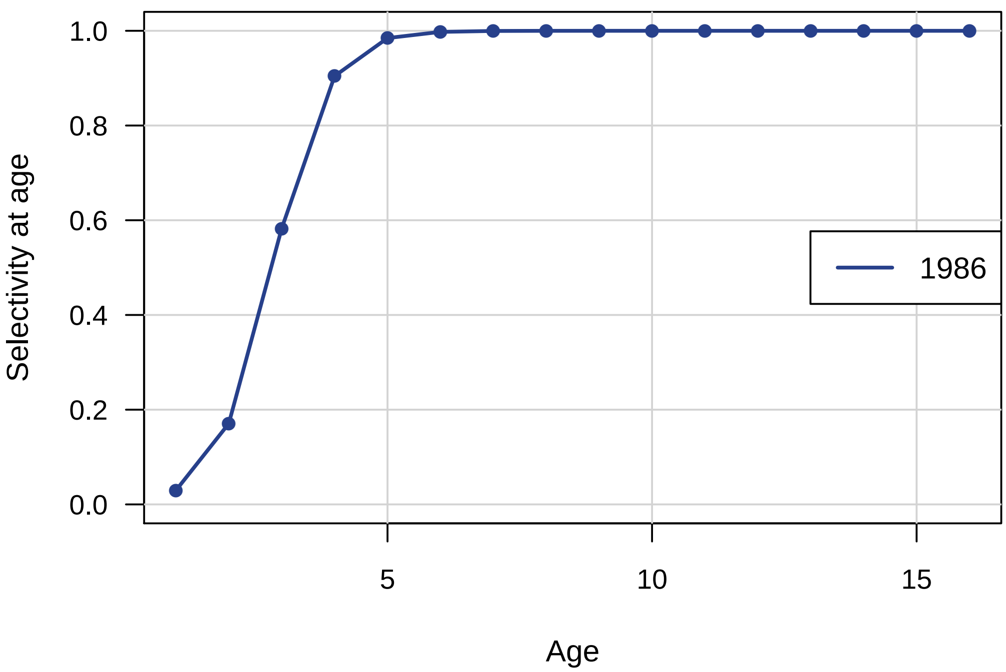


Figure 11. Estimated selectivities of the general recreational fleet. Years indicated on plot signify the first year of a time block.

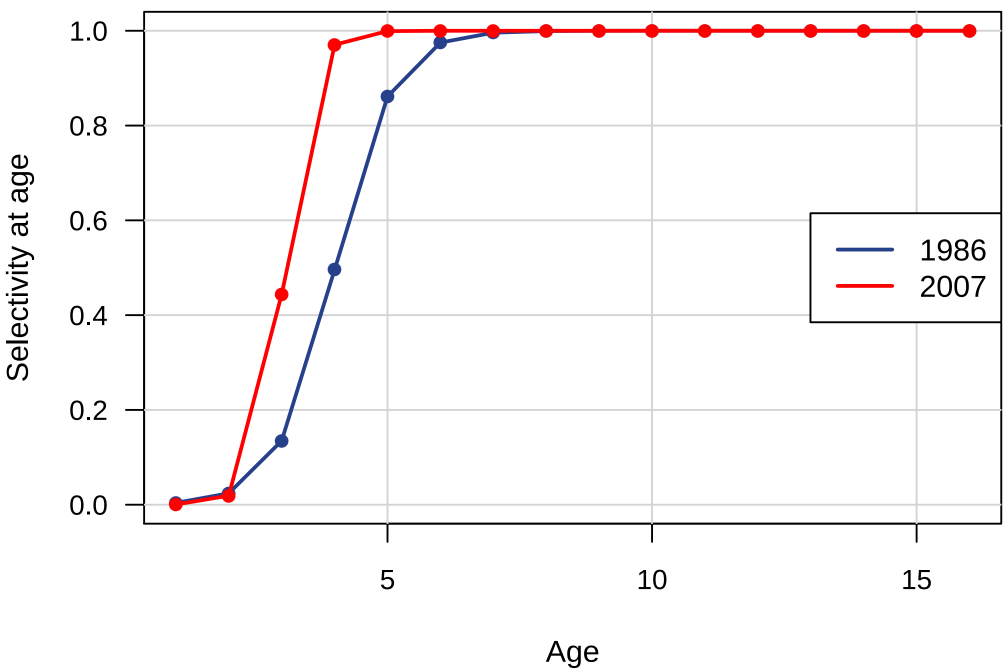


Figure 12. Average selectivity from the terminal assessment years, weighted by geometric mean Fs from the last three assessment years, and used in computation of benchmarks and projections.

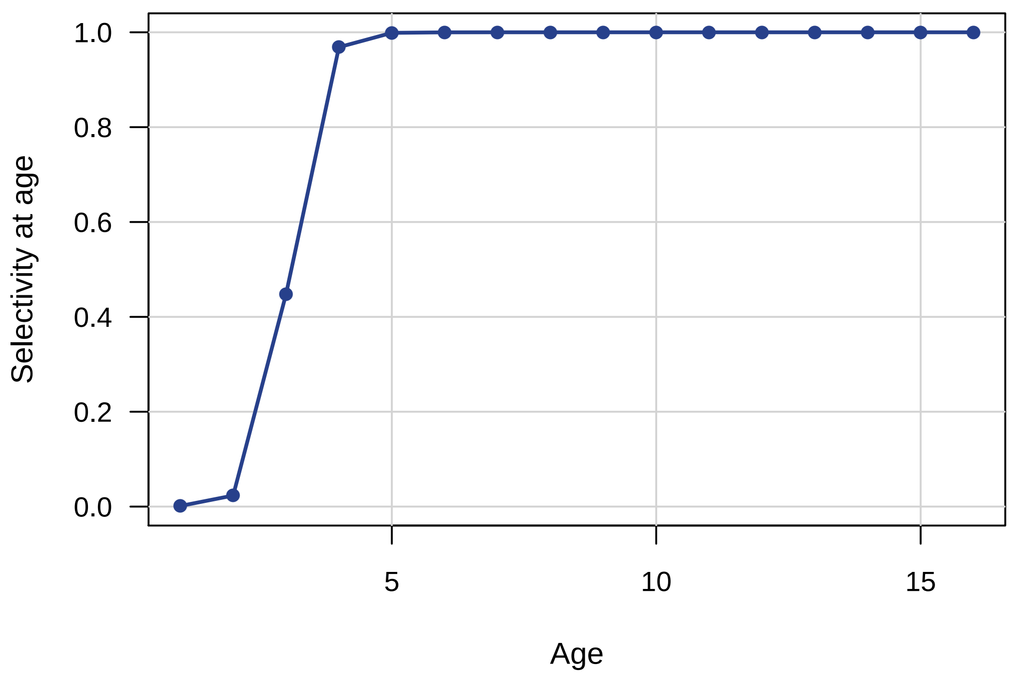


Figure 13. Estimated fully selected fishing mortality rate (per year) by fishery. comm refers to the commercial fleet, and GR to the general recreational fleet.

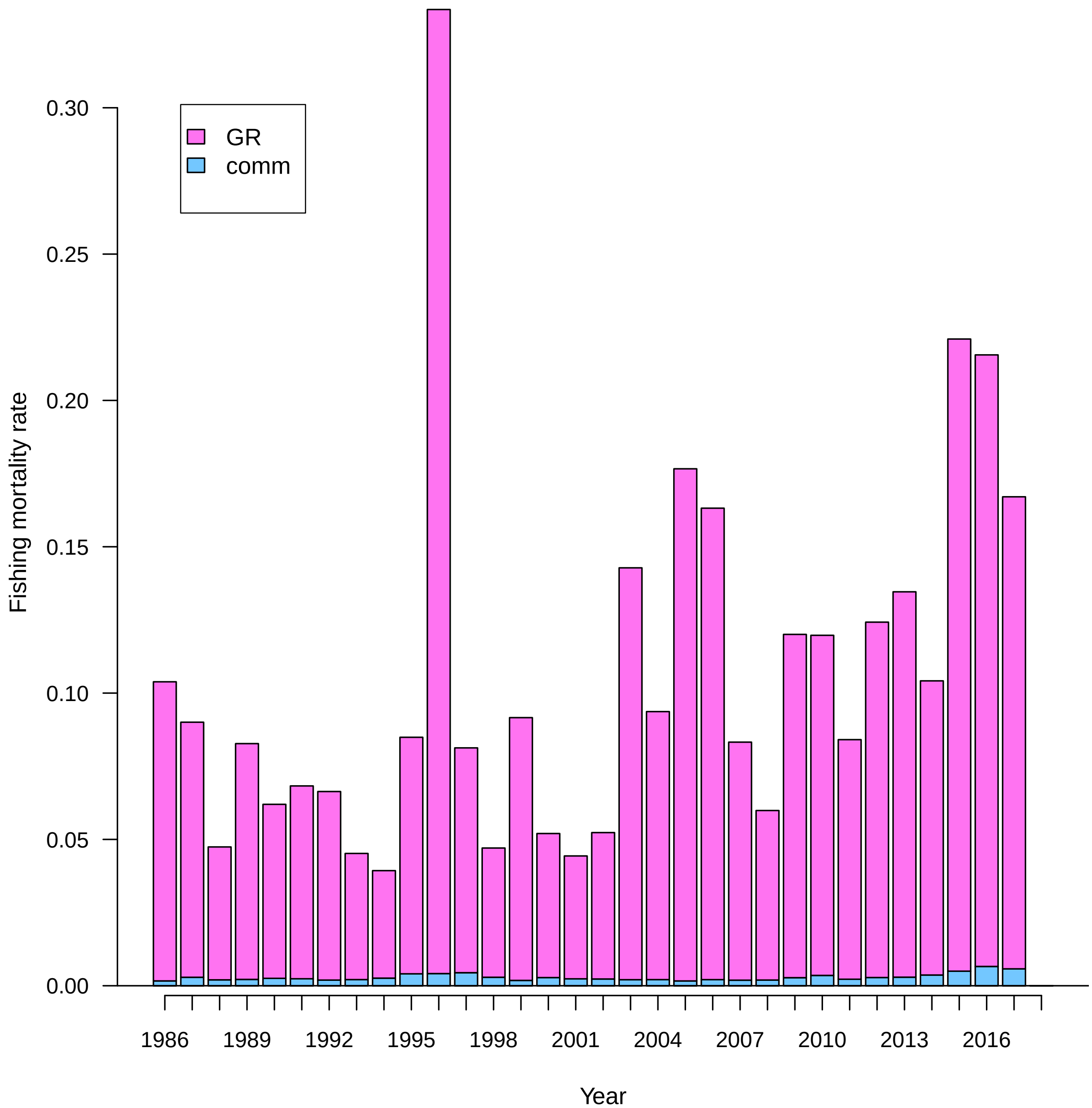


Figure 14. Estimated landings in numbers by fishery from the catch-age model. comm refers to the commercial fleet, and GR to the general recreational fleet.

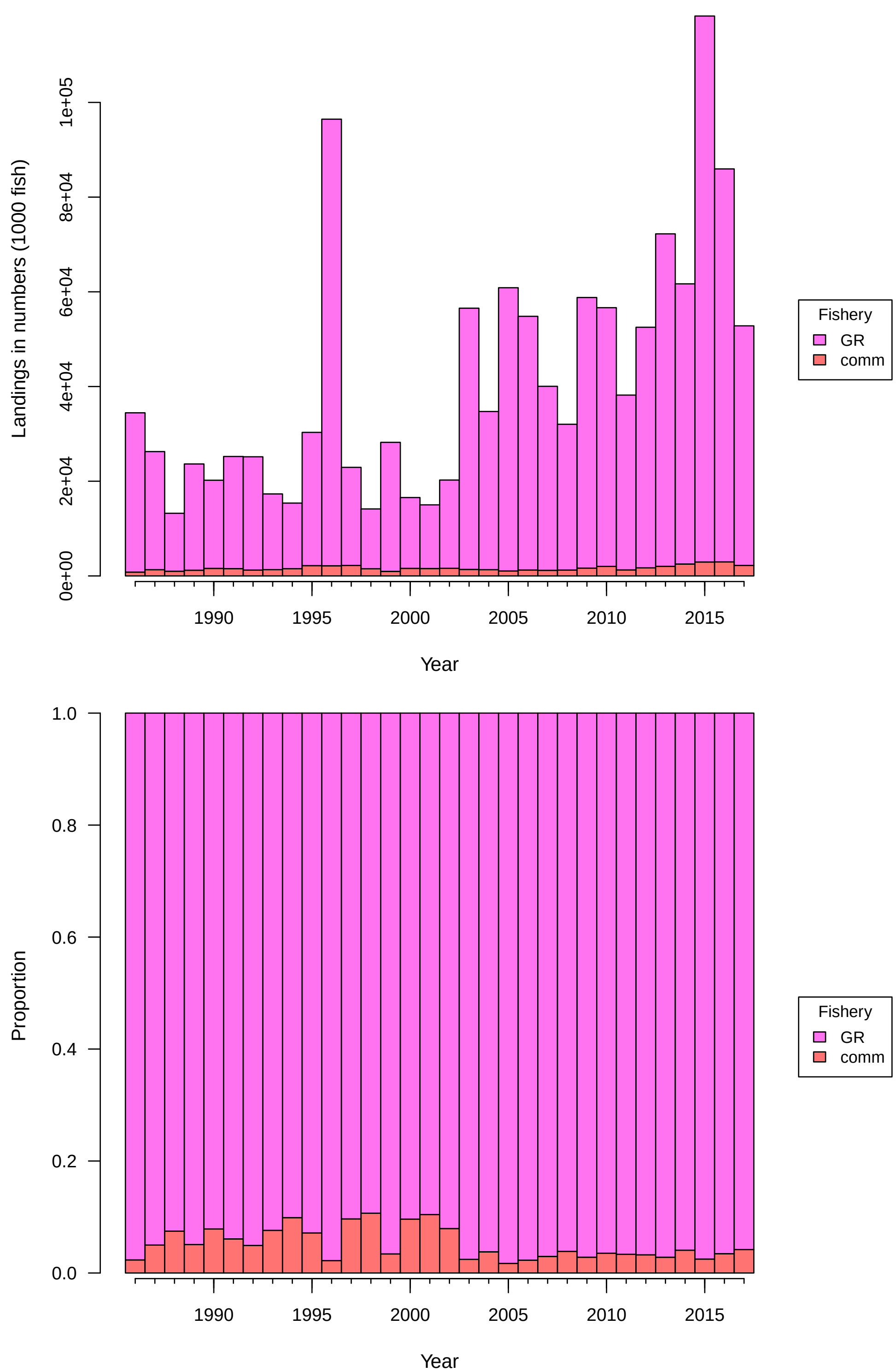


Figure 15. Estimated landings in whole weight by fishery from the catch-age model. comm refers to the commercial fleet, and GR to the general recreational fleet.

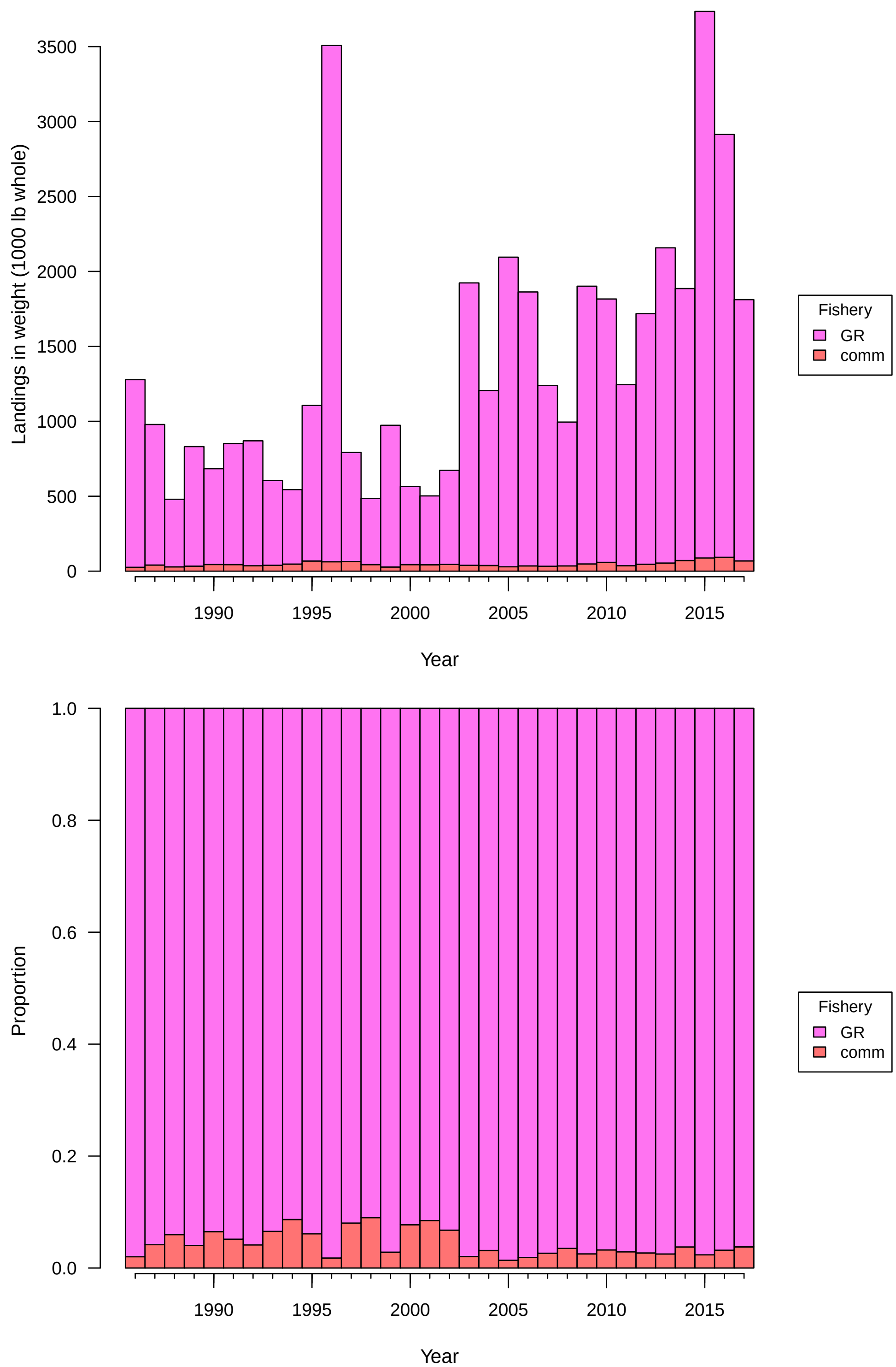


Figure 16. Top panel: Spawner-recruit relationship, with and without lognormal bias correction. The expected curve was used for computing management benchmarks. Years within panel indicate year of recruitment generated from spawning biomass. Bottom panel: log of recruits (number age-1 fish) per spawner as a function of spawners.

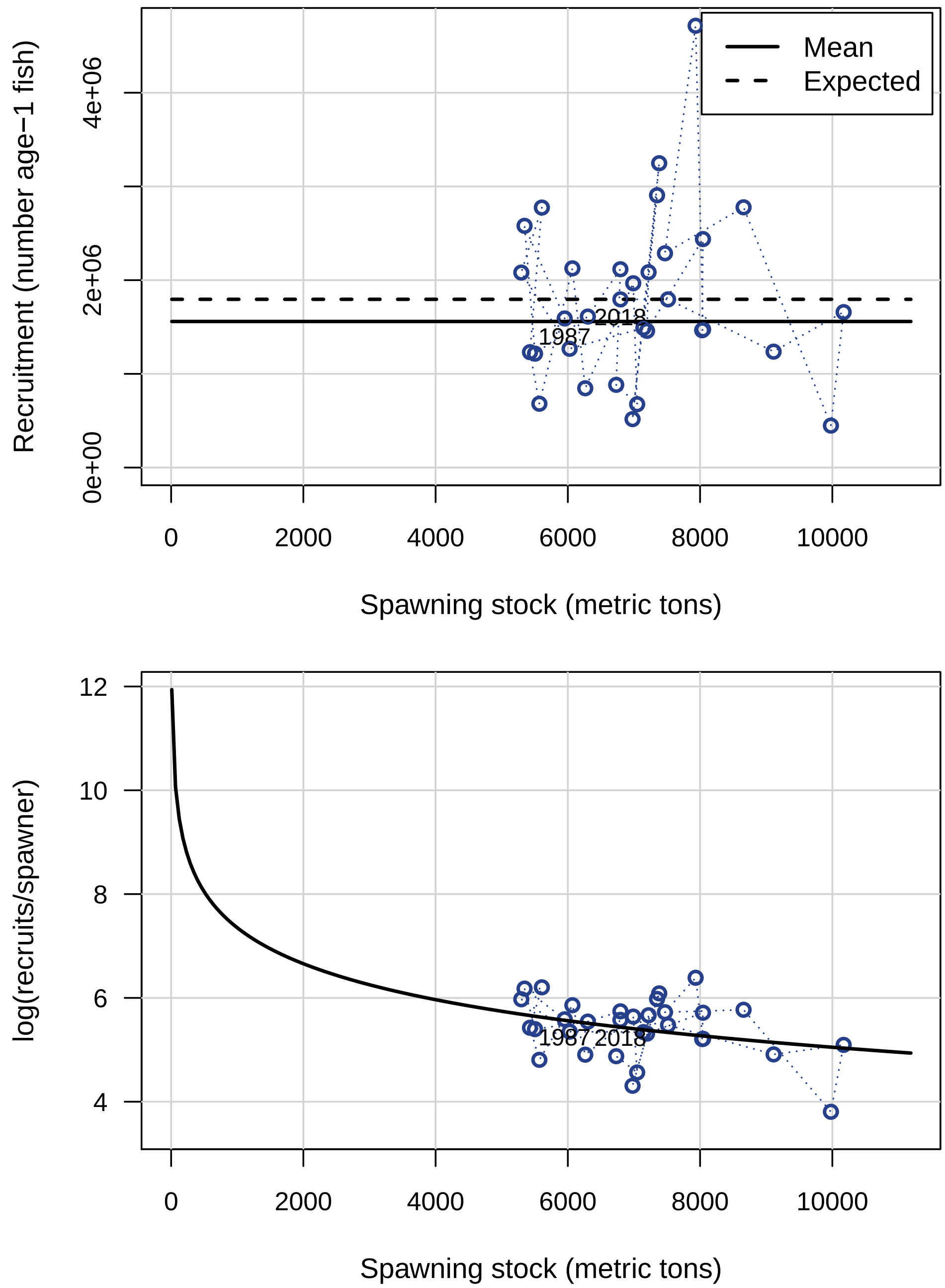


Figure 17. Probability densities of spawner-recruit quantities R0 (unfished recruitment of age-1 fish), the SD of recruitment residuals, and unfished spawners per recruit. Vertical lines represent point estimates or values from the base run of the Beaufort Assessment Model.

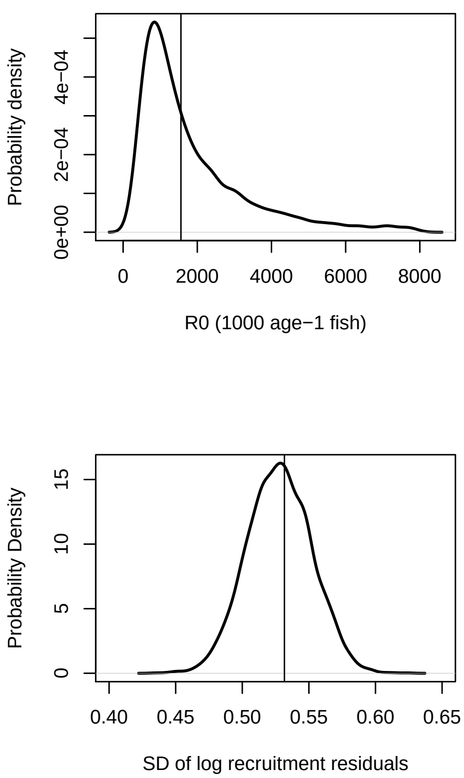


Figure 18. Top panel: yield per recruit (kg). Bottom panel: spawning potential ratio (spawning biomass per recruit relative to that at the unfished level), from which the X% level of SPR provides $F_{X\%}$. Both curves are based on average selectivity from the end of the assessment period.

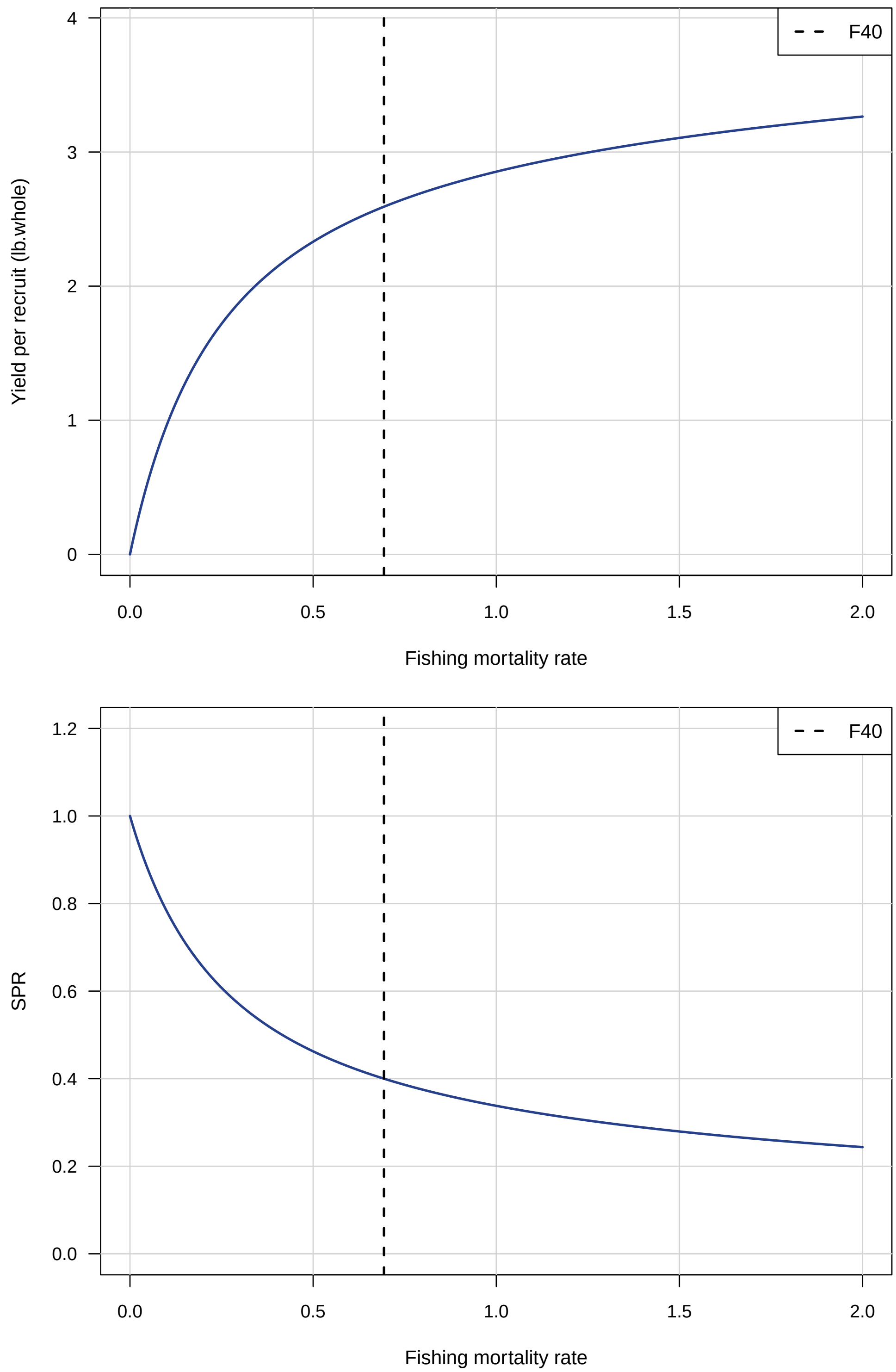


Figure 19. Top panel: equilibrium landings. The vertical dashed line occurs where fishing rate is $F_{40\%} = 0.69$ *and equilibrium landings are* $L_{\mathrm{F40\%}}$ *(1000 lb). Bottom panel: equilibrium spawning biomass. Both curves are based on average selectivity from the end of the assessment period.*

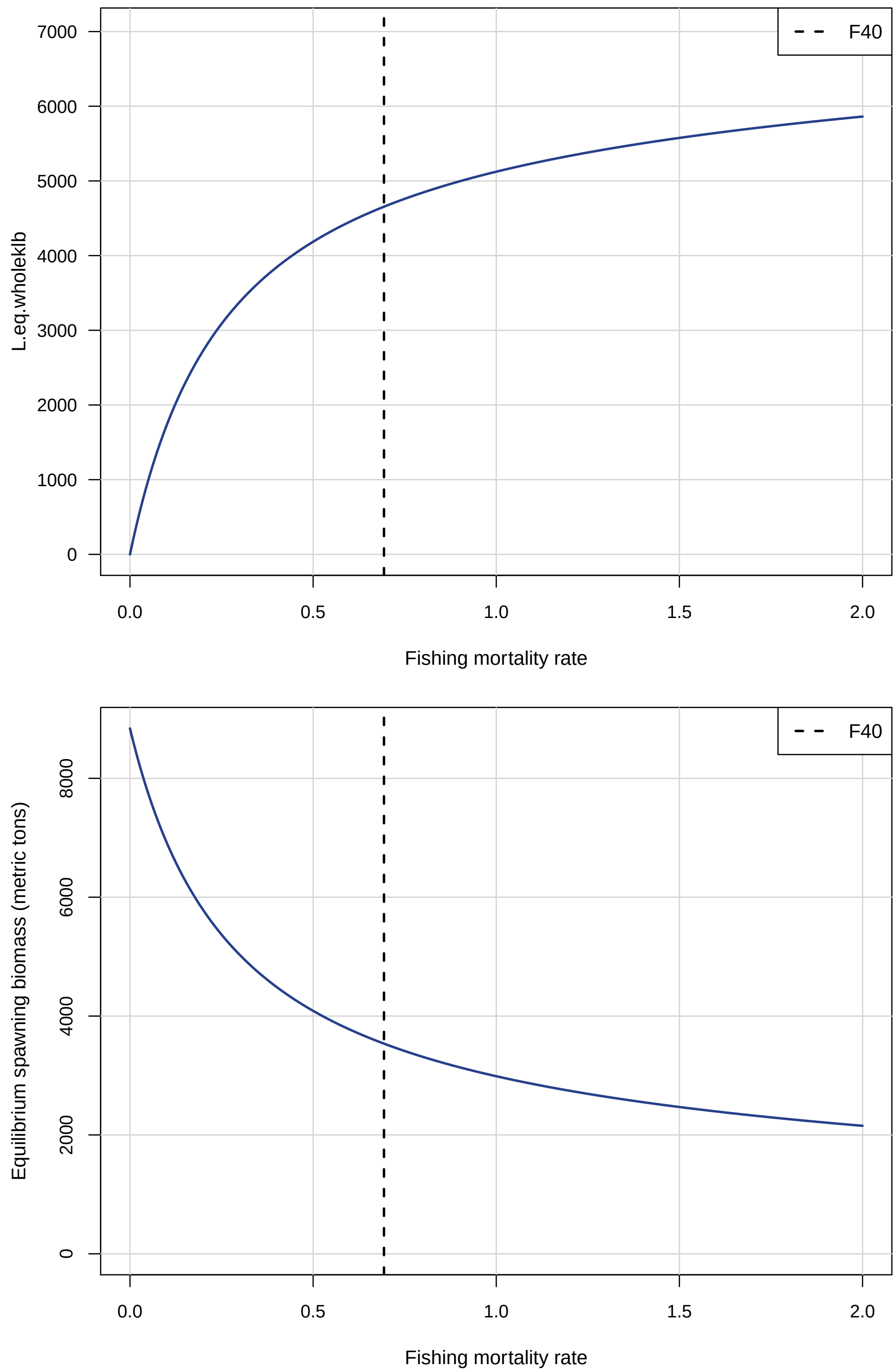


Figure 20. Probability densities of $F_{40\%}$-related benchmarks from the ensemble model of the Beaufort Assessment Model. Vertical lines represent point estimates from the base run.

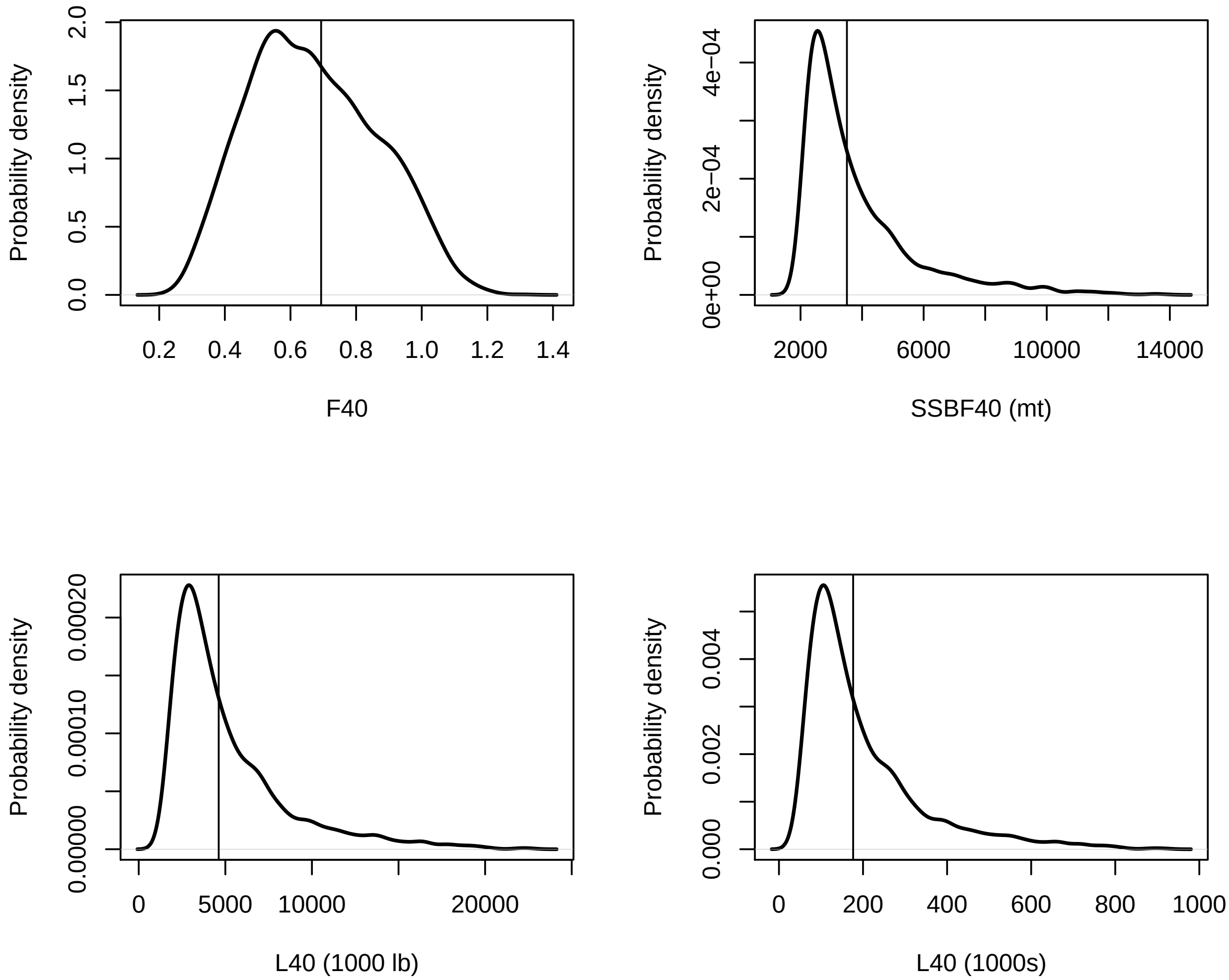


Figure 21. Estimated time series relative to benchmarks. Solid line indicates estimates from base run of the Beaufort Assessment Model; gray error bands indicate 5^{th} *and* 95^{th} *percentiles of the ensemble modeling. Top panel: spawning biomass relative to the minimum stock size threshold (*MSST*). Middle panel: spawning biomass relative to* $\mathrm{SSB}_{\mathrm{F40\%}}$. *Bottom panel: F relative to* $F_{40\%}$.

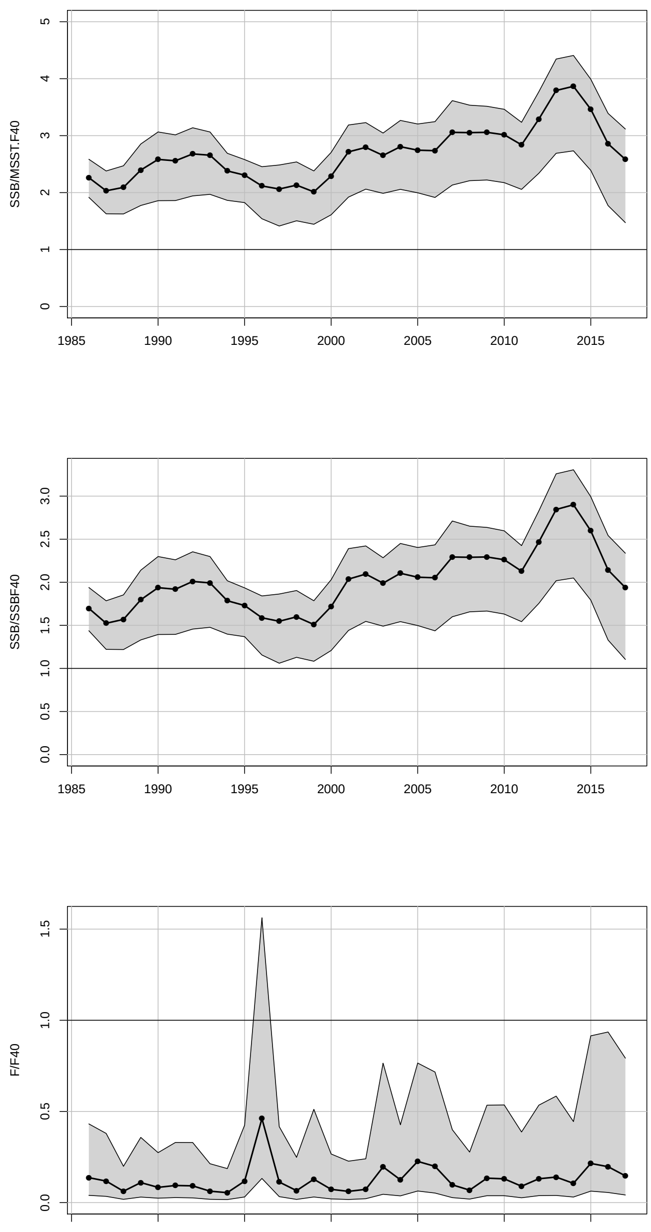


Figure 22. Probability densities of terminal status estimates from ensemble model of the Beaufort Assessment Model. Vertical lines represent point estimates from the base run.

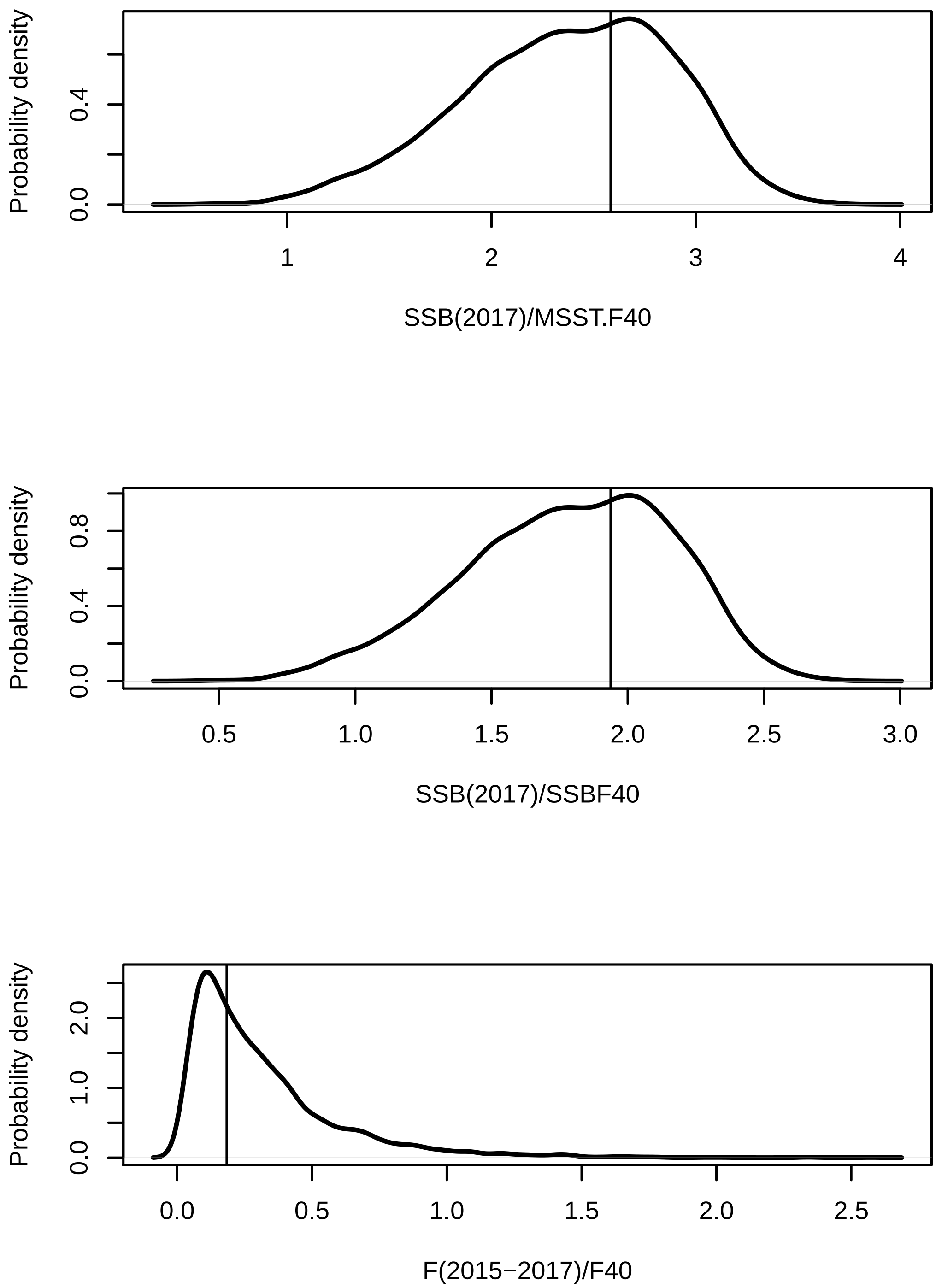
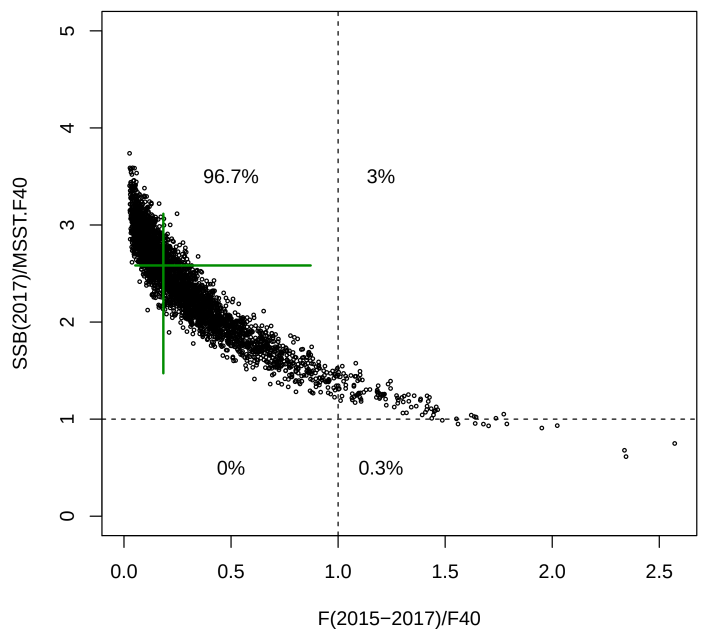


Figure 23. Phase plots of terminal status estimates from the ensemble model of the Beaufort Assessment Model. Top panel is status relative to MSST*, and the bottom panel is status relative to* $\mathrm{SSB}_{\mathrm{F40\%}}$*. The intersection of crosshairs indicates estimates from the base run; lengths of crosshairs defined by* 5^{th} *and* 95^{th} *percentiles.*



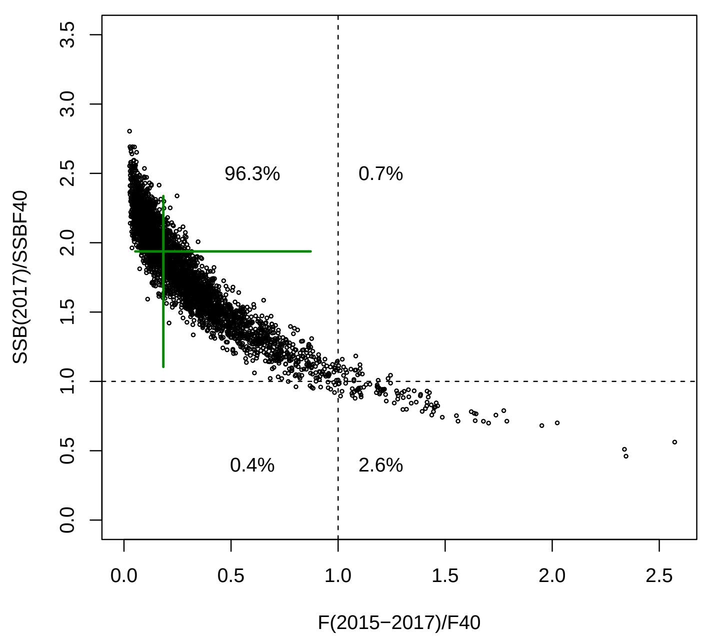


Figure 24. Age structure relative to the equilibrium expected at $L_{\mathrm{F40\%}}$.

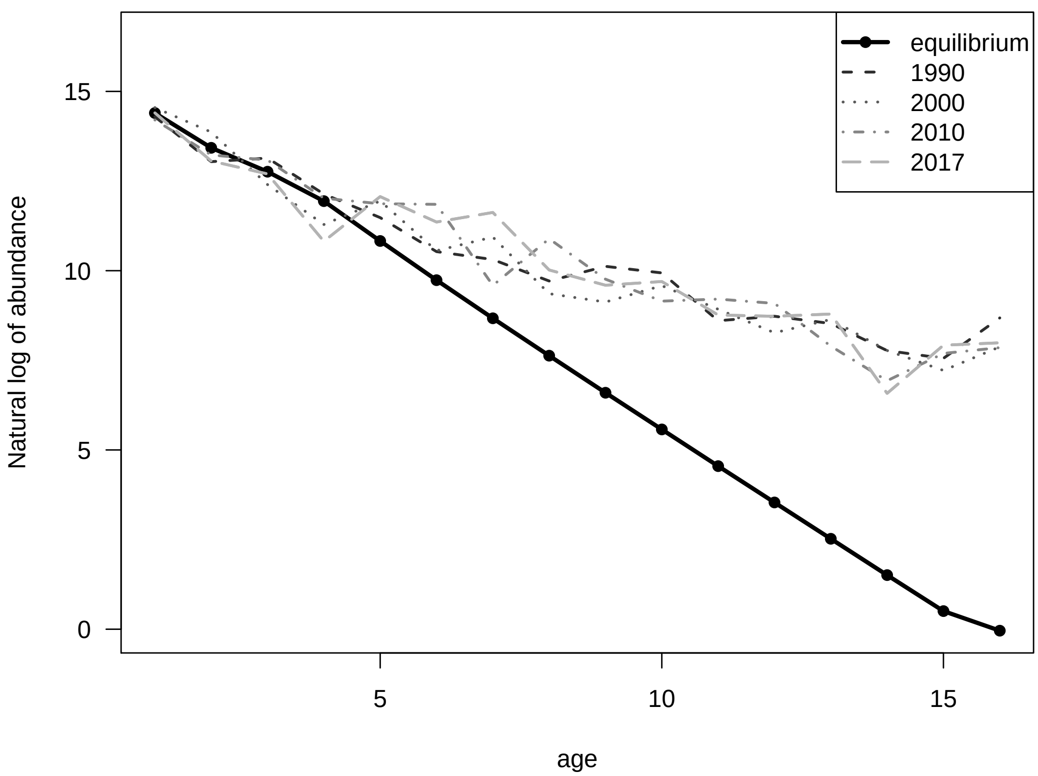
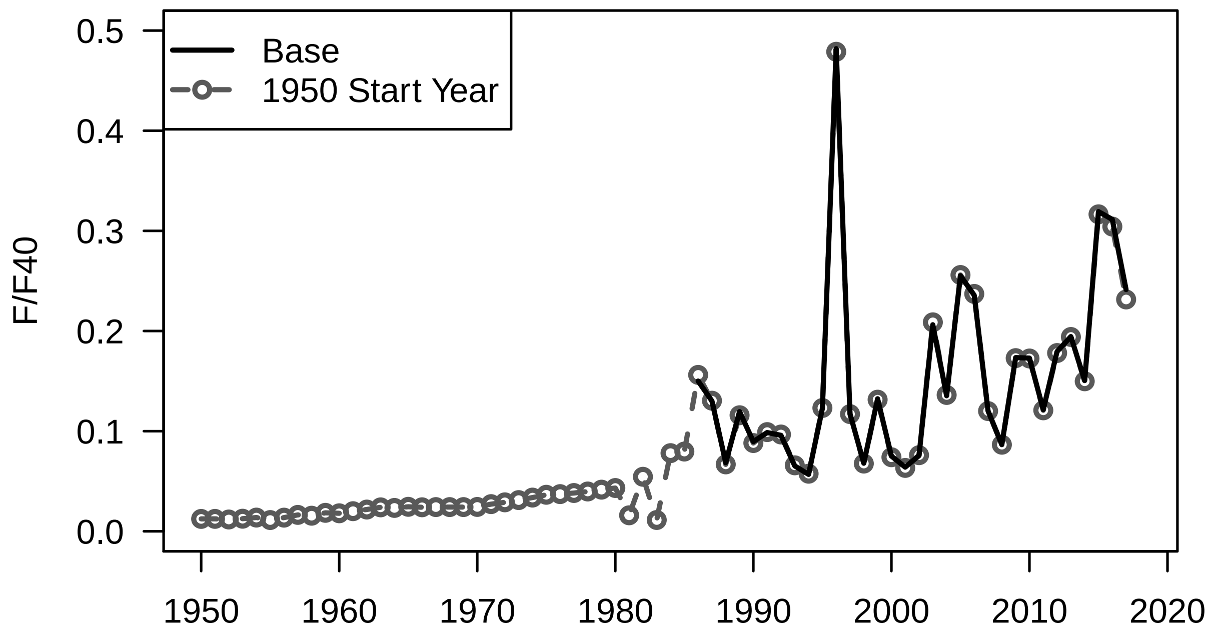


Figure 25. Sensitivity to an earlier start year (sensitivity run S1). Top panel: Ratio of F to $F_{40\%}$*. Bottom panel: Ratio of* SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.



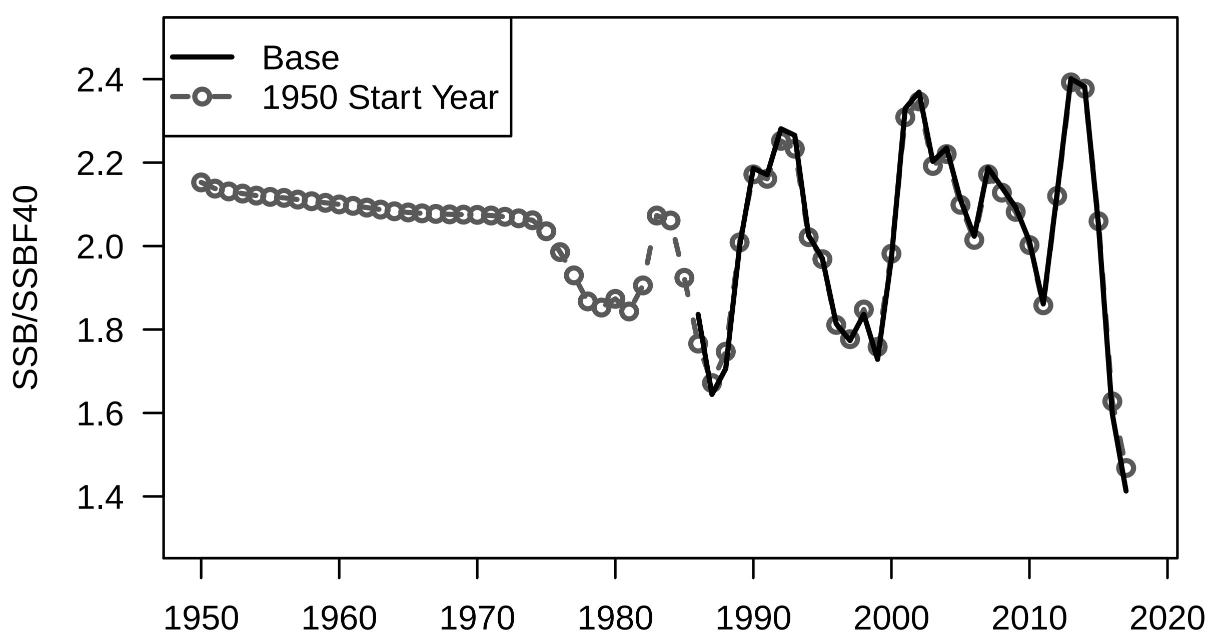
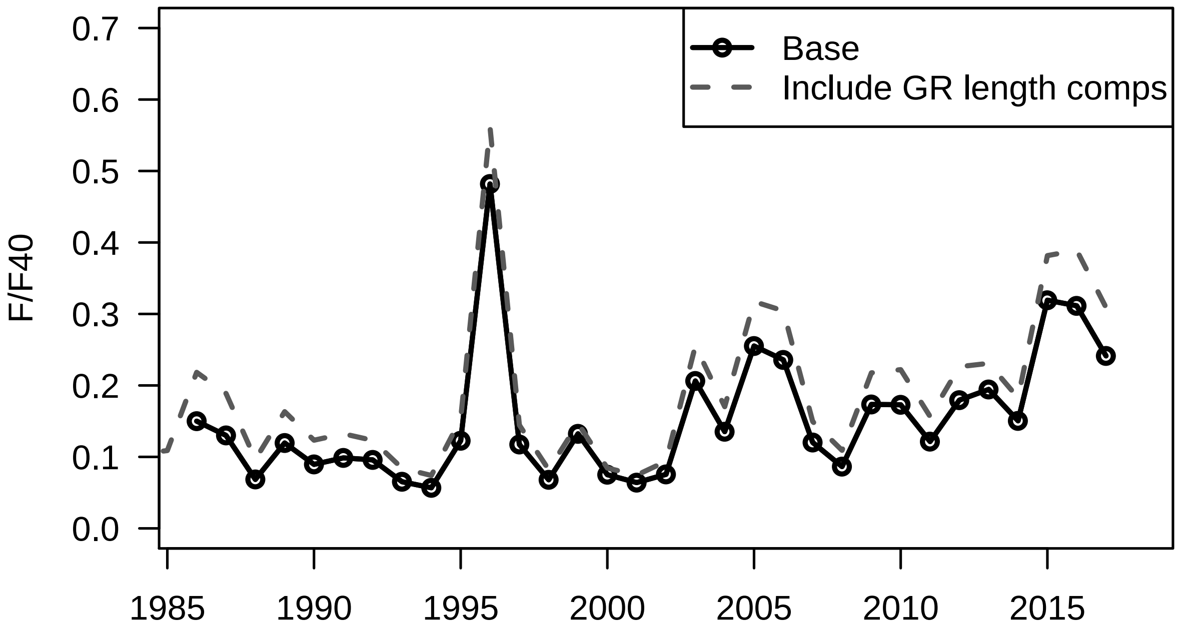


Figure 26. Sensitivity to including recreational length compositions (sensitivity run S2). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F}40\%}$.



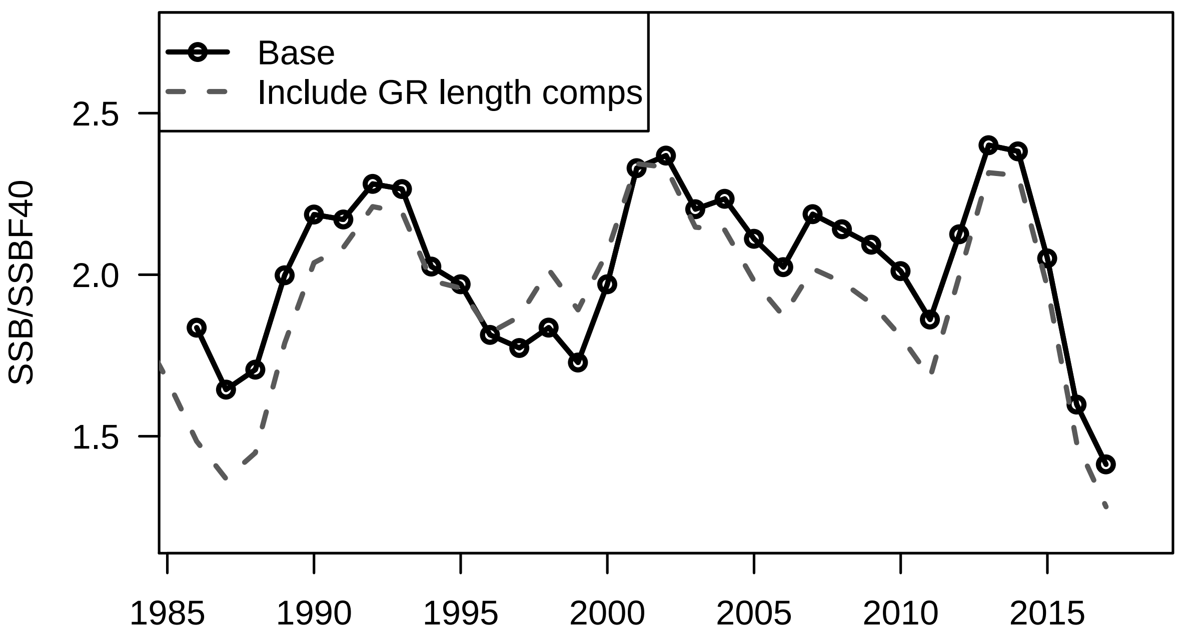
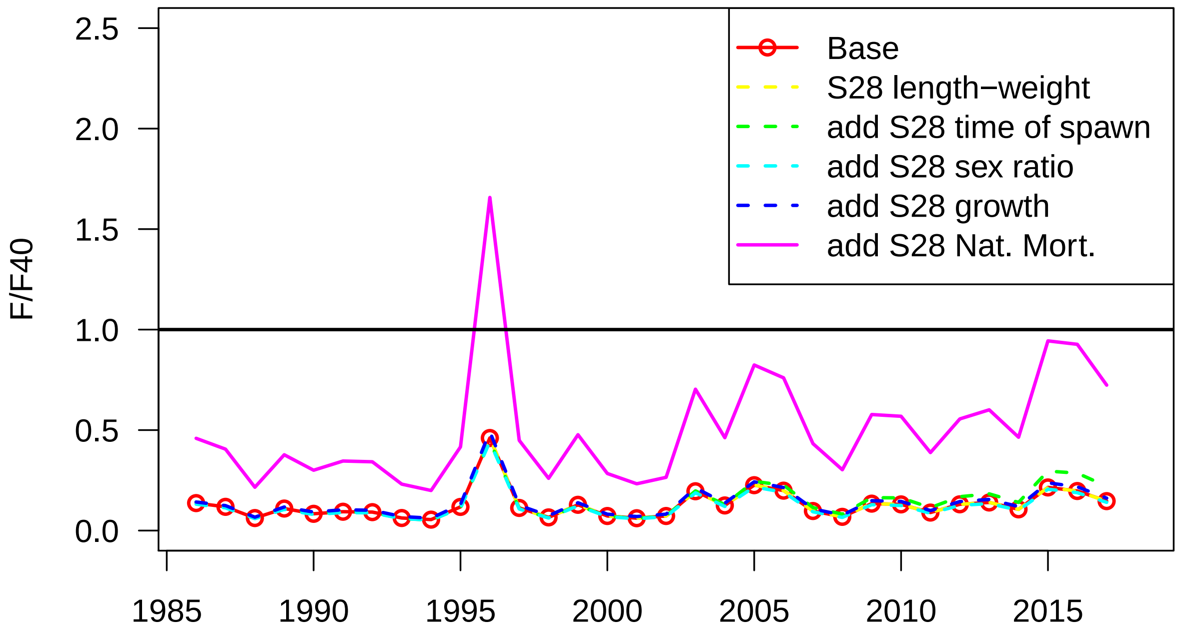


Figure 27. Sensitivity to SEDAR 28 life history values (sensitivity runs S3a-e). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.



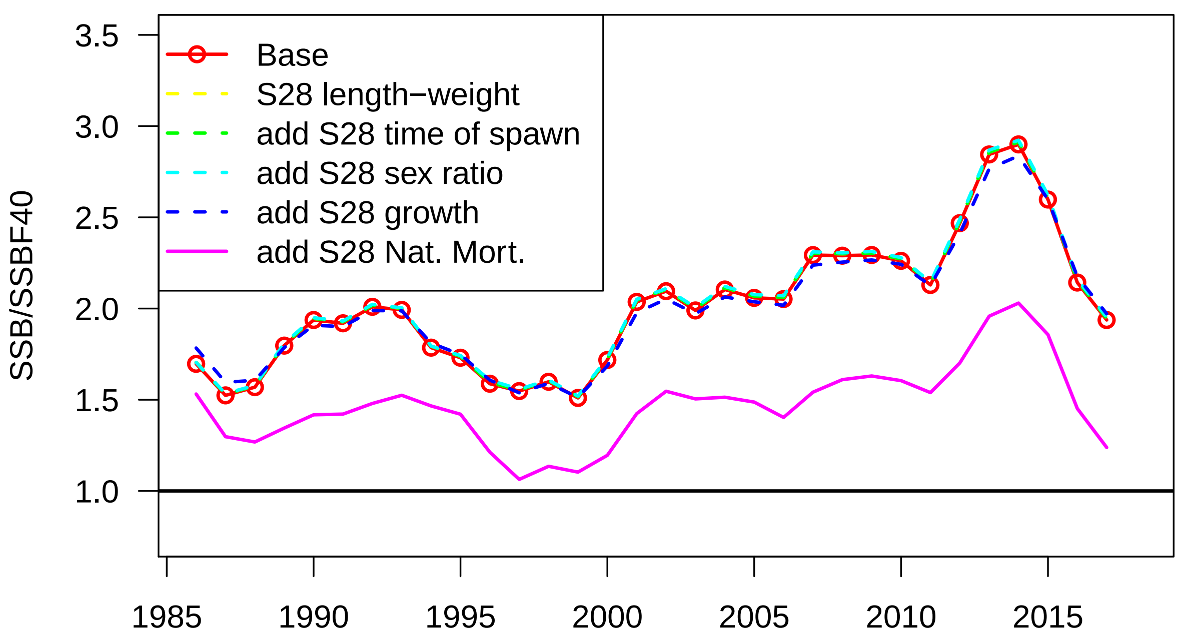


Figure 28. Sensitivity to including the headboat index (sensitivity run S4). Top panel: Ratio of F to $F_{40\%}$. *Bottom panel: Ratio of* SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

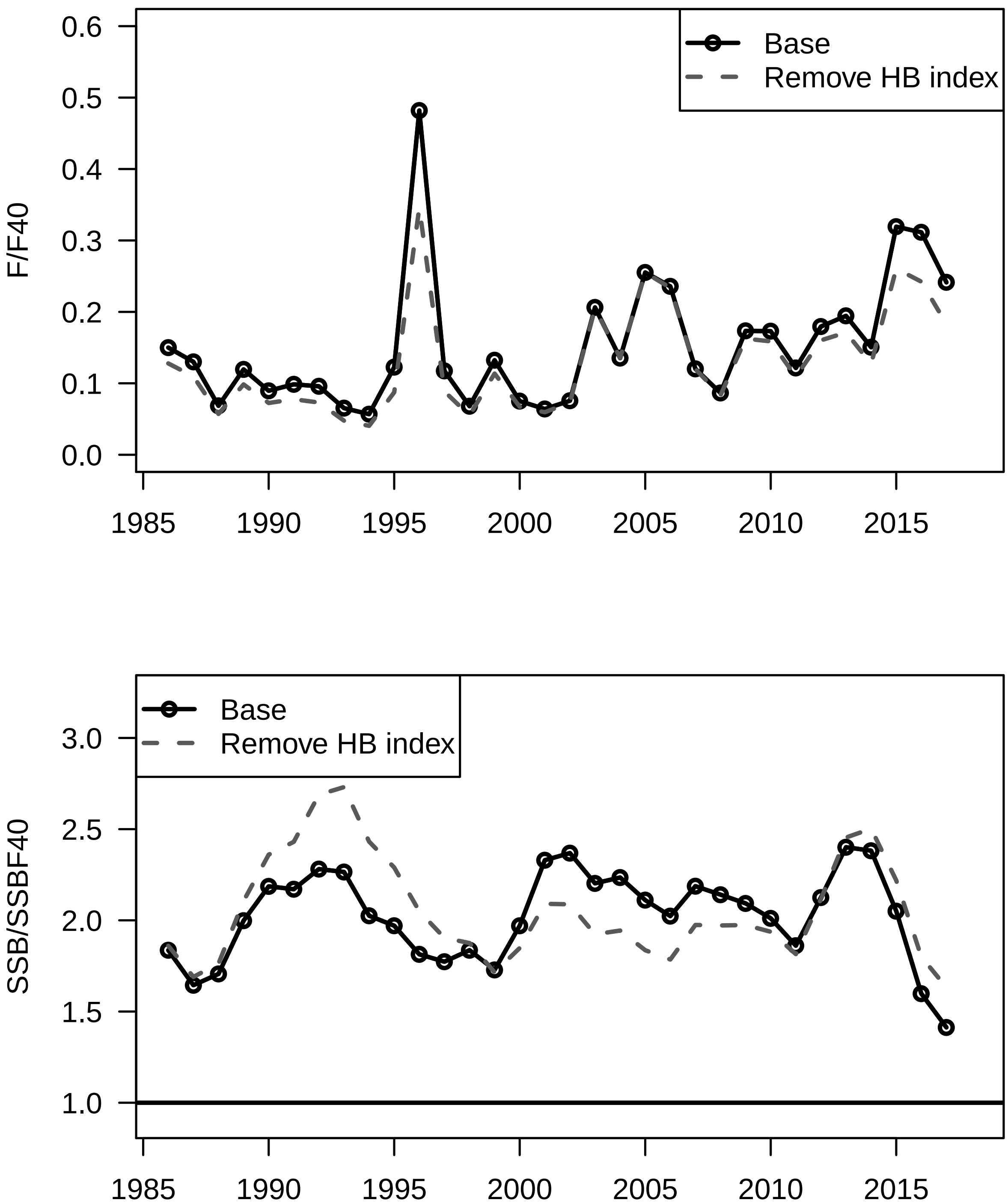


Figure 29. Sensitivity to smoothing the general recreational peaks (sensitivity run S5). Top panel: Ratio of F to $F_{40\%}$. *Bottom panel: Ratio of* SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

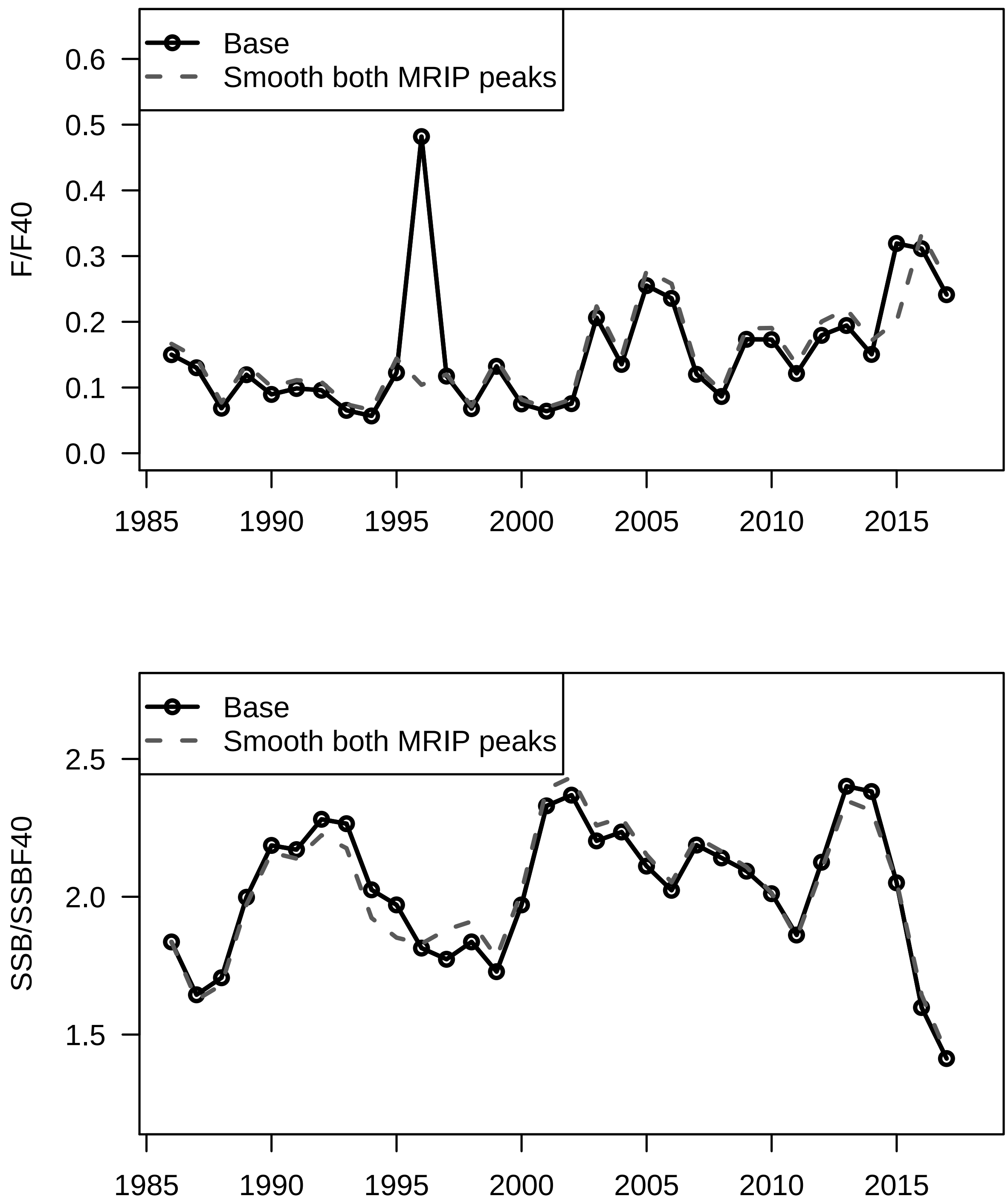


Figure 30. Sensitivity to higher and lower recreational landings (sensitivity runs S6 and S10). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F}40\%}$. *Any lines not visible overlap results of the base run.*

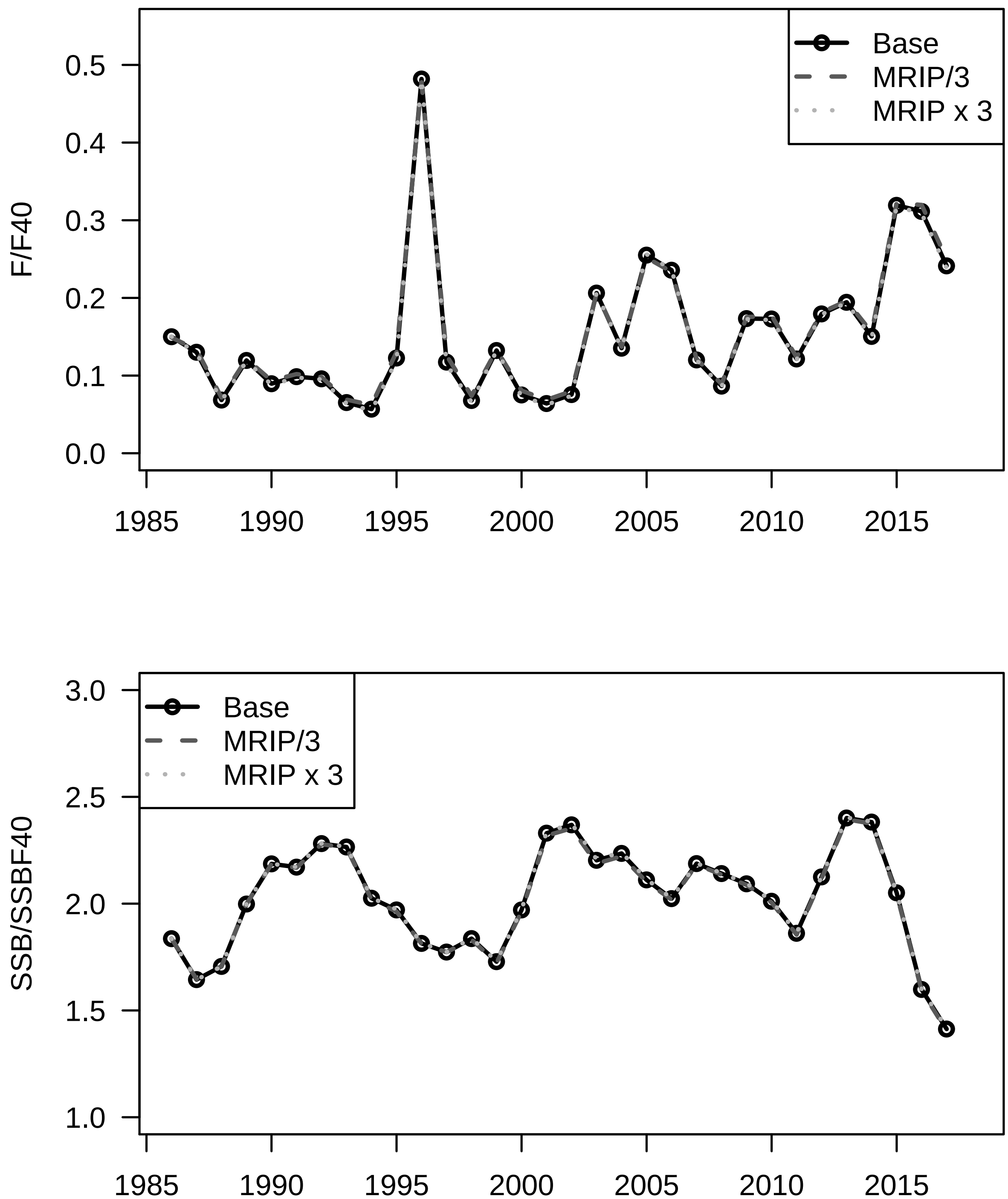
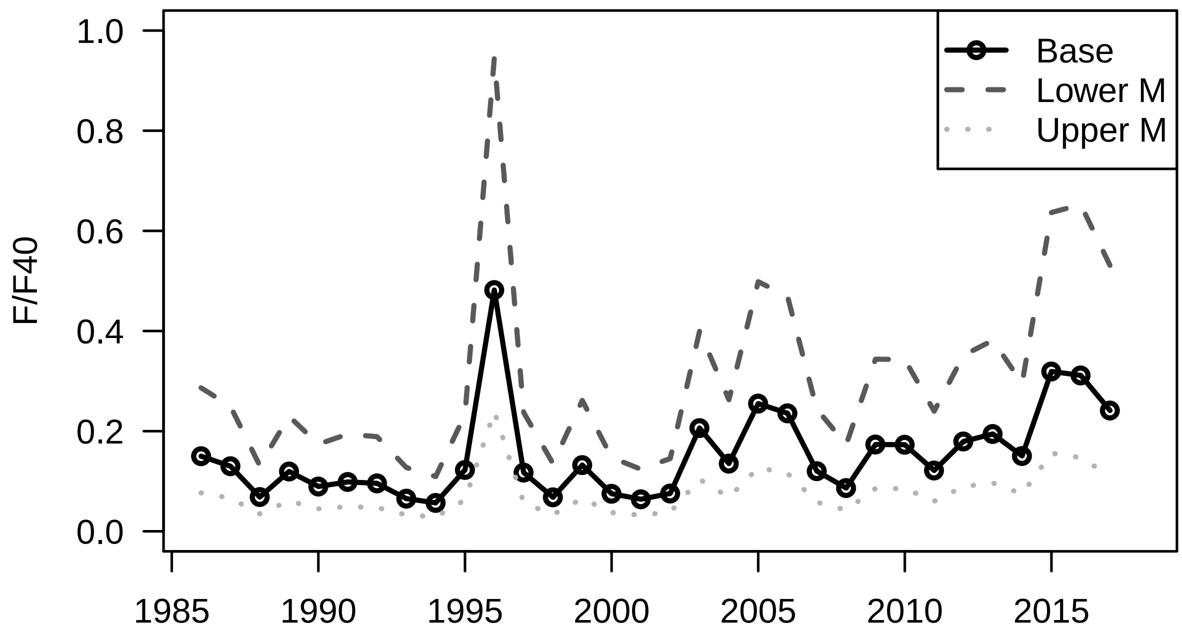


Figure 31. Sensitivity to changes in natural mortality (sensitivity runs S7b–S8b). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.



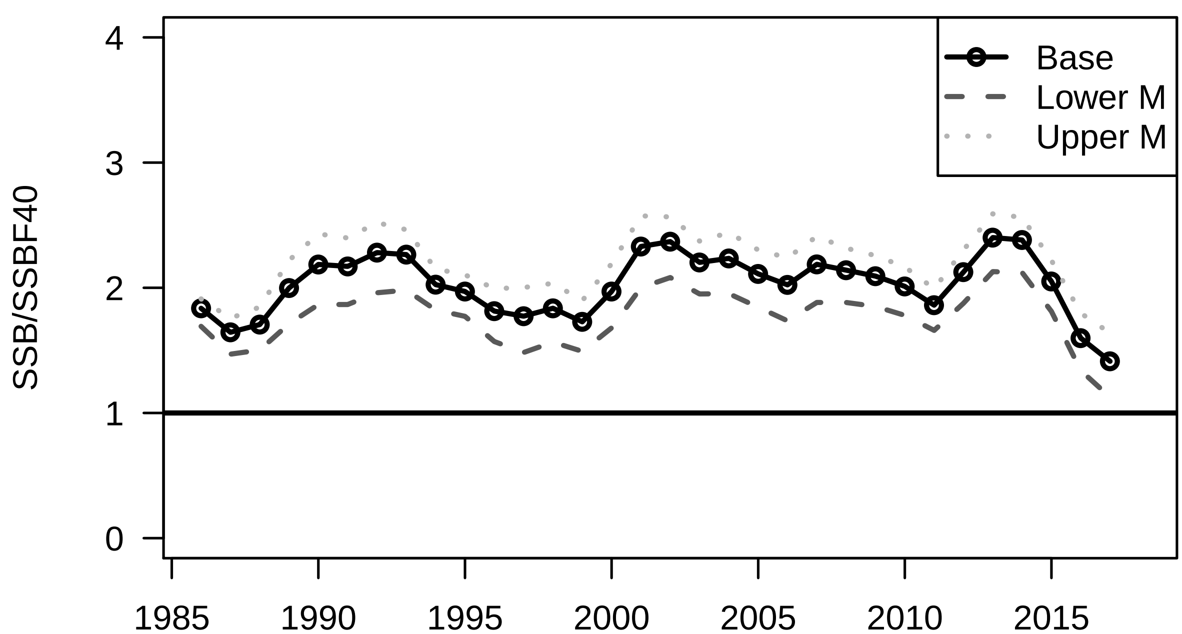


Figure 32. Individual sensitivity comparison of the parameters values provided to the ensemble model. This variation contains the upper and lower bounds for landings, discards, and discard mortality. (sensitivity run S7a–c and S8a–c). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

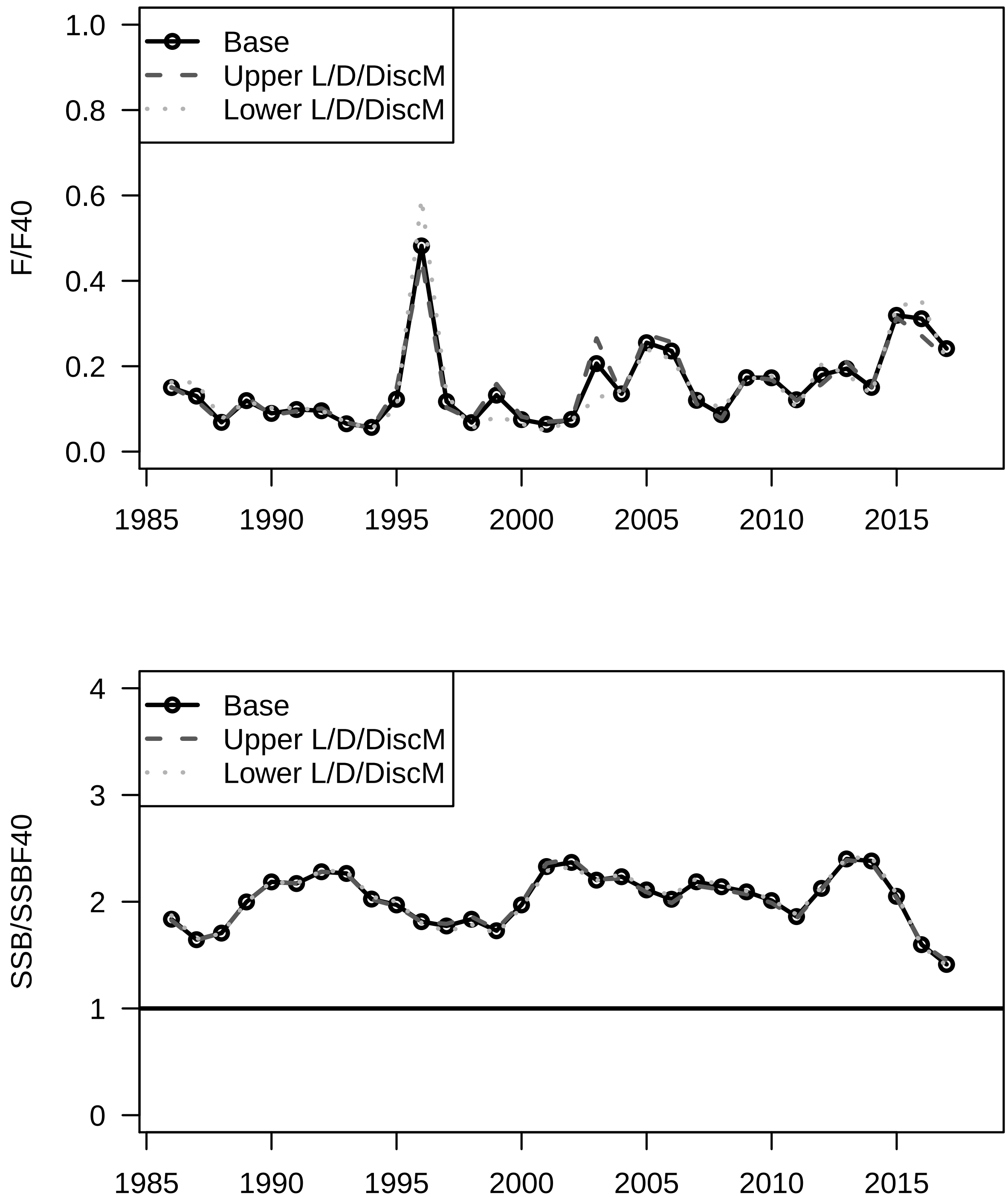


Figure 33. Sensitivity to an alternative maturity schedule (sensitivity runs S12). Top panel: Ratio of F to $F_{40\%}$. Bottom panel: Ratio of SSB *to* $\mathrm{SSB}_{\mathrm{F40\%}}$.

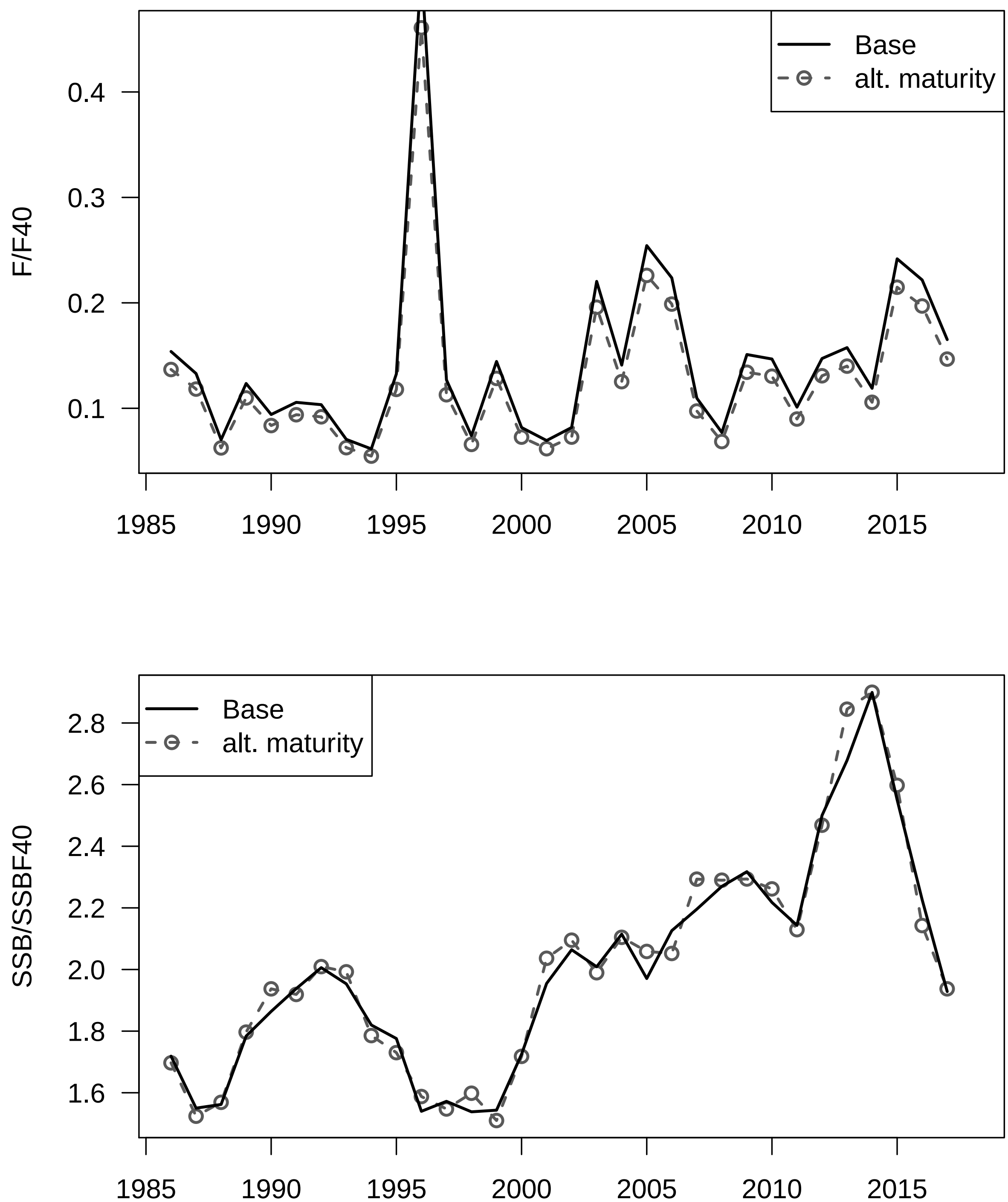


Figure 34. Phase plot of terminal status estimates from sensitivity runs of the Beaufort Assessment Model.

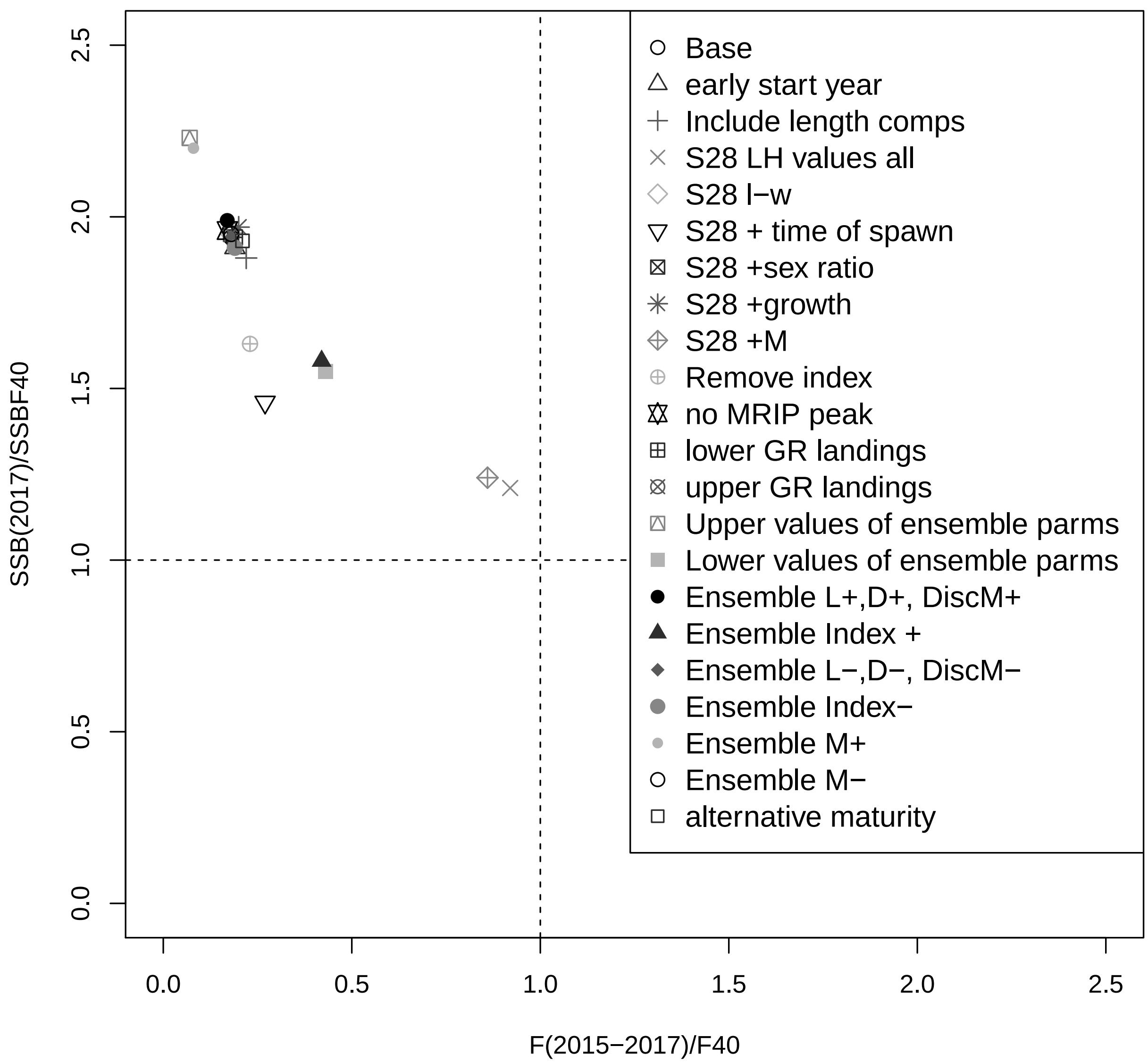
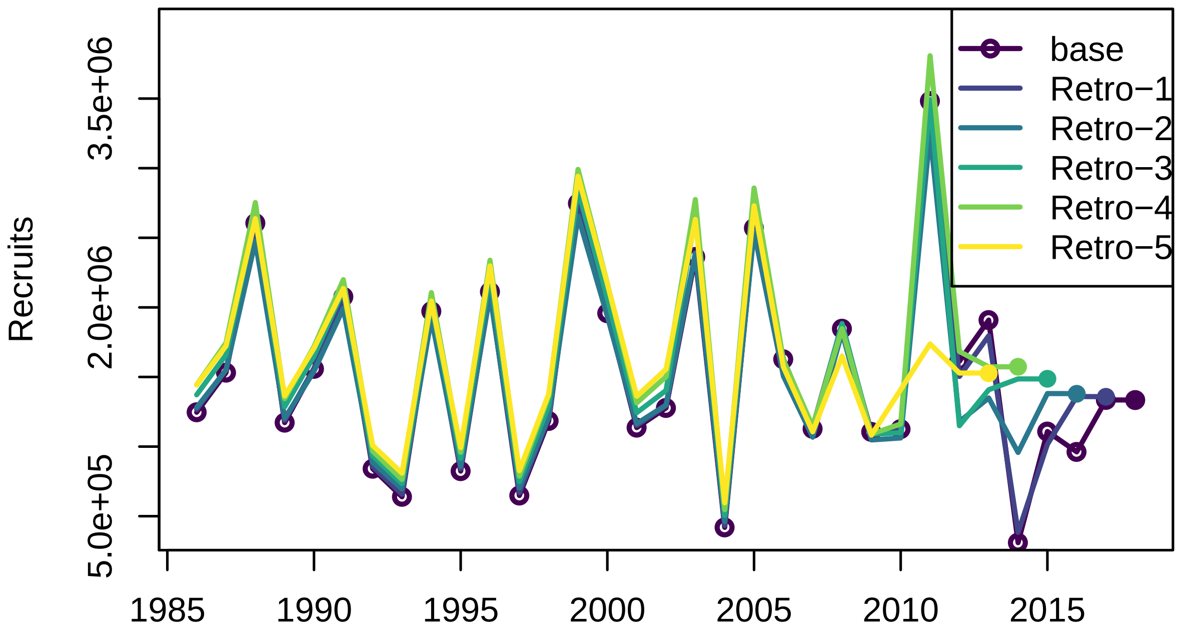


Figure 35. Retrospective analyses. Sensitivity to terminal year of data (sensitivity runs S9a–e). Top panel: Recruits. Bottom panel: Spawning biomass. Closed circles show terminal-year estimates. Imperceptible lines overlap results of the base run.



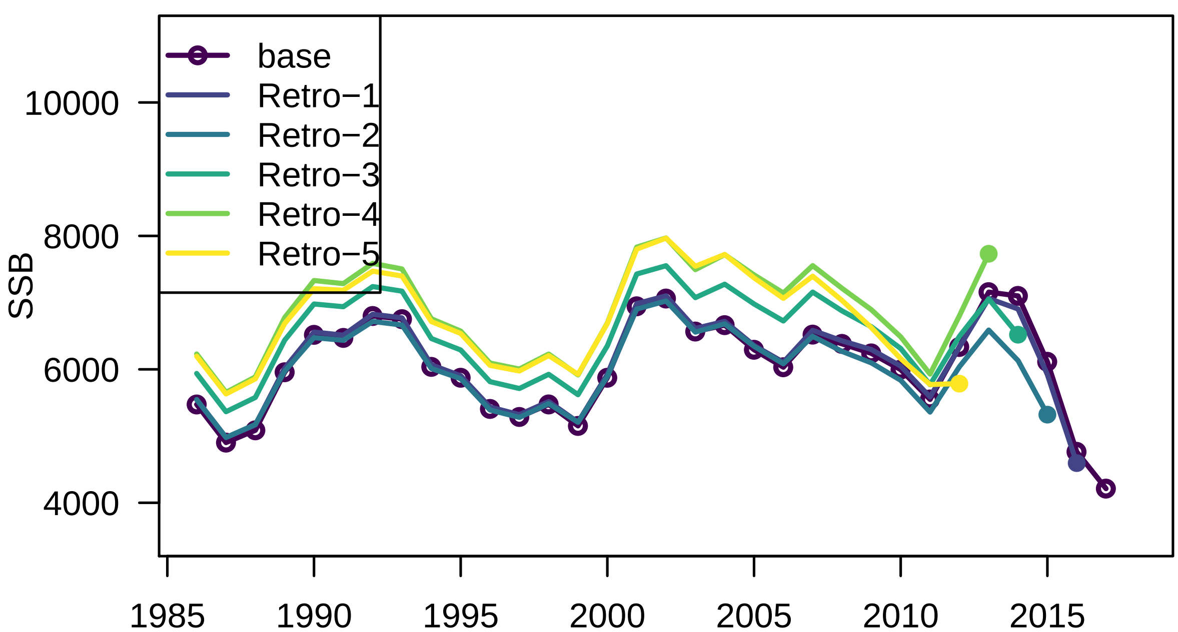
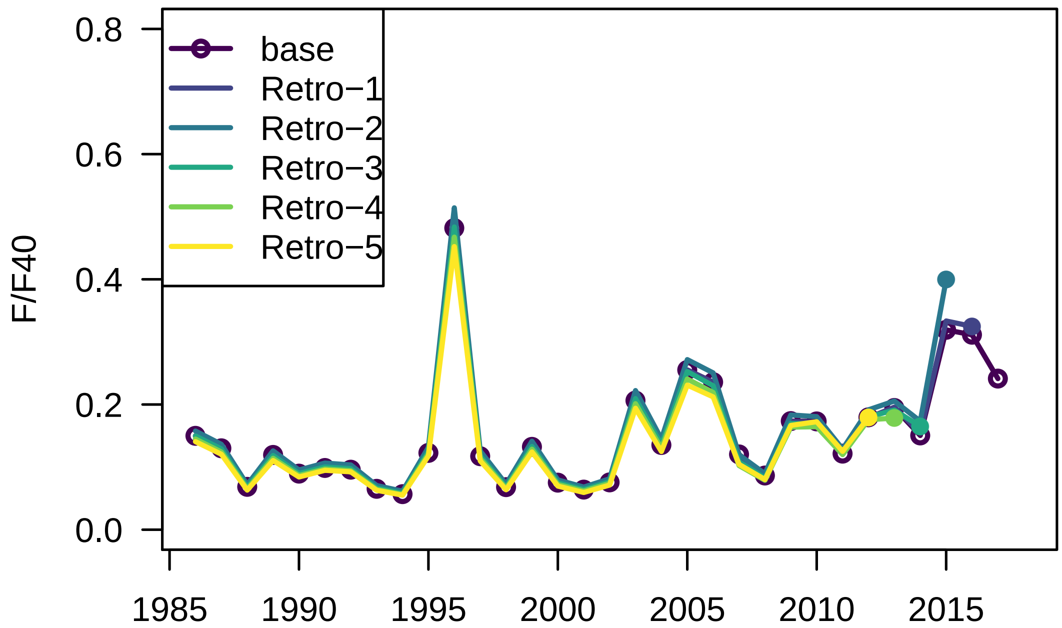


Figure 36. Retrospective status analyses. Sensitivity to terminal year of data (sensitivity runs S9a–e). Top panel: Fishing status. Bottom panel: Biomass status. Closed circles show terminal-year estimates. Imperceptible lines overlap results of the base run.



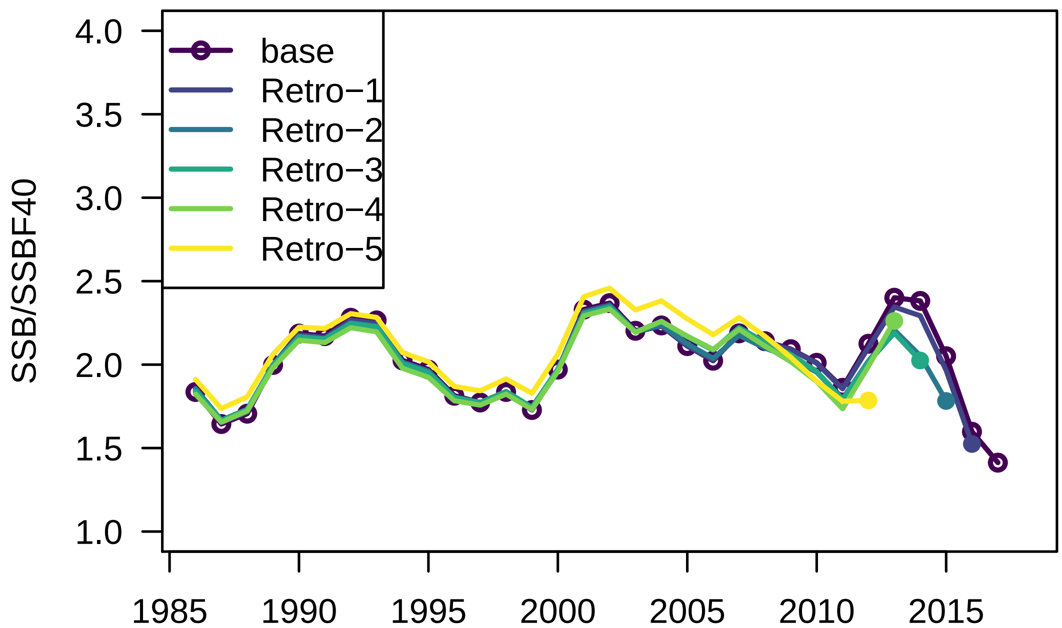


Figure 37. Projection results under scenario 1—fishing mortality rate fixed at F_{current}, with 2020 as the first year of new regulations. The interim years (2018–2019) use a mean of the 2014–2017 landings. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5^{th} and 95^{th} percentiles of replicate projections. Horizontal lines mark $L_{\mathrm{F40\%}}$-related quantities from the base run (solid blue lines) and medians from the MCB runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

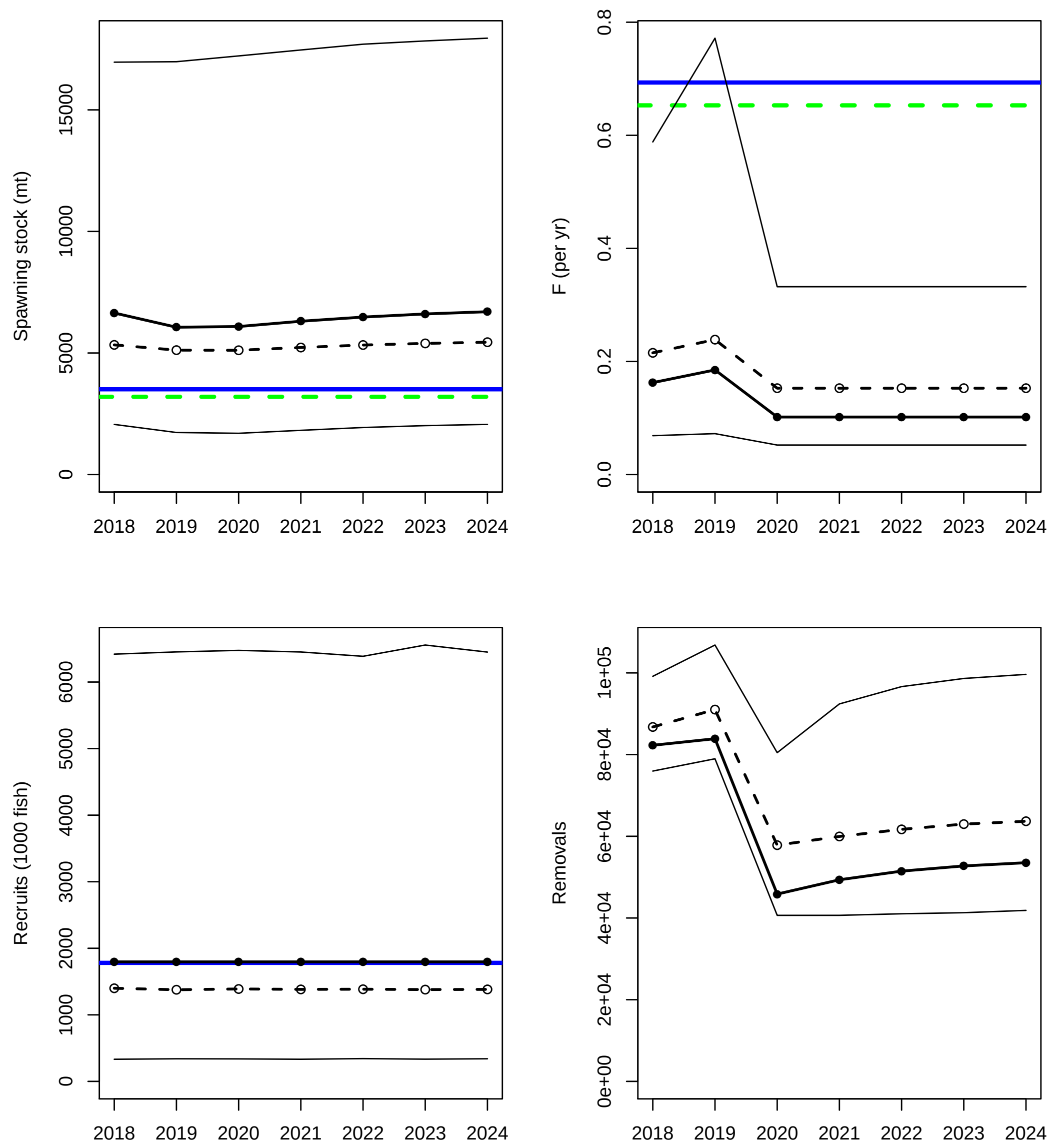


Figure 38. Projection results under scenario 2—fishing mortality rate fixed at $F = F_{40\%}$, with 2020 as the first year of new regulations. The interim years (2018–2019) use a mean of the 2014–2017 landings. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5^{th} and 95^{th} percentiles of replicate projections. Horizontal lines mark $L_{F40\%}$-related quantities from the base run (solid blue lines) and medians from the MCB runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

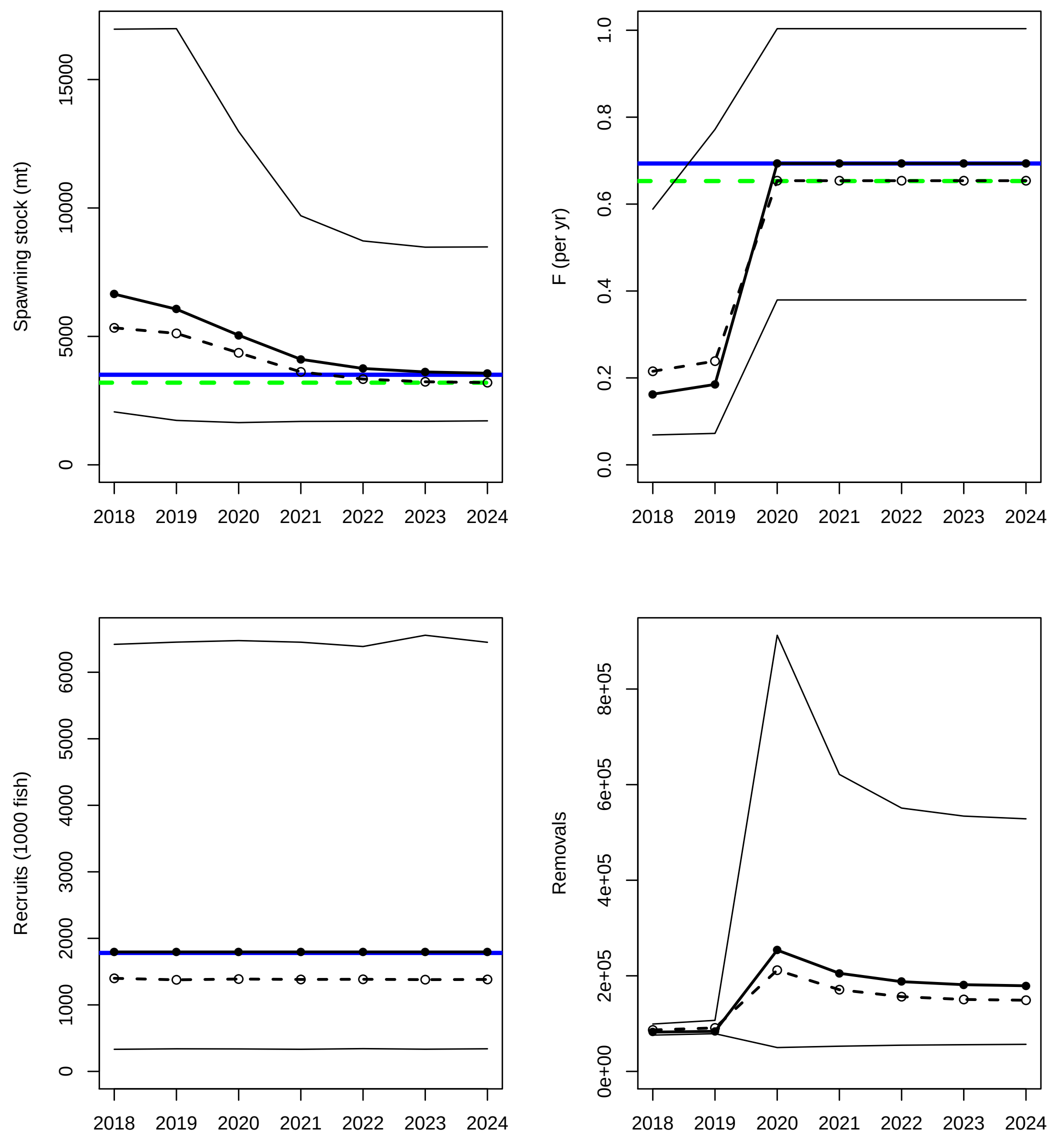


Figure 39. Projection results under scenario 3—fishing mortality rate fixed at $F = 75\%F_{40\%}$, with 2020 as the first year of new regulations. The interim years (2018–2019) use a mean of the 2014–2017 landings. In all panels, expected values represented by solid lines, median values represented by dashed lines, and uncertainty represented by thin lines corresponding to 5^{th} and 95^{th} percentiles of replicate projections. Horizontal lines mark $L_{F40\%}$-related quantities from the base run (solid blue lines) and medians from the MCB runs(dashed green lines). Spawning stock (SSB) is at time of peak spawning.

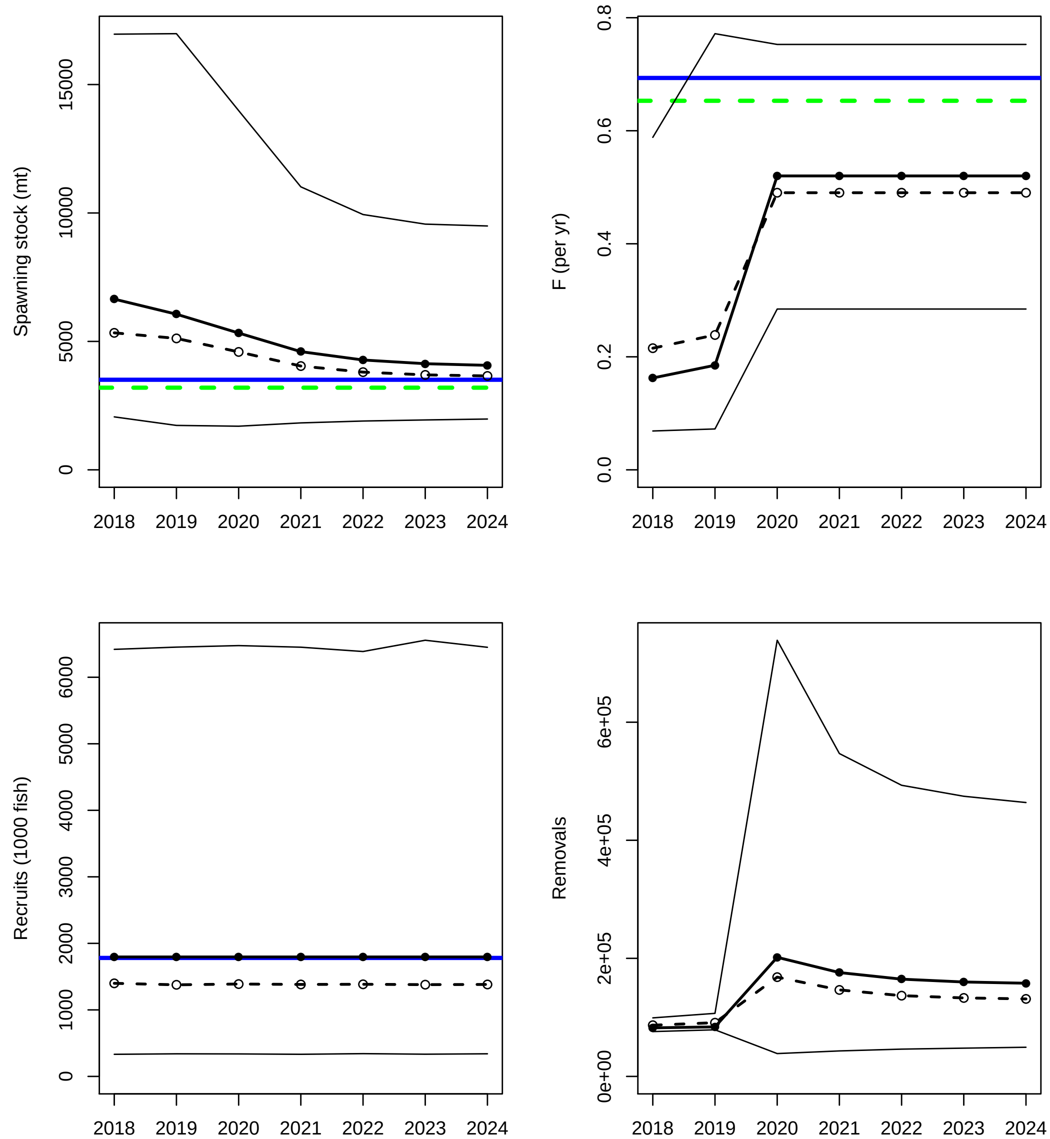
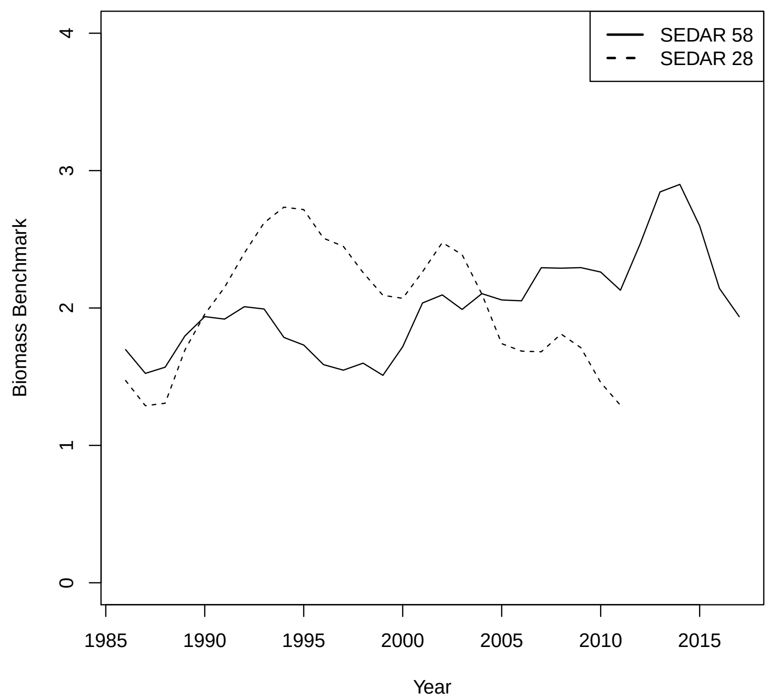


Figure 40. Comparing benchmark time series from current and last assessment. Solid line represents the base run of the current benchmark assessment and the dashed line represents the base run from the last assessment. Top panel: The biomass status time series. Bottom panel: The fishing status time series. The current benchmark assessment used $F_{40\%}$ *as an MSY proxy, while the last assessment benchmarks are relative to MSY.*



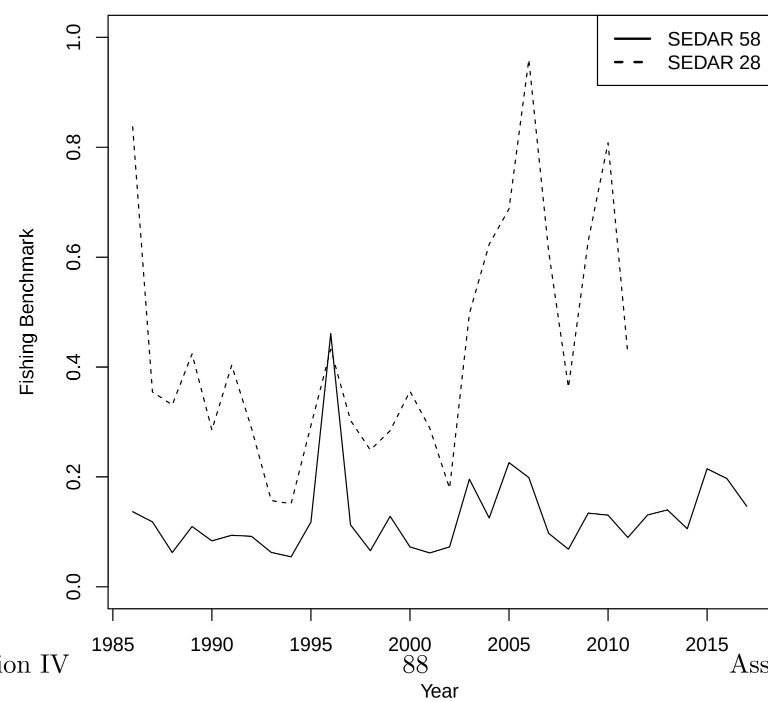
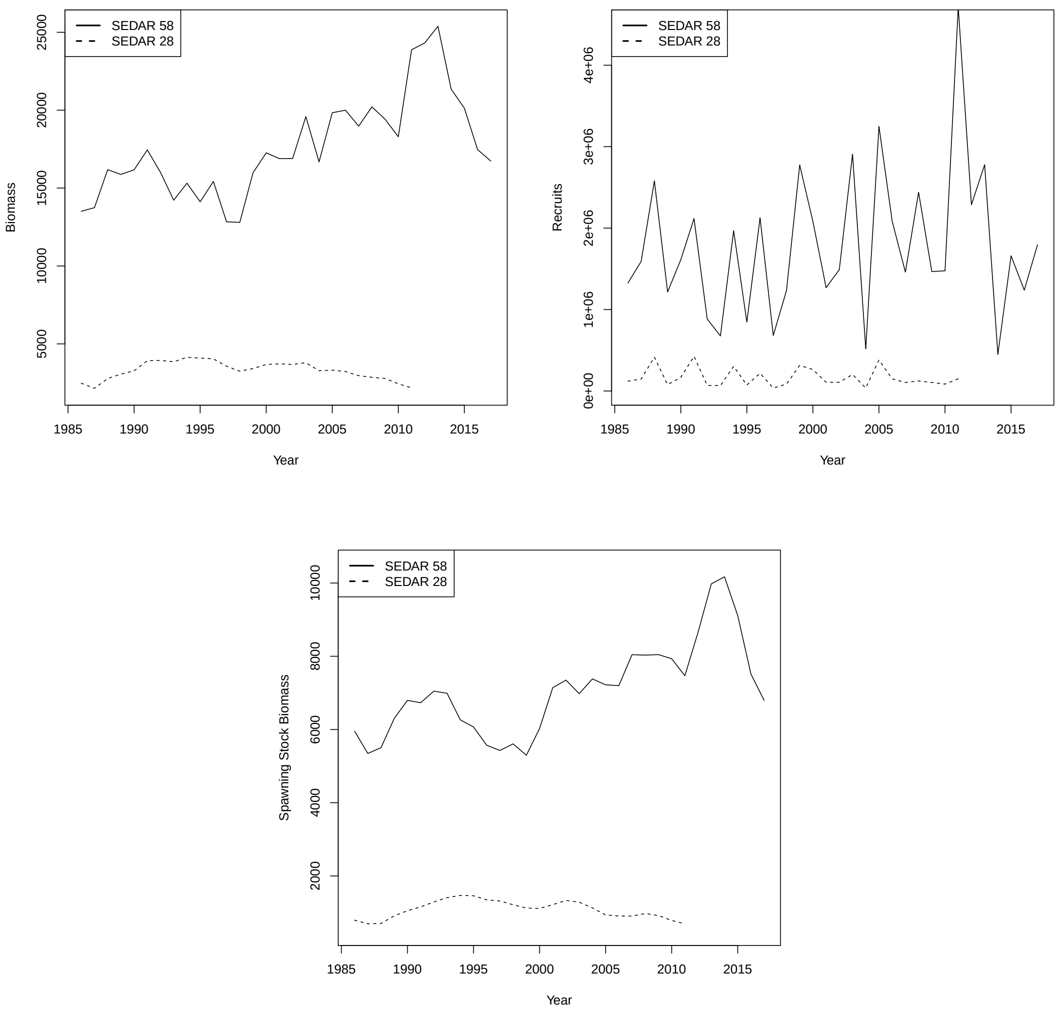


Figure 41. Comparing biological time series from current and last assessment. Solid line represents the base run of the current benchmark assessment and the dashed line represents the base run from the last assessment. Top left panel: The biomass time series. Top right panel: The recruits time series. Bottom panel: The spawning stock biomass time series.



Appendix A Abbreviations and symbols

Table 21. Acronyms and abbreviations used in this report

Symbol	Meaning
ABC	Acceptable Biological Catch
AW	Assessment Workshop (here, for cobia)
ASY	Average Sustainable Yield
B	Total biomass of stock, conventionally on January 1r
BAM	Beaufort Assessment Model (a statistical catch-age formulation)
CPUE	Catch per unit effort; used after adjustment as an index of abundance
CV	Coefficient of variation
DW	Data Workshop (here, for cobia)
F	Instantaneous rate of fishing mortality
F_{MSY}	Fishing mortality rate at which MSY can be attained
FL	State of Florida
GA	State of Georgia
GLM	Generalized linear model
K	Average size of stock when not exploited by man; carrying capacity
kg	Kilogram(s); 1 kg is about 2.2 lb.
klb	Thousand pounds; thousands of pounds
lb	Pound(s); 1 lb is about 0.454 kg
m	Meter(s); 1 m is about 3.28 feet.
M	Instantaneous rate of natural (non-fishing) mortality
MARMAP	Marine Resources Monitoring, Assessment, and Prediction Program, a fishery-independent data collection program of SCDNR
MCB	Monte Carlo/Bootstrap, an approach to quantifying uncertainty in model results
MFMT	Maximum fishing-mortality threshold; a limit reference point used in U.S. fishery management; often based on F_{MSY}
mm	Millimeter(s); 1 inch = 25.4 mm
MRFSS	Marine Recreational Fisheries Statistics Survey, a data-collection program of NMFS, predecessor of MRIP
MRIP	Marine Recreational Information Program, a data-collection program of NMFS, descended from MRFSS
MSST	Minimum stock-size threshold; a limit reference point used in U.S. fishery management. The SAFMC has defined MSST for cobia as $(1-M)\mathrm{SSB}_{\mathrm{MSY}} = 0.7\mathrm{SSB}_{\mathrm{MSY}}$.
MSY	Maximum sustainable yield (per year)
mt	Metric ton(s). One mt is 1000 kg, or about 2205 lb.
N	Number of fish in a stock, conventionally on January 1
NC	State of North Carolina
NMFS	National Marine Fisheries Service, same as "NOAA Fisheries Service"
NOAA	National Oceanic and Atmospheric Administration; parent agency of NMFS
OY	Optimum yield; SFA specifies that OY $\leq$ MSY.
PSE	Proportional standard error
R	Recruitment
SAFMC	South Atlantic Fishery Management Council (also, Council)
SC	State of South Carolina
SCDNR	Department of Natural Resources of SC
SDNR	Standard deviation of normalized residuals
SEDAR	SouthEast Data Assessment and Review process
SEFIS	SouthEast Fishery-Independent Survey
SFA	Sustainable Fisheries Act; the Magnuson–Stevens Act, as amended
SL	Standard length (of a fish)
SPR	Spawning potential ratio
SSB	Spawning stock biomass; mature biomass of males and females
$\mathrm{SSB}_{\mathrm{MSY}}$	Level of SSB at which MSY can be attained
TIP	Trip Interview Program, a fishery-dependent biodata collection program of NMFS
TL	Total length (of a fish), as opposed to FL (fork length) or SL (standard length)
VPA	Virtual population analysis, an age-structured assessment
WW	Whole weight, as opposed to GW (gutted weight)
yr	Year(s)

Appendix B Parameter estimates from the Beaufort Assessment Model

```
# Number of parameters = 125  Objective function value = 13081.0  Maximum gradient component = 3.71966e-005
# Linf:
1262.00000000
# K:
0.310000000000
# t0:
-0.530000000000
# len_cv_val:
0.116000000000
# Linf_L:
1287.00000000
# K_L:
0.260000000000
# t0_L:
-1.74000000000
# len_cv_val_L:
0.245818304825
# Linf_F:
1334.00000000
# K_F:
0.320000000000
# t0_F:
-0.500000000000
# len_cv_val_F:
0.0820000000000
# log_Nage_dev:
 -0.654606338343 -0.441705938715 -0.619957311353 0.176467046709 0.339404359345 -0.656543149543 -0.206782890707
 -0.0840897095860 -0.513959621286 -0.414635309252 -0.329974414368 -0.258789190181 -0.200518485752 -0.153648100868
 -0.343450521296
# log_R0:
14.2595966272
# steep:
0.990000000000
# rec_sigma:
0.531632919938
# R_autocorr:
0.00000000000
# log_rec_dev:
 -0.161932496243 0.0205253511603 0.503706776325 -0.248438173459 0.0333688981026 0.305931790396 -0.568047801597
 -0.835406816529 0.232612759621 -0.610653211406 0.310301391756 -0.827317950002 -0.235267474544 0.576597323894
 0.289006143057 -0.206309975810 -0.0448039037301 0.622943441840 -1.10201589514 0.734229257077 0.290908719265
 -0.0657253518860 0.447539090944 -0.0612092267582 -0.0550598410519 1.10683518523 0.383511976197 0.577708090873
 -1.24545797456 0.0625324840168 -0.230612587042
# log_dm_comm_lc:
-1.02432279118
# log_dm_GR_ac:
-1.46674441375
# selpar_A50_comm1:
2.82590807557
# selpar_slope_comm1:
1.91389775589
# selpar_A50_GR1:
4.00896043328
# selpar_slope_GR1:
1.84230846787
# selpar_A50_GR2:
3.06054251474
# selpar_slope_GR2:
3.71958042115
# log_q_HB:
-12.9183541549
# log_avg_F_comm:
-6.07314681773
# log_F_dev_comm:
 -0.424069815234 0.135797947850 -0.216544352021 -0.133787336457 0.0435327739423 -0.00955281294585 -0.214978379226
 -0.131867283604 0.0833504793268 0.532828030995 0.555213745278 0.627229754565 0.200520044140 -0.264880706964
 0.162002846803 -0.00550720158837 -0.0367627593564 -0.169361776664 -0.187492099025 -0.472726076068 -0.273336756815
  -0.399168892170 -0.398993439407 -0.0742960074569 0.145063909500 -0.336327178662 -0.121858601971 -0.101247872650
  0.103846413447 0.369578318374 0.591669551699 0.422125532362
# log_avg_F_GR:
-2.57187349680
# log_F_dev_GR:
 0.200503557442 0.0378909967745 -0.611845664864 -0.0301237470240 -0.317811086908 -0.195665551427 -0.210585874736
  -0.611835804826 -0.769342704285 0.0187052190295 1.41841397805 -0.0328960856420 -0.580030482082 0.132723076871
  -0.471309715880 -0.634965404137 -0.460862395590 0.560945162946 0.106221150008 0.709479170126 0.577734731641
  -0.145984434067 -0.508972871794 0.174024726979 0.138884783626 -0.230930697233 0.149279159448 0.218034114960
  -0.0767711988528 0.645291772347 0.550443945020 0.251358174081
# F_init:
0.00506529251796
```

Appendix C Beaufort Assessment Model code for Cobia

```
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##
//##  SEDAR 58  SA Cobia, 2019
//##  (Modified from: SEDAR 50  SA BLT assessment model, 2017)
//##  NMFS, Beaufort Lab, Sustainable Fisheries Branch
//##
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
DATA_SECTION

!!cout << "Starting Beaufort Assessment Model" << endl;
!!cout << endl;
!!cout << "                BAM!" << endl;
!!cout << endl;

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: set-up section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>

// Starting and ending years of the model (year data starts)
init_int styr;
init_int endyr;

// Starting and ending years to estimate recruitment deviations from S-R curve
init_int styr_rec_dev;
init_int endyr_rec_dev;
// Ending years of 3 phases of constraints on recruitment deviations
// (allows possible heavier constraint (weights defined later) in early and late period, with lighter constraint in the middle)
init_int endyr_rec_phase1;
init_int endyr_rec_phase2;
// ending years of selectivity block 1
//init_int endyr_selex_phase1_comm; // comm
init_int endyr_selex_phase1_GR; // GR
// ending years of selectivity block 2
//init_int endyr_selex_phase2_comm; // comm
//init_int endyr_selex_phase2_cL; // cL
//init_int endyr_selex_phase2_GR; // GR

//number assessment years
number nyrs;
number nyrs_rec;

//this section MUST BE INDENTED!!!
 LOCAL_CALCS
   nyrs=endyr-styr+1.;
   nyrs_rec=endyr_rec_dev-styr_rec_dev+1.;
 END_CALCS

// Number of ages in population model(classes are 1,...,N+; assumes last age is plus group
init_int nages;
// Vector of ages for age bins in population model, last is a plus group
init_vector agebins(1,nages);

//Total number of ages used to match age comps: plus group may differ from popn, first age must not
init_int nages_agec;

//Vector of ages for age bins in age comps
init_vector agebins_agec(1,nages_agec);

// Number length bins used to match length comps and width of bins (mm)
init_int nlenbins;          //used to match data
init_number lenbins_width;  //width of length bins (mm)

// Vector of length bins (mm; midpoint of bin) used to match length comps and bins used to compute plus group
init_vector lenbins(1,nlenbins);

// Max value of F used in spr and msy calculations
init_number max_F_spr_msy;
// Number of iterations in spr calculations
init_int n_iter_spr;
//Total number of iterations for msy calcs
int n_iter_msy;
 LOCAL_CALCS
n_iter_msy=n_iter_spr;
 END_CALCS

// Starting and ending years to compute arithmetic average recruitment for SPR-related values
init_int styr_rec_spr;
init_int endyr_rec_spr;
//Arithmetic average recruitment for SPR-related values
number nyrs_rec_spr;
 LOCAL_CALCS
   nyrs_rec_spr=endyr_rec_spr-styr_rec_spr+1.;
 END_CALCS


// Number of years at end of time series over which to average sector Fs, for weighted selectivities
init_int selpar_n_yrs_wgted;
// Multiplicative bias correction of recruitment (may set to 1.0 for none or negative to compute from recruitment variance)
init_number set_BiasCor;
```

```
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: observed data section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>

//##################################################################################################
//## Commercial Handline
//##################################################################################################
//## comm ######## INDEX ########
//## comm ## Starting and ending years of CPUE index
//init_int styr_comm_cpue;
//init_int endyr_comm_cpue;
//## comm ## Observed index CPUE and CVs
//init_vector obs_comm_cpue(styr_comm_cpue,endyr_comm_cpue);
//init_vector comm_cpue_cv(styr_comm_cpue,endyr_comm_cpue);

//## comm ######## LANDINGS ########
//## comm ## Starting and ending years of landings (bt50 landings+discards; includes comm and cO (commercial other))
init_int styr_comm_L;
init_int endyr_comm_L;
//## comm ## Observed landings (1000 lbs) and assumed CVs
init_vector obs_comm_L(styr_comm_L,endyr_comm_L);
init_vector comm_L_cv(styr_comm_L,endyr_comm_L);

//## comm ######## LENGTH COMPS ########
//## comm ## Number and vector of years of length compositions to be pooled
init_int nyr_comm_lenc_pool;
init_ivector yrs_comm_lenc_pool(1,nyr_comm_lenc_pool);
//# Annual sample size (nfish) of length comp data; used to weight years for pooling
init_vector nfish_comm_lenc_pool(1,nyr_comm_lenc_pool);
//## comm ## Number and vector of years of length compositions, after pooling
init_int nyr_comm_lenc;
init_ivector yrs_comm_lenc(1,nyr_comm_lenc);
//## comm ## Sample size of length comp data (first row observed n.trips, second row n.fish)
init_vector nsamp_comm_lenc(1,nyr_comm_lenc);
init_vector nfish_comm_lenc(1,nyr_comm_lenc);
//## comm ## Observed length comps (3cm bins; proportions by year)
init_matrix obs_comm_lenc(1,nyr_comm_lenc,1,nlenbins);

//##################################################################################################
//## Recreational Headboat
//##################################################################################################
//## HB ######## INDEX ########
//## HB ## Starting and ending years of CPUE index
init_int styr_HB_cpue;
init_int endyr_HB_cpue;
//## HB ## Observed index CPUE and CVs
init_vector obs_HB_cpue(styr_HB_cpue,endyr_HB_cpue);//Observed CPUE
init_vector HB_cpue_cv(styr_HB_cpue,endyr_HB_cpue); //CV of cpue

//##################################################################################################
//## General Recreational
//##################################################################################################
//## GR ######## LANDINGS ########
//## GR ## Starting and ending years of landings (bt50 landings+discards)
init_int styr_GR_L;
init_int endyr_GR_L;
//## GR ## Observed landings (1000 lbs) and assumed CVs
init_vector obs_GR_L(styr_GR_L,endyr_GR_L);   //vector of observed landings by year
init_vector GR_L_cv(styr_GR_L,endyr_GR_L);    //vector of CV of landings by year

//## GR ######## LENGTH COMPS ########
//## GR ## Number and vector of years of length compositions
//init_int nyr_GR_lenc;
//init_ivector yrs_GR_lenc(1,nyr_GR_lenc);
//## GR ## Sample size of length comp data (first row observed n.trips, second row n.fish)
//nit_vector nsamp_GR_lenc(1,nyr_GR_lenc);
//init_vector nfish_GR_lenc(1,nyr_GR_lenc);
//## GR ## Observed length comps (3cm bins; proportions by year)
//init_matrix obs_GR_lenc(1,nyr_GR_lenc,1,nlenbins);

//  Age compositions
init_int nyr_GR_agec;
init_ivector yrs_GR_agec(1,nyr_GR_agec);
init_vector nsamp_GR_agec(1,nyr_GR_agec);
init_vector nfish_GR_agec(1,nyr_GR_agec);
init_matrix obs_GR_agec(1,nyr_GR_agec,1,nages_agec);

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: parameter section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##################################################################################################
//## Parameter values and initial guesses
//##################################################################################################
//######## Population ########
init_vector set_Linf(1,7); // VonBert Linf (mmFL)
init_vector set_K(1,7); // VonBert K
init_vector set_t0(1,7); // VonBert t0
init_vector set_len_cv(1,7); // CV of length at age
//########Landings growth curve
init_vector set_Linf_L(1,7);           // VonBert Linf (mmFL)
init_vector set_K_L(1,7);              // VonBert K
init_vector set_t0_L(1,7);             // VonBert t0
init_vector set_len_cv_L(1,7);         // CV of length at age
//########Female only growth curve (popl and landings)
```

```
init_vector set_Linf_F(1,7);            // VonBert Linf (mmFL)
init_vector set_K_F(1,7);               // VonBert K
init_vector set_t0_F(1,7);              // VonBert t0
init_vector set_len_cv_F(1,7);          // CV of length at age
//######## Constant M ########
init_vector set_M_constant(1,7); // constant M (used only to compute MSST=(1-M)SSBmsy)
//######## StockRecruitment ########
init_vector set_steep(1,7);          // SR steepness parameter
init_vector set_log_R0(1,7);         // SR log_R0 parameter
init_vector set_R_autocorr(1,7);     // SR recruitment autocorrelation (lag 1)
init_vector set_rec_sigma(1,7);      // standard deviation of recruitment in log space
//######## DirichletMultinomial ########
init_vector set_log_dm_comm_lc(1,7);   // Dirichlet-multinomial overdispersion parameter (log-space): comm length comps
//init_vector set_log_dm_cL_lc(1,7);  // Dirichlet-multinomial overdispersion parameter (log-space): cL length comps
//init_vector set_log_dm_HB_lc(1,7);   // Dirichlet-multinomial overdispersion parameter (log-space): HB length comps
//init_vector set_log_dm_GR_lc(1,7);   // Dirichlet-multinomial overdispersion parameter (log-space): GR length comps
init_vector set_log_dm_GR_ac(1,7);    //Dirichlet-multinomial overdispersion parameter
//######## Selectivity ########
init_vector set_selpar_A50_comm1(1,7); // comm age at 0.5 selectivity
init_vector set_selpar_slope_comm1(1,7); // comm slope of ascending limb
//init_vector set_selpar_A50_comm2(1,7); // comm age at 0.5 selectivity (block 2)
//init_vector set_selpar_slope_comm2(1,7); // comm slope of ascending limb (block 2)
// init_vector set_selpar_A502_comm2(1,7); // comm L502 (block 2)
// init_vector set_selpar_slope2_comm2(1,7); // comm slope of descending limb (block 2)
//init_vector set_selpar_A50_comm3(1,7); // comm age at 0.5 selectivity (block 3)
//init_vector set_selpar_slope_comm3(1,7); // comm slope of ascending limb (block 3)
//init_vector set_selpar_A50_cL1(1,7); // cL age at 0.5 selectivity
//init_vector set_selpar_slope_cL1(1,7); // cL slope of ascending limb
//init_vector set_selpar_A50_cL2(1,7); // cL age at 0.5 selectivity (block 2)
//init_vector set_selpar_slope_cL2(1,7); // cL slope of ascending limb (block 2)
//// init_vector set_selpar_A502_cL2(1,7); // cL L502 (block 2)
//// init_vector set_selpar_slope2_cL2(1,7); // cL slope of descending limb (block 2)
//init_vector set_selpar_A50_cL3(1,7); // cL age at 0.5 selectivity (block 3)
//init_vector set_selpar_slope_cL3(1,7); // cL slope of ascending limb (block 3)
init_vector set_selpar_A50_GR1(1,7);  // GR age at 0.5 selectivity
init_vector set_selpar_slope_GR1(1,7); // GR slope of ascending limb
init_vector set_selpar_A50_GR2(1,7); // GR age at 0.5 selectivity (block 2)
init_vector set_selpar_slope_GR2(1,7); // GR slope of ascending limb (block 2)
// init_vector set_selpar_A502_GR2(1,7); // GR L502 (block 2)
// init_vector set_selpar_slope2_GR2(1,7); // GR slope of descending limb (block 2)
//init_vector set_selpar_A50_GR3(1,7); // GR age at 0.5 selectivity (block 3)
//init_vector set_selpar_slope_GR3(1,7); // GR slope of ascending limb (block 3)
//######## IndexCatchability ########
//init_vector set_log_q_comm(1,7);       // comm CPUE (log q)
//init_vector set_log_q_cL(1,7);       // cL CPUE (log q)
init_vector set_log_q_HB(1,7);       // HB CPUE (log q)
//######## FishingMortality ########
init_vector set_F_init(1,7);   // initial F (not log space)
init_vector set_log_avg_F_comm(1,7); // comm log mean F
//init_vector set_log_avg_F_cL(1,7); // cL log mean F
init_vector set_log_avg_F_GR(1,7); // GR log mean F

//#####################################################################################################
//## Dev vectors
//#####################################################################################################
init_vector set_log_F_dev_comm(1,3);  // comm F devs
//init_vector set_log_F_dev_cL(1,3); // cL F devs
init_vector set_log_F_dev_GR(1,3); // GR F devs
init_vector set_log_RWq_dev(1,3); // Random walk on q
init_vector set_log_rec_dev(1,3); // recruitment devs
init_vector set_log_Nage_dev(1,3); // Nage devs

//######## F dev initial guesses ########
//## comm (1962 - 2015)
init_vector set_log_F_dev_comm_vals(styr_comm_L,endyr_comm_L);
//## cL (1958 - 2015)
//init_vector set_log_F_dev_cL_vals(styr_cL_L,endyr_cL_L);
// ## GR (1973 - 2015)
init_vector set_log_F_dev_GR_vals(styr_GR_L,endyr_GR_L);

//######## Rec dev initial guesses (1958 - 2015) ########
init_vector set_log_rec_dev_vals(styr_rec_dev,endyr_rec_dev);

//######## initial N age devs, all ages but the first one (2 to 15) ########
init_vector set_log_Nage_dev_vals(2,nages);

//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: likelihood weights section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
init_number set_w_L; // landings

//init_number set_w_I_comm;         // comm index
//init_number set_w_I_cL;         // cL index
init_number set_w_I_HB;         // HB index
init_number set_w_lc_comm;        // comm length comps
//init_number set_w_lc_cL;        // cL length comps
//init_number set_w_lc_GR; // GR length comps
init_number set_w_ac_GR; //weight for the Recreational age comps
init_number set_w_Nage_init;    // log N.age.dev residuals (initial abundance)for fitting initial abundance at age (excluding first age)
init_number set_w_rec;          // SR residuals (for fitting SR curve)
init_number set_w_rec_early;    // constraint on early recruitment deviations
init_number set_w_rec_end;      // constraint on ending recruitment deviations
init_number set_w_fullF;        // penalty if F exceeds 3.0 (reduced by factor of 10 each phase, not applied in final phase of optimization) full F summed over fisheries
init_number set_w_Ftune;        // weight on tuning F (penalty not applied in final phase of optimization)
```

```
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//-- BAM DATA_SECTION: miscellaneous stuff section
//--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>

// Length-weight parameter a (W=aL^b); mm to kg
init_number wgtpar_a;
// Length-weight parameter b (W=aL^b); mm to kg
init_number wgtpar_b;

// Length-batchFecundity parameter a (BF=a + bL); mm to eggs
//init_number batchfecpar_a;
// Length-batchFecundity b (BF=a + bL); mm to eggs
//init_number batchfecpar_b;
// Number of batches spawned per mature female per year
//init_number nbatch;
// Value by which to scale fecundity unit (e.g. 1000000 to diplay fecundity in millions)
//init_number fecpar_scale;

// vector of maturity-at-age for females (ages 1 - 15 )
init_vector maturity_f_obs(1,nages);
// Proportion female by age (assumed 50:50 sex ratio)
init_vector prop_f_obs(1,nages);
// time of year (as fraction) for spawning
init_number spawn_time_frac;
// age-dependent natural mortality at age (ages 1 - 15 )
init_vector set_M(1,nages);

// Spawner-recruit parameters:  SR function switch (integer 1=Beverton-Holt, 2=Ricker)
init_int SR_switch;

// switch for rate increase in q: Integer value (choose estimation phase, negative value turns it off)
init_int set_q_rate_phase;
// annual positive rate of increase on all fishery dependent q's due to technology creep
init_number set_q_rate;

// density dependence on fishery catchability coefficients (DDq) switch: Integer value (choose estimation phase of random walk, negative value turns it off)
init_int set_q_DD_phase;
// q_DD exponent, value of zero is density independent, est range is (0.1,0.9)
init_number set_q_DD_beta;
// SE of q_DD exponent (0.128 provides 95% CI in range 0.5)
init_number set_q_DD_beta_se;
// Age to begin counting q_DD (should be age near full exploitation)
init_int set_q_DD_stage;      //age to begin counting biomass, should be near full exploitation

// Variance (sd^2) of fishery dependent random walk catchabilities (0.03 is near the sd=0.17 of Wilberg and Bence)
init_number set_RWq_var;     //assumed variance of RW q

// Tuning F (not applied in last phase of optimization, or not applied at all if penalty weight=0)
init_number set_Ftune;
// Year for tuning F
init_int set_Ftune_yr;

// threshold sample sizes ntrips (>=)for length comps (set to 99999.0 if sel is fixed):
init_number minSS_comm_lenc; // comm len comps
//init_number minSS_cL_lenc; // cL len comps
// init_number minSS_HB_lenc; // HB len comps (to be removed for bt50)
//init_number minSS_GR_lenc; // GR len comps
//threshold sample sizes for age comps
init_number minSS_GR_agec;

// Input for deterministic F-based projections
// Last year of projections, must be later than assessment endyr by default
init_int endyr_proj; // Projection end year (must be later than assessment endyr)
init_int styr_regs;   // Apply current F until styr_regs, then the projection F
init_int Fproj_switch;  // Switching indicating value to use for defining projection F: 1=Fcurrent, 2=Fmsy, 3=F30, 4=F40
init_number Fproj_mult; // Multiplier 'c' applied to compute projection F, for example Fproj=cFmsy
// Calculate projection start year
int styr_proj;
 LOCAL_CALCS
   styr_proj=endyr+1;
 END_CALCS

// Aging error matrix (columns are true age 1- 15 , rows are ages as read for age comps: columns should sum to one)
init_matrix age_error(1,nages,1,nages);

//-----------------------------------<< 999 >>------------------------------------
// END OF READING IN VALUES FROM .dat file
//-----------------------------------<< 999 >>------------------------------------


// #######Indexing integers for year(iyear), age(iage),length(ilen) ###############
int iyear;
int iage;
int ilen;
int ff;

number sqrt2pi;
number g2mt;                    //conversion of grams to metric tons
number g2kg;                    //conversion of grams to kg
number g2klb;                   //conversion of grams to 1000 lb
number mt2klb;                  //conversion of metric tons to 1000 lb
number mt2lb;                   //conversion of metric tons to lb
number dzero;                   //small additive constant to prevent division by zero
number huge_number;             //huge number, to avoid irregular parameter space
```

```
init_number end_of_data_file;
//this section MUST BE INDENTED!!!
 LOCAL_CALCS
   if(end_of_data_file!=999)
   {
       cout << "*** WARNING: Data File NOT READ CORRECTLY ****" << endl;
       exit(0);
   }
   else
   {cout << "Data File read correctly" << endl;}
 END_CALCS

//##########################################################################################################
PARAMETER_SECTION //#########################################################################################################
//##########################################################################################################

 LOCAL_CALCS
  const double Linf_LO=set_Linf(2); const double Linf_HI=set_Linf(3); const double Linf_PH=set_Linf(4);
  const double K_LO=set_K(2); const double K_HI=set_K(3); const double K_PH=set_K(4);
  const double t0_LO=set_t0(2); const double t0_HI=set_t0(3); const double t0_PH=set_t0(4);
  const double len_cv_LO=set_len_cv(2); const double len_cv_HI=set_len_cv(3); const double len_cv_PH=set_len_cv(4);

  const double Linf_L_LO=set_Linf_L(2); const double Linf_L_HI=set_Linf_L(3); const double Linf_L_PH=set_Linf_L(4);
  const double K_L_LO=set_K_L(2); const double K_L_HI=set_K_L(3); const double K_L_PH=set_K_L(4);
  const double t0_L_LO=set_t0_L(2); const double t0_L_HI=set_t0_L(3); const double t0_L_PH=set_t0_L(4);
  const double len_cv_L_LO=set_len_cv_L(2); const double len_cv_L_HI=set_len_cv_L(3); const double len_cv_L_PH=set_len_cv_L(4);

  const double Linf_F_LO=set_Linf_F(2); const double Linf_F_HI=set_Linf_F(3); const double Linf_F_PH=set_Linf_F(4);
  const double K_F_LO=set_K_F(2); const double K_F_HI=set_K_F(3); const double K_F_PH=set_K_F(4);
  const double t0_F_LO=set_t0_F(2); const double t0_F_HI=set_t0_F(3); const double t0_F_PH=set_t0_F(4);
  const double len_cv_F_LO=set_len_cv_F(2); const double len_cv_F_HI=set_len_cv_F(3); const double len_cv_F_PH=set_len_cv_F(4);

  const double M_constant_LO=set_M_constant(2); const double M_constant_HI=set_M_constant(3); const double M_constant_PH=set_M_constant(4);
  const double steep_LO=set_steep(2); const double steep_HI=set_steep(3); const double steep_PH=set_steep(4);
  const double log_R0_LO=set_log_R0(2); const double log_R0_HI=set_log_R0(3); const double log_R0_PH=set_log_R0(4);
  const double R_autocorr_LO=set_R_autocorr(2); const double R_autocorr_HI=set_R_autocorr(3); const double R_autocorr_PH=set_R_autocorr(4);
  const double rec_sigma_LO=set_rec_sigma(2); const double rec_sigma_HI=set_rec_sigma(3); const double rec_sigma_PH=set_rec_sigma(4);

  const double log_dm_comm_lc_LO=set_log_dm_comm_lc(2); const double log_dm_comm_lc_HI=set_log_dm_comm_lc(3); const double log_dm_comm_lc_PH=set_log_dm_comm_lc(4);
  //const double log_dm_cL_lc_LO=set_log_dm_cL_lc(2); const double log_dm_cL_lc_HI=set_log_dm_cL_lc(3); const double log_dm_cL_lc_PH=set_log_dm_cL_lc(4);
  //const double log_dm_GR_lc_LO=set_log_dm_GR_lc(2); const double log_dm_GR_lc_HI=set_log_dm_GR_lc(3); const double log_dm_GR_lc_PH=set_log_dm_GR_lc(4);
  const double log_dm_GR_ac_LO=set_log_dm_GR_ac(2); const double log_dm_GR_ac_HI=set_log_dm_GR_ac(3); const double log_dm_GR_ac_PH=set_log_dm_GR_ac(4);

  const double selpar_A50_comm1_LO=set_selpar_A50_comm1(2); const double selpar_A50_comm1_HI=set_selpar_A50_comm1(3); const double selpar_A50_comm1_PH=set_selpar_A50_comm1(4);
  const double selpar_slope_comm1_LO=set_selpar_slope_comm1(2); const double selpar_slope_comm1_HI=set_selpar_slope_comm1(3); const double selpar_slope_comm1_PH=set_selpar_slope_comm1(4);
  //const double selpar_A50_comm2_LO=set_selpar_A50_comm2(2); const double selpar_A50_comm2_HI=set_selpar_A50_comm2(3); const double selpar_A50_comm2_PH=set_selpar_A50_comm2(4);
  //const double selpar_slope_comm2_LO=set_selpar_slope_comm2(2); const double selpar_slope_comm2_HI=set_selpar_slope_comm2(3); const double selpar_slope_comm2_PH=set_selpar_slope_comm2(4);
  // const double selpar_A502_comm2_LO=set_selpar_A502_comm2(2); const double selpar_A502_comm2_HI=set_selpar_A502_comm2(3); const double selpar_A502_comm2_PH=set_selpar_A502_comm2(4);
  // const double selpar_slope2_comm2_LO=set_selpar_slope2_comm2(2); const double selpar_slope2_comm2_HI=set_selpar_slope2_comm2(3); const double selpar_slope2_comm2_PH=set_selpar_slope2_comm2(4);
  //const double selpar_A50_comm3_LO=set_selpar_A50_comm3(2); const double selpar_A50_comm3_HI=set_selpar_A50_comm3(3); const double selpar_A50_comm3_PH=set_selpar_A50_comm3(4);
  //const double selpar_slope_comm3_LO=set_selpar_slope_comm3(2); const double selpar_slope_comm3_HI=set_selpar_slope_comm3(3); const double selpar_slope_comm3_PH=set_selpar_slope_comm3(4);

  const double selpar_A50_GR1_LO=set_selpar_A50_GR1(2); const double selpar_A50_GR1_HI=set_selpar_A50_GR1(3); const double selpar_A50_GR1_PH=set_selpar_A50_GR1(4);
  const double selpar_slope_GR1_LO=set_selpar_slope_GR1(2); const double selpar_slope_GR1_HI=set_selpar_slope_GR1(3); const double selpar_slope_GR1_PH=set_selpar_slope_GR1(4);
  const double selpar_A50_GR2_LO=set_selpar_A50_GR2(2); const double selpar_A50_GR2_HI=set_selpar_A50_GR2(3); const double selpar_A50_GR2_PH=set_selpar_A50_GR2(4);
  const double selpar_slope_GR2_LO=set_selpar_slope_GR2(2); const double selpar_slope_GR2_HI=set_selpar_slope_GR2(3); const double selpar_slope_GR2_PH=set_selpar_slope_GR2(4);
  // const double selpar_A502_GR2_LO=set_selpar_A502_GR2(2); const double selpar_A502_GR2_HI=set_selpar_A502_GR2(3); const double selpar_A502_GR2_PH=set_selpar_A502_GR2(4);
  // const double selpar_slope2_GR2_LO=set_selpar_slope2_GR2(2); const double selpar_slope2_GR2_HI=set_selpar_slope2_GR2(3); const double selpar_slope2_GR2_PH=set_selpar_slope2_GR2(4);
  //const double selpar_A50_GR3_LO=set_selpar_A50_GR3(2); const double selpar_A50_GR3_HI=set_selpar_A50_GR3(3); const double selpar_A50_GR3_PH=set_selpar_A50_GR3(4);
  //const double selpar_slope_GR3_LO=set_selpar_slope_GR3(2); const double selpar_slope_GR3_HI=set_selpar_slope_GR3(3); const double selpar_slope_GR3_PH=set_selpar_slope_GR3(4);


  //const double log_q_comm_LO=set_log_q_comm(2); const double log_q_comm_HI=set_log_q_comm(3); const double log_q_comm_PH=set_log_q_comm(4);
  //const double log_q_cL_LO=set_log_q_cL(2); const double log_q_cL_HI=set_log_q_cL(3); const double log_q_cL_PH=set_log_q_cL(4);
  const double log_q_HB_LO=set_log_q_HB(2); const double log_q_HB_HI=set_log_q_HB(3); const double log_q_HB_PH=set_log_q_HB(4);

  const double F_init_LO=set_F_init(2); const double F_init_HI=set_F_init(3); const double F_init_PH=set_F_init(4);
  const double log_avg_F_comm_LO=set_log_avg_F_comm(2); const double log_avg_F_comm_HI=set_log_avg_F_comm(3); const double log_avg_F_comm_PH=set_log_avg_F_comm(4);
  //const double log_avg_F_cL_LO=set_log_avg_F_cL(2); const double log_avg_F_cL_HI=set_log_avg_F_cL(3); const double log_avg_F_cL_PH=set_log_avg_F_cL(4);
  const double log_avg_F_GR_LO=set_log_avg_F_GR(2); const double log_avg_F_GR_HI=set_log_avg_F_GR(3); const double log_avg_F_GR_PH=set_log_avg_F_GR(4);

  //-dev vectors---------------------------------------------------------------------------------------------------------------------
  const double log_F_dev_comm_LO=set_log_F_dev_comm(1); const double log_F_dev_comm_HI=set_log_F_dev_comm(2); const double log_F_dev_comm_PH=set_log_F_dev_comm(3);
  //const double log_F_dev_cL_LO=set_log_F_dev_cL(1); const double log_F_dev_cL_HI=set_log_F_dev_cL(2); const double log_F_dev_cL_PH=set_log_F_dev_cL(3);
  const double log_F_dev_GR_LO=set_log_F_dev_GR(1); const double log_F_dev_GR_HI=set_log_F_dev_GR(2); const double log_F_dev_GR_PH=set_log_F_dev_GR(3);

  const double log_RWq_LO=set_log_RWq_dev(1); const double log_RWq_HI=set_log_RWq_dev(2); const double log_RWq_PH=set_log_RWq_dev(3);

  const double log_rec_dev_LO=set_log_rec_dev(1); const double log_rec_dev_HI=set_log_rec_dev(2); const double log_rec_dev_PH=set_log_rec_dev(3);
  const double log_Nage_dev_LO=set_log_Nage_dev(1); const double log_Nage_dev_HI=set_log_Nage_dev(2); const double log_Nage_dev_PH=set_log_Nage_dev(3);

 END_CALCS

////-------------Growth------------------------------------------------------------------------------------
  //Population growth parms and conversions
  init_bounded_number Linf(Linf_LO,Linf_HI,Linf_PH);
  init_bounded_number K(K_LO,K_HI,K_PH);
  init_bounded_number t0(t0_LO,t0_HI,t0_PH);
  init_bounded_number len_cv_val(len_cv_LO,len_cv_HI,len_cv_PH);
  vector Linf_out(1,8);
  vector K_out(1,8);
  vector t0_out(1,8);
  vector len_cv_val_out(1,8);

  vector meanlen_TL(1,nages);   //mean total length (mm) at age all fish
```

```
  vector wgt_g(1,nages);        //whole wgt in g
  vector wgt_kg(1,nages);       //whole wgt in kg
  vector wgt_mt(1,nages);       //whole wgt in mt
  vector wgt_klb(1,nages);      //whole wgt in 1000 lb
  vector wgt_lb(1,nages);       //whole wgt in lb

  init_bounded_number Linf_L(Linf_L_LO,Linf_L_HI,Linf_L_PH);
  init_bounded_number K_L(K_L_LO,K_L_HI,K_L_PH);
  init_bounded_number t0_L(t0_L_LO,t0_L_HI,t0_L_PH);
  init_bounded_number len_cv_val_L(len_cv_L_LO,len_cv_L_HI,len_cv_L_PH);
  vector Linf_L_out(1,8);
  vector K_L_out(1,8);
  vector t0_L_out(1,8);
  vector len_cv_val_L_out(1,8);
  vector meanlen_TL_L(1,nages);   //mean total length (mm) at age all fish

  vector wgt_g_L(1,nages);        //whole wgt in g
  vector wgt_kg_L(1,nages);       //whole wgt in kg
  vector wgt_mt_L(1,nages);       //whole wgt in mt
  vector wgt_klb_L(1,nages);      //whole wgt in 1000 lb
  vector wgt_lb_L(1,nages);       //whole wgt in lb
  vector wgt_klb_gut_L(1,nages);  //gutted wgt in 1000 lb
  vector wgt_lb_gut_L(1,nages);   //gutted wgt in lb

  init_bounded_number Linf_F(Linf_F_LO,Linf_F_HI,Linf_F_PH);
  init_bounded_number K_F(K_F_LO,K_F_HI,K_F_PH);
  init_bounded_number t0_F(t0_F_LO,t0_F_HI,t0_F_PH);
  init_bounded_number len_cv_val_F(len_cv_F_LO,len_cv_F_HI,len_cv_F_PH);
  vector Linf_F_out(1,8);
  vector K_F_out(1,8);
  vector t0_F_out(1,8);
  vector len_cv_val_F_out(1,8);
  vector meanlen_TL_F(1,nages);   //mean total length (mm) at age all fish

  vector wgt_g_F(1,nages);        //whole wgt in g
  vector wgt_kg_F(1,nages);       //whole wgt in kg
  vector wgt_mt_F(1,nages);       //whole wgt in mt
  vector wgt_klb_F(1,nages);      //whole wgt in 1000 lb
  vector wgt_lb_F(1,nages);       //whole wgt in lb


  //vector batchfec(1,nages);     //batch fecundity at age
  //vector fec(1,nages);          //annual fecundity at age

  matrix len_comm_mm(styr,endyr,1,nages);          //mean length at age of commercial handline landings in mm
  matrix wholewgt_comm_klb(styr,endyr,1,nages);    //whole wgt of commercial handline landings in 1000 lb
  //matrix len_cL_mm(styr,endyr,1,nages);          //mean length at age of commercial longline landings in mm
  //matrix wholewgt_cL_klb(styr,endyr,1,nages);    //whole wgt of commercial longline landings in 1000 lb
  matrix len_HB_mm(styr,endyr,1,nages);          //mean length at age of HB landings in mm
  matrix wholewgt_HB_klb(styr,endyr,1,nages);    //whole wgt of HB landings in 1000 lb
  matrix len_GR_mm(styr,endyr,1,nages);          //mean length at age of GR landings in mm
  matrix wholewgt_GR_klb(styr,endyr,1,nages);    //whole wgt of GR landings in 1000 lb

  matrix lenprob(1,nages,1,nlenbins);           //distn of size at age (age-length key, 3 cm bins) in population
  number zscore_len;                            //standardized normal values used for computing lenprob
  vector cprob_lenvec(1,nlenbins);              //cumulative probabilities used for computing lenprob
  number zscore_lzero;                          //standardized normal values for length = 0
  number cprob_lzero;                           //length probability mass below zero, used for computing lenprob

  matrix lenprob_L(1,nages,1,nlenbins);
  number zscore_len_L;                            //standardized normal values used for computing lenprob
  vector cprob_lenvec_L(1,nlenbins);              //cumulative probabilities used for computing lenprob
  number zscore_lzero_L;                          //standardized normal values for length = 0
  number cprob_lzero_L;                           //length probability mass below zero, used for computing lenprob

  matrix lenprob_F(1,nages,1,nlenbins);
  number zscore_len_F;                            //standardized normal values used for computing lenprob
  vector cprob_lenvec_F(1,nlenbins);              //cumulative probabilities used for computing lenprob
  number zscore_lzero_F;                          //standardized normal values for length = 0
  number cprob_lzero_F;                           //length probability mass below zero, used for computing lenprob


  //matrices below are used to match length comps
  matrix lenprob_comm(1,nages,1,nlenbins);     //distn of size at age in comm
  //matrix lenprob_cL(1,nages,1,nlenbins);     //distn of size at age in cL
  matrix lenprob_HB(1,nages,1,nlenbins);     //distn of size at age in HB
  matrix lenprob_GR(1,nages,1,nlenbins);     //distn of size at age in GR

  vector len_sd(1,nages);
  vector len_cv(1,nages); //for fishgraph
  //All Fishery-dependent
  vector len_sd_L(1,nages);
  vector len_cv_L(1,nages); //for fishgraph
  //Females
  vector len_sd_F(1,nages);
  vector len_cv_F(1,nages);

//----Predicted length and age compositions
  matrix pred_comm_lenc(1,nyr_comm_lenc,1,nlenbins); //predicted length comps pooled across years
  matrix pred_comm_lenc_yr(1,nyr_comm_lenc_pool,1,nlenbins); //annual predicted length comps
  //matrix pred_cL_lenc(1,nyr_cL_lenc,1,nlenbins);
  //matrix pred_HB_lenc(1,nyr_HB_lenc,1,nlenbins);
  //matrix pred_GR_lenc(1,nyr_GR_lenc,1,nlenbins);
  matrix pred_GR_agec(1,nyr_GR_agec,1,nages_agec);
```

```
  matrix pred_GR_agec_allages(1,nyr_GR_agec,1,nages);
  matrix ErrorFree_GR_agec(1,nyr_GR_agec,1,nages);

//Sample size (perhaps adjusted herein) used in fitting comp data
  vector nsamp_comm_lenc_allyr(styr,endyr);
  //vector nsamp_cL_lenc_allyr(styr,endyr);
  // vector nsamp_HB_lenc_allyr(styr,endyr);
  //vector nsamp_GR_lenc_allyr(styr,endyr);
  vector nsamp_GR_agec_allyr(styr,endyr);

//Nfish used in MCB analysis (not used in fitting)
  vector nfish_comm_lenc_allyr(styr,endyr);
  //vector nfish_cL_lenc_allyr(styr,endyr);
  // vector nfish_HB_lenc_allyr(styr,endyr);
  //vector nfish_GR_lenc_allyr(styr,endyr);
  vector nfish_GR_agec_allyr(styr,endyr);

//Computed effective sample size for output (not used in fitting)
  vector neff_comm_lenc_allyr(styr,endyr);
  //vector neff_cL_lenc_allyr(styr,endyr);
  // vector neff_HB_lenc_allyr(styr,endyr);
  //vector neff_GR_lenc_allyr(styr,endyr);
  vector neff_GR_agec_allyr(styr,endyr);

//-----Population-----------------------------------------------------------------------------------
  matrix N(styr,endyr+1,1,nages);           //Population numbers by year and age at start of yr
  matrix N_mdyr(styr,endyr,1,nages);        //Population numbers by year and age at mdpt of yr: used for comps and cpue
  matrix N_spawn(styr,endyr,1,nages);       //Population numbers by year and age at peaking spawning: used for SSB
  init_bounded_vector log_Nage_dev(2,nages,log_Nage_dev_LO,log_Nage_dev_HI,log_Nage_dev_PH);
  vector log_Nage_dev_output(1,nages);      //used in output. equals zero for first age
  matrix B(styr,endyr+1,1,nages);           //Population biomass by year and age at start of yr
  vector totB(styr,endyr+1);                //Total biomass by year
  vector totN(styr,endyr+1);                //Total abundance by year
  vector SSB(styr,endyr);                   //Total spawning biomass by year (female mature biomass)
  vector SSB_knum(styr,endyr);              //Total spawning numbers by year (number of mature females)
  vector rec(styr,endyr+1);                 //Recruits by year
  vector prop_f(1,nages);
  //vector prop_m(1,nages);
  vector maturity_f(1,nages);
  //vector maturity_m(1,nages);
  vector reprod(1,nages);
  vector reprodknum(1,nages);

//---Stock-Recruit Function (Beverton-Holt, steepness parameterization)----------
  init_bounded_number log_R0(log_R0_LO,log_R0_HI,log_R0_PH);        //log(virgin Recruitment)
  vector log_R0_out(1,8);
  number R0;                                  //virgin recruitment
  init_bounded_number steep(steep_LO,steep_HI,steep_PH); //steepness
  vector steep_out(1,8);
  init_bounded_number rec_sigma(rec_sigma_LO,rec_sigma_HI,rec_sigma_PH);  //sd recruitment residuals
  vector rec_sigma_out(1,8);
  init_bounded_number R_autocorr(R_autocorr_LO,R_autocorr_HI,R_autocorr_PH);  //autocorrelation in SR
  vector R_autocorr_out(1,8);

  number rec_sigma_sq;                        //square of rec_sigma
  number rec_logL_add;                        //additive term in -logL term

  init_bounded_dev_vector log_rec_dev(styr_rec_dev,endyr_rec_dev,log_rec_dev_LO,log_rec_dev_HI,log_rec_dev_PH);
  vector log_rec_dev_output(styr,endyr+1);             //used in t.series output. equals zero except for yrs in log_rec_dev
  vector log_rec_dev_out(styr_rec_dev,endyr_rec_dev);  //used in output for bound checking

  number var_rec_dev;                           //variance of log recruitment deviations, from yrs with unconstrainted S-R(XXXX-XXXX)
  number sigma_rec_dev;                         //sample SD of log residuals (may not equal rec_sigma
  number BiasCor;                               //Bias correction in equilibrium recruits
  number S0;                                    //equal to spr_F0*R0 = virgin SSB
  number B0;                                    //equal to bpr_F0*R0 = virgin B
  number R1;                                    //Recruits in styr
  number R_virgin;                              //unfished recruitment with bias correction
  vector SdS0(styr,endyr);                      //Spawners relative to the unfished level


  init_bounded_number log_dm_comm_lc(log_dm_comm_lc_LO,log_dm_comm_lc_HI,log_dm_comm_lc_PH);
  //init_bounded_number log_dm_cL_lc(log_dm_cL_lc_LO,log_dm_cL_lc_HI,log_dm_cL_lc_PH);
  // init_bounded_number log_dm_HB_lc(log_dm_HB_lc_LO,log_dm_HB_lc_HI,log_dm_HB_lc_PH);
  //init_bounded_number log_dm_GR_lc(log_dm_GR_lc_LO,log_dm_GR_lc_HI,log_dm_GR_lc_PH);
  init_bounded_number log_dm_GR_ac(log_dm_GR_ac_LO,log_dm_GR_ac_HI,log_dm_GR_ac_PH);

  vector log_dm_comm_lc_out(1,8);
  //vector log_dm_cL_lc_out(1,8);
  // vector log_dm_HB_lc_out(1,8);
  //vector log_dm_GR_lc_out(1,8);
  vector log_dm_GR_ac_out(1,8);
//-----------------------------------------------------------------------------------------------------------------------------------------------
////---Selectivity-------------------------------------------------------------------------

//Commercial handline-------------------------------------------------
  matrix sel_comm(styr,endyr,1,nages);
  vector sel_comm_vec(1,nages);
  //vector sel_comm_block1(1,nages);
  //vector sel_comm_block2(1,nages);
  //vector sel_comm_block3(1,nages);

  init_bounded_number selpar_A50_comm1(selpar_A50_comm1_LO,selpar_A50_comm1_HI,selpar_A50_comm1_PH);
  init_bounded_number selpar_slope_comm1(selpar_slope_comm1_LO,selpar_slope_comm1_HI,selpar_slope_comm1_PH);
  //init_bounded_number //selpar_A50_comm2(selpar_A50_comm2_LO,selpar_A50_comm2_HI,selpar_A50_comm2_PH);
```

```
  //init_bounded_number selpar_slope_comm2(selpar_slope_comm2_LO,selpar_slope_comm2_HI,selpar_slope_comm2_PH);
  // init_bounded_number selpar_A502_comm2(selpar_A502_comm2_LO,selpar_A502_comm2_HI,selpar_A502_comm2_PH);
  // init_bounded_number selpar_slope2_comm2(selpar_slope2_comm2_LO,selpar_slope2_comm2_HI,selpar_slope2_comm2_PH);
  //init_bounded_number selpar_A50_comm3(selpar_A50_comm3_LO,selpar_A50_comm3_HI,selpar_A50_comm3_PH);
  //init_bounded_number selpar_slope_comm3(selpar_slope_comm3_LO,selpar_slope_comm3_HI,selpar_slope_comm3_PH);

  vector selpar_A50_comm1_out(1,8);
  vector selpar_slope_comm1_out(1,8);
  //vector selpar_A50_comm2_out(1,8);
  //vector selpar_slope_comm2_out(1,8);
  // vector selpar_A502_comm2_out(1,8);
  // vector selpar_slope2_comm2_out(1,8);
  //vector selpar_A50_comm3_out(1,8);
  //vector selpar_slope_comm3_out(1,8);

  //Headboat ------------------------------------------------
  matrix sel_HB(styr,endyr,1,nages); // Still need to define sel_HB to associate with HB index, but can just set equal to sel_GR below
  vector sel_HB_block1(1,nages);
  vector sel_HB_block2(1,nages);
  //vector sel_HB_block3(1,nages);

  //General Rec
  matrix sel_GR(styr,endyr,1,nages);
  vector sel_GR_block1(1,nages);
  vector sel_GR_block2(1,nages);
  //vector sel_GR_block3(1,nages);

  init_bounded_number selpar_A50_GR1(selpar_A50_GR1_LO,selpar_A50_GR1_HI,selpar_A50_GR1_PH);
  init_bounded_number selpar_slope_GR1(selpar_slope_GR1_LO,selpar_slope_GR1_HI,selpar_slope_GR1_PH);
  init_bounded_number selpar_A50_GR2(selpar_A50_GR2_LO,selpar_A50_GR2_HI,selpar_A50_GR2_PH);
  init_bounded_number selpar_slope_GR2(selpar_slope_GR2_LO,selpar_slope_GR2_HI,selpar_slope_GR2_PH);
  // init_bounded_number selpar_A502_GR2(selpar_A502_GR2_LO,selpar_A502_GR2_HI,selpar_A502_GR2_PH);
  // init_bounded_number selpar_slope2_GR2(selpar_slope2_GR2_LO,selpar_slope2_GR2_HI,selpar_slope2_GR2_PH);
  //init_bounded_number selpar_A50_GR3(selpar_A50_GR3_LO,selpar_A50_GR3_HI,selpar_A50_GR3_PH);
  //init_bounded_number selpar_slope_GR3(selpar_slope_GR3_LO,selpar_slope_GR3_HI,selpar_slope_GR3_PH);

  vector selpar_A50_GR1_out(1,8);
  vector selpar_slope_GR1_out(1,8);
  vector selpar_A50_GR2_out(1,8);
  vector selpar_slope_GR2_out(1,8);
  // vector selpar_A502_GR2_out(1,8);
  // vector selpar_slope2_GR2_out(1,8);
 //vector selpar_A50_GR3_out(1,8);
 //vector selpar_slope_GR3_out(1,8);

//Weighted total selectivity--------------------------------------------
  //effort-weighted, recent selectivities
  vector sel_wgted_L(1,nages);  //toward landings
  vector sel_wgted_tot(1,nages);//toward Z, landings plus deads discards

//-----------------------------------------------------------------------------------------------------------------------------------------------
//-------CPUE Predictions--------------------------------
  //vector pred_comm_cpue(styr_comm_cpue,endyr_comm_cpue);                   //predicted comm index (weight fish per effort)
  //matrix N_comm(styr_comm_cpue,endyr_comm_cpue,1,nages);                   //used to compute comm index
  //vector pred_cL_cpue(styr_cL_cpue,endyr_cL_cpue);                   //predicted cL index (weight fish per effort)
 // matrix N_cL(styr_cL_cpue,endyr_cL_cpue,1,nages);                   //used to compute cL index
  vector pred_HB_cpue(styr_HB_cpue,endyr_HB_cpue);                   //predicted HB index (number fish per effort)
  matrix N_HB(styr_HB_cpue,endyr_HB_cpue,1,nages);                   //used to compute HB index

//---Catchability (CPUE q's)---------------------------------------------------------
  //init_bounded_number log_q_comm(log_q_comm_LO,log_q_comm_HI,log_q_comm_PH);
  //init_bounded_number log_q_cL(log_q_cL_LO,log_q_cL_HI,log_q_cL_PH);
  init_bounded_number log_q_HB(log_q_HB_LO,log_q_HB_HI,log_q_HB_PH);

  //vector log_q_comm_out(1,8);
 // vector log_q_cL_out(1,8);
  vector log_q_HB_out(1,8);

  number q_rate;
  //vector q_rate_fcn_comm(styr_comm_cpue,endyr_comm_cpue);         //increase due to technology creep (saturates in 2003)
  //vector q_rate_fcn_cL(styr_cL_cpue,endyr_cL_cpue);         //increase due to technology creep (saturates in 2003)
  vector q_rate_fcn_HB(styr_HB_cpue,endyr_HB_cpue);         //increase due to technology creep (saturates in 2003)

//  init_bounded_number q_DD_beta(0.1,0.9,set_q_DD_phase);    //not estimated so commented out and declared as number (below)
  number q_DD_beta;
  vector q_DD_fcn(styr,endyr);    //density dependent function as a multiple of q (scaled a la Katsukawa and Matsuda. 2003)
  number B0_q_DD;                 //B0 of ages q_DD_age plus
  vector B_q_DD(styr,endyr);      //annual biomass of ages q_DD_age plus

//Fishery dependent random walk catchability
 //init_bounded_vector q_RW_log_dev_comm(styr_comm_cpue,endyr_comm_cpue-1,log_RWq_LO,log_RWq_HI,log_RWq_PH);
 //init_bounded_vector q_RW_log_dev_cL(styr_cL_cpue,endyr_cL_cpue-1,log_RWq_LO,log_RWq_HI,log_RWq_PH);
 init_bounded_vector q_RW_log_dev_HB(styr_HB_cpue,endyr_HB_cpue-1,log_RWq_LO,log_RWq_HI,log_RWq_PH);

//Fishery dependent catchability over time, may be constant
 //vector q_comm(styr_comm_cpue,endyr_comm_cpue);
 //vector q_cL(styr_cL_cpue,endyr_cL_cpue);
 vector q_HB(styr_HB_cpue,endyr_HB_cpue);

//-----------------------------------------------------------------------------------------------------------------------------------------------
//---Landings in numbers (total or 1000 fish) and in wgt (whole klb)--------------------------------------------------
  matrix L_comm_num(styr,endyr,1,nages);   //landings (numbers) at age
  matrix L_comm_klb(styr,endyr,1,nages);   //landings (1000 lb whole weight) at age
  vector pred_comm_L_knum(styr,endyr);     //yearly landings in 1000 fish summed over ages
  vector pred_comm_L_klb(styr,endyr);      //yearly landings in 1000 lb whole summed over ages
```

```
  //matrix L_cL_num(styr,endyr,1,nages);   //landings (numbers) at age
  //matrix L_cL_klb(styr,endyr,1,nages);   //landings (1000 lb whole weight) at age
  //vector pred_cL_L_knum(styr,endyr);     //yearly landings in 1000 fish summed over ages
  //vector pred_cL_L_klb(styr,endyr);      //yearly landings in 1000 lb whole summed over ages

  matrix L_GR_num(styr,endyr,1,nages);   //landings (numbers) at age
  matrix L_GR_klb(styr,endyr,1,nages);   //landings (1000 lb whole weight) at age
  vector pred_GR_L_knum(styr,endyr);     //yearly landings in 1000 fish summed over ages
  vector pred_GR_L_klb(styr,endyr);      //yearly landings in 1000 lb whole summed over ages

  matrix L_total_num(styr,endyr,1,nages);//total landings in number at age
  matrix L_total_klb(styr,endyr,1,nages);//landings in klb whole wgt at age
  vector L_total_knum_yr(styr,endyr);    //total landings in 1000 fish by yr summed over ages
  vector L_total_klb_yr(styr,endyr);     //total landings (klb whole wgt) by yr summed over ages

////---MSY calcs----------------------------------------------------------------------------
  number F_comm_prop;       //proportion of F_sum attributable to comm, last X=selpar_n_yrs_wgted yrs
  //number F_cL_prop;       //proportion of F_sum attributable to comm, last X=selpar_n_yrs_wgted yrs
  number F_GR_prop;       //proportion of F_sum attributable to GR, last X=selpar_n_yrs_wgted yrs

  number F_init_comm_prop;  //proportion of F_init attributable to comm, first X yrs
  //number F_init_cL_prop;  //proportion of F_init attributable to cL, first X yrs
  number F_init_GR_prop;  //proportion of F_init attributable to GR, first X yrs

  number F_temp_sum;      //sum of geom mean Fsum's in last X yrs, used to compute F_fishery_prop

  vector F_end(1,nages);
  vector F_end_L(1,nages);
  number F_end_apex;

  number SSB_msy_out;           //SSB (total mature biomass) at msy
  number F_msy_out;             //F at msy
  number msy_klb_out;           //max sustainable yield (1000 lb whole wgt)
  number msy_knum_out;          //max sustainable yield (1000 fish)
  number B_msy_out;             //total biomass at MSY
  number R_msy_out;             //equilibrium recruitment at F=Fmsy
  number spr_msy_out;           //spr at F=Fmsy

  number F20_dum; //intermediate calculation for F20
  number F30_dum; //intermediate calculation for F30
  number F40_dum; //intermediate calculation for F40
  number F20_out;               //F20
  number F30_out;               //F30
  number F40_out;               //F40
  number SSB_F30_out;
  number SSB_F30_knum_out;
  number B_F30_out;
  number R_F30_out;
  number L_F30_knum_out;
  number L_F30_klb_out;

  number SSB_F40_out;
  number SSB_F40_knum_out;
  number B_F40_out;
  number R_F40_out;
  number L_F40_knum_out;
  number L_F40_klb_out;
  number rec_mean;   //arithmetic average recruitment used in SPR-related quantities

  vector N_age_msy(1,nages);         //numbers at age for MSY calculations: beginning of yr
  vector N_age_msy_spawn(1,nages);   //numbers at age for MSY calculations: time of peak spawning
  vector L_age_msy(1,nages);         //landings at age for MSY calculations
  vector Z_age_msy(1,nages);         //total mortality at age for MSY calculations
  vector F_L_age_msy(1,nages);       //fishing mortality landings (not discards) at age for MSY calculations
  vector F_msy(1,n_iter_msy);        //values of full F to be used in equilibrium calculations
  vector spr_msy(1,n_iter_msy);      //reproductive capacity-per-recruit values corresponding to F values in F_msy
  vector R_eq(1,n_iter_msy);         //equilibrium recruitment values corresponding to F values in F_msy
  vector L_eq_klb(1,n_iter_msy);     //equilibrium landings(klb whole wgt) values corresponding to F values in F_msy
  vector L_eq_knum(1,n_iter_msy);    //equilibrium landings(1000 fish) values corresponding to F values in F_msy
  vector SSB_eq(1,n_iter_msy);       //equilibrium reproductive capacity values corresponding to F values in F_msy
  vector SSB_eq_knum(1,n_iter_msy);
  vector B_eq(1,n_iter_msy);         //equilibrium biomass values corresponding to F values in F_msy

  vector FdF_msy(styr,endyr);
  vector FdF30(styr,endyr);
  vector FdF40(styr,endyr);
  vector SdSSB_msy(styr,endyr);
  number SdSSB_msy_end;
  number FdF_msy_end;
  number FdF_msy_end_mean;           //geometric mean of last X yrs

  vector SdSSB_F30(styr,endyr);
  vector Sdmsst_F30(styr,endyr);
  number SdSSB_F30_end;
  number Sdmsst_F30_end;
  number FdF30_end_mean;             //geometric mean of last selpar_n_yrs_wgted yrs
  vector L_age_F30(1,nages);         //landings at age for F30 calculations

  vector SdSSB_F40(styr,endyr);
  vector Sdmsst_F40(styr,endyr);
  number SdSSB_F40_end;
  number Sdmsst_F40_end;
  number FdF40_end_mean;             //geometric mean of last selpar_n_yrs_wgted yrs
  number Fend_mean_temp;  //intermediate calc for geometric mean of last selpar_n_yrs_wgted yrs
```

```
  number Fend_mean;  //geometric mean of last selpar_n_yrs_wgted yrs
  vector L_age_F40(1,nages);         //landings at age for F40 calculations

  vector wgt_wgted_L_klb(1,nages);   //fishery-weighted average weight at age of landings in whole weight
  number wgt_wgted_L_denom;          //used in intermediate calculations

  number iter_inc_msy;               //increments used to compute msy, equals 1/(n_iter_msy-1)

////--------Mortality------------------------------------------------------------------

  vector M(1,nages);                         //age-dependent natural mortality
  init_bounded_number M_constant(M_constant_LO,M_constant_HI,M_constant_PH);   //age-indpendent: used only for MSST
  vector M_constant_out(1,8);
  number smsy2msstM;                         //scales Smsy to get msst using (1-M). Used only in output.
  number smsy2msst75;                        //scales Smsy to get msst using 75%. Used only in output.

  matrix F(styr,endyr,1,nages);
  vector Fsum(styr,endyr);                   //Full fishing mortality rate by year
  vector Fapex(styr,endyr);                  //Max across ages, fishing mortality rate by year (may differ from Fsum bc of dome-shaped sel
  matrix Z(styr,endyr,1,nages);

  init_bounded_number log_avg_F_comm(log_avg_F_comm_LO,log_avg_F_comm_HI,log_avg_F_comm_PH);
  vector log_avg_F_comm_out(1,8);
  init_bounded_dev_vector log_F_dev_comm(styr_comm_L,endyr_comm_L,log_F_dev_comm_LO,log_F_dev_comm_HI,log_F_dev_comm_PH);
  vector log_F_dev_comm_out(styr_comm_L,endyr_comm_L);
  matrix F_comm(styr,endyr,1,nages);
  vector F_comm_out(styr,endyr);        //used for intermediate calculations in fcn get_mortality
  number log_F_dev_init_comm;
  number log_F_dev_end_comm;

  init_bounded_number log_avg_F_GR(log_avg_F_GR_LO,log_avg_F_GR_HI,log_avg_F_GR_PH);
  vector log_avg_F_GR_out(1,8);
  init_bounded_dev_vector log_F_dev_GR(styr_GR_L,endyr_GR_L,log_F_dev_GR_LO,log_F_dev_GR_HI,log_F_dev_GR_PH);
  vector log_F_dev_GR_out(styr_GR_L,endyr_GR_L);
  matrix F_GR(styr,endyr,1,nages);
  vector F_GR_out(styr,endyr); //used for intermediate calculations in fcn get_mortality
  number log_F_dev_init_GR;
  number log_F_dev_end_GR;

  init_bounded_number F_init(F_init_LO,F_init_HI,F_init_PH); //scales early F for initialization
  vector F_init_out(1,8);
  number F_init_denom;  //interim calculation. From Erik's red snapper ASPM

  //number F_init_ratio;   //scales initial F, which is read in as a fixed value
  //vector sel_initial(1,nages);       //initial selectivity (a combination of recreational and commercial selectivities)

//---Per-recruit stuff----------------------------------------------------------------------------------
  vector N_age_spr(1,nages);         //numbers at age for SPR calculations: beginning of year
  vector N_age_spr_spawn(1,nages);   //numbers at age for SPR calculations: time of peak spawning
  vector L_age_spr(1,nages);         //catch at age for SPR calculations
  vector Z_age_spr(1,nages);         //total mortality at age for SPR calculations
  vector spr_static(styr,endyr);     //vector of static SPR values by year
  vector F_L_age_spr(1,nages);       //fishing mortality of landings (not discards) at age for SPR calculations
  vector F_spr(1,n_iter_spr);        //values of full F to be used in per-recruit calculations
  vector spr_spr(1,n_iter_spr);      //reproductive capacity-per-recruit values corresponding to F values in F_spr
  vector spr_ratio(1,n_iter_spr);    //reproductive capacity-per-recruit relative to spr_F0 values corresponding to F values in F_spr
  vector L_spr(1,n_iter_spr);        //landings(lb)-per-recruit (ypr) values corresponding to F values in F_spr

  vector N_spr_F0(1,nages);          //Used to compute spr at F=0: at time of peak spawning
  vector N_bpr_F0(1,nages);          //Used to compute bpr at F=0: at start of year
  vector N_spr_initial(1,nages);     //Initial spawners per recruit at age given initial F
  vector N_initial_eq(1,nages);      //Initial equilibrium abundance at age
  vector F_initial(1,nages);         //initial F at age
  vector Z_initial(1,nages);         //initial Z at age
  number spr_initial;                //initial spawners per recruit
  number spr_F0;                     //Spawning biomass per recruit at F=0
  number bpr_F0;                     //Biomass per recruit at F=0

  number iter_inc_spr;               //increments used to compute msy, equals max_F_spr_msy/(n_iter_spr-1)

////-------SDNR output-----------------------------------------------------------------------------

  number sdnr_lc_comm;
  //number sdnr_lc_cL;
  //number sdnr_lc_HB;
  //number sdnr_lc_GR;
  number sdnr_ac_GR;
 // number sdnr_I_comm;
 // number sdnr_I_cL;
  number sdnr_I_HB;

////-------Objective function components-----------------------------------------------------------------------------
  number w_L;

 // number w_I_comm;
 // number w_I_cL;
  number w_I_HB;

  number w_lc_comm;
  //number w_lc_cL;
  //number w_lc_HB;
  //number w_lc_GR;
  number w_ac_GR;

  number w_Nage_init;
```

```
  number w_rec;
  number w_rec_early;
  number w_rec_end;
  number w_fullF;
  number w_Ftune;

  number f_comm_L;
  //number f_cL_L;
  // number f_HB_L;
  number f_GR_L;

  //number f_comm_cpue;
  //number f_cL_cpue;
  number f_HB_cpue;

  //number f_comm_RWq_cpue;
  //number f_cL_RWq_cpue;
  number f_HB_RWq_cpue;

  number f_comm_lenc;
  //number f_cL_lenc;
  // number f_HB_lenc;
  number f_GR_lenc;

  number f_GR_agec;

//  Penalties and constraints. Not all are used.
  number f_Nage_init;              //weight on log devs to estimate initial abundance (excluding first age)
  number f_rec_dev;                //weight on recruitment deviations to fit S-R curve
  number f_rec_dev_early;          //extra weight on deviations in first recruitment stanza
  number f_rec_dev_end;            //extra weight on deviations in ending recruitment stanza
  number f_fullF_constraint;       //penalty for Fapex>X
  number f_Ftune;                  //penalty for tuning F in Ftune yr.  Not applied in final optimization phase.
  number f_priors;                 //prior information on parameters

   //init_number xdum;
   objective_function_value fval;
   number fval_data;
   number grad_max;

 //--Dummy variables ----
   number denom;                   //denominator used in some calculations
   number numer;                   //numerator used in some calculations

  //---------- Projection quantities--------------------------------------------------------------
  number F_reg_proj;    //value used to define the projections
  vector F_proj(styr_proj,endyr_proj);         //F by yr for projections (=F_reg_proj after regulations start, current F till then)
  vector L_knum_proj(styr_proj,endyr_proj);    //total landings in 1000 fish for projections
  vector L_klb_proj(styr_proj,endyr_proj);     //total landings in weight (1000 lb) for projections

  vector B_proj(styr_proj,endyr_proj);         //Biomass for projections
  vector SSB_proj(styr_proj,endyr_proj);       //SSB for projections
  vector R_proj(styr_proj,endyr_proj);         //recruits for projections
  vector FL_age_proj(1,nages);          //F (landings) by age for projections

  matrix N_proj(styr_proj,endyr_proj,1,nages);           //Population numbers by year and age at start of yr
  matrix N_spawn_proj(styr_proj,endyr_proj,1,nages);     //Population numbers by year and age at peaking spawning: used for SSB in projections
  matrix Z_proj(styr_proj,endyr_proj,1,nages);           //Z by year and age for projections
  matrix L_age_proj(styr_proj,endyr_proj,1,nages);       //Projected landings at age in numbers

//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//INITIALIZATION_SECTION
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
GLOBALS_SECTION
  #include "admodel.h"          // Include AD class definitions
  #include "admb2r.cpp"         // Include S-compatible output functions (needs preceding)
  #include <time.h>
time_t start,finish;
long hour,minute,second;
double elapsed_time;

//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
RUNTIME_SECTION
 maximum_function_evaluations 1000, 2000,3000, 5000, 10000;//, 10000, 10000;
 convergence_criteria 1e-2, 1e-2,1e-3, 1e-3, 1e-4;//, 1e-4, 1e-4;

//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
PRELIMINARY_CALCS_SECTION

// Set values of fixed parameters or set initial guess of estimated parameters

 //Population
  Linf=set_Linf(1);
  K=set_K(1);
  t0=set_t0(1);
  len_cv_val=set_len_cv(1);

  //All fisheries
  Linf_L=set_Linf_L(1);
  K_L=set_K_L(1);
  t0_L=set_t0_L(1);
  len_cv_val_L=set_len_cv_L(1);
```

```
 //Females
 Linf_F=set_Linf_F(1);
 K_F=set_K_F(1);
 t0_F=set_t0_F(1);
 len_cv_val_F=set_len_cv_F(1);

 M=set_M;
 M_constant=set_M_constant(1);
 smsy2msstM=1.0-M_constant;
 smsy2msst75=0.75;

 log_R0=set_log_R0(1);
 steep=set_steep(1);
 R_autocorr=set_R_autocorr(1);
 rec_sigma=set_rec_sigma(1);

 log_dm_comm_lc=set_log_dm_comm_lc(1);
 //log_dm_cL_lc=set_log_dm_cL_lc(1);
 // log_dm_HB_lc=set_log_dm_HB_lc(1);
 //log_dm_GR_lc=set_log_dm_GR_lc(1);
 log_dm_GR_ac=set_log_dm_GR_ac(1);

// log_q_comm=set_log_q_comm(1);
 //log_q_cL=set_log_q_cL(1);
 log_q_HB=set_log_q_HB(1);

 q_rate=set_q_rate;
 //q_rate_fcn_comm=1.0;
 //q_rate_fcn_cL=1.0;
 q_rate_fcn_HB=1.0;
 q_DD_beta=set_q_DD_beta;
 q_DD_fcn=1.0;

 //q_RW_log_dev_comm.initialize();
// q_RW_log_dev_cL.initialize();
 q_RW_log_dev_HB.initialize();

  if (set_q_rate_phase<0 & q_rate!=0.0)
 {

   for (iyear=styr_HB_cpue; iyear<=endyr_HB_cpue; iyear++)
     {   if (iyear>styr_HB_cpue & iyear <=2003)
         {//q_rate_fcn_HB(iyear)=(1.0+q_rate)*q_rate_fcn_HB(iyear-1); //compound
            q_rate_fcn_HB(iyear)=(1.0+(iyear-styr_HB_cpue)*q_rate)*q_rate_fcn_HB(styr_HB_cpue);  //linear
         }
         if (iyear>2003) {q_rate_fcn_HB(iyear)=q_rate_fcn_HB(iyear-1);}
     }
 } //end q_rate conditional

 w_L=set_w_L;

// w_I_comm=set_w_I_comm;
// w_I_cL=set_w_I_cL;
 w_I_HB=set_w_I_HB;

 w_lc_comm=set_w_lc_comm;
 //w_lc_cL=set_w_lc_cL;
 //w_lc_HB=set_w_lc_HB;
 //w_lc_GR=set_w_lc_GR;
 w_ac_GR=set_w_ac_GR;

 w_Nage_init=set_w_Nage_init;
 w_rec=set_w_rec;
 w_rec_early=set_w_rec_early;
 w_rec_end=set_w_rec_end;
 w_fullF=set_w_fullF;
 w_Ftune=set_w_Ftune;

 F_init=set_F_init(1);

 log_avg_F_comm=set_log_avg_F_comm(1);
 //log_avg_F_cL=set_log_avg_F_cL(1);
 // log_avg_F_HB=set_log_avg_F_HB(1);
 log_avg_F_GR=set_log_avg_F_GR(1);

 log_F_dev_comm=set_log_F_dev_comm_vals;
 //log_F_dev_cL=set_log_F_dev_cL_vals;
 // log_F_dev_HB=set_log_F_dev_HB_vals;
 log_F_dev_GR=set_log_F_dev_GR_vals;

 selpar_A50_comm1=set_selpar_A50_comm1(1);
 selpar_slope_comm1=set_selpar_slope_comm1(1);
 //selpar_A50_comm2=set_selpar_A50_comm2(1);
 //selpar_slope_comm2=set_selpar_slope_comm2(1);
 // selpar_A502_comm2=set_selpar_A502_comm2(1);
 // selpar_slope2_comm2=set_selpar_slope2_comm2(1);
 //selpar_A50_comm3=set_selpar_A50_comm3(1);
 //selpar_slope_comm3=set_selpar_slope_comm3(1);

 selpar_A50_GR1=set_selpar_A50_GR1(1);
 selpar_slope_GR1=set_selpar_slope_GR1(1);
 selpar_A50_GR2=set_selpar_A50_GR2(1);
 selpar_slope_GR2=set_selpar_slope_GR2(1);
 // selpar_A502_GR2=set_selpar_A502_GR2(1);
 // selpar_slope2_GR2=set_selpar_slope2_GR2(1);
```

```
  //selpar_A50_GR3=set_selpar_A50_GR3(1);
  //selpar_slope_GR3=set_selpar_slope_GR3(1);

 sqrt2pi=sqrt(2.*3.14159265);
 g2mt=0.000001;         //conversion of grams to metric tons
 g2kg=0.001;            //conversion of grams to kg
 mt2klb=2.20462;        //conversion of metric tons to 1000 lb
 mt2lb=mt2klb*1000.0;   //conversion of metric tons to lb
 g2klb=g2mt*mt2klb;     //conversion of grams to 1000 lb
 dzero=0.00001;
 huge_number=1.0e+10;

 SSB_msy_out=0.0;

 iter_inc_msy=max_F_spr_msy/(n_iter_msy-1);
 iter_inc_spr=max_F_spr_msy/(n_iter_spr-1);

 maturity_f=maturity_f_obs;

 prop_f=prop_f_obs;

//Fill in sample sizes of comps, possibly sampled in nonconsec yrs
//Used primarily for output in R object

      nsamp_comm_lenc_allyr=missing;
  //nsamp_cL_lenc_allyr=missing;
  //nsamp_GR_lenc_allyr=missing;
  nsamp_GR_agec_allyr=missing;

      nfish_comm_lenc_allyr=missing;
  //nfish_cL_lenc_allyr=missing;
  //nfish_GR_lenc_allyr=missing;
  nfish_GR_agec_allyr=missing;

      for (iyear=1; iyear<=nyr_comm_lenc; iyear++)
         {if (nsamp_comm_lenc(iyear)>=minSS_comm_lenc)
           {nsamp_comm_lenc_allyr(yrs_comm_lenc(iyear))=nsamp_comm_lenc(iyear);
            nfish_comm_lenc_allyr(yrs_comm_lenc(iyear))=nfish_comm_lenc(iyear);}}
      //for (iyear=1; iyear<=nyr_cL_lenc; iyear++)
      //   {if (nsamp_cL_lenc(iyear)>=minSS_cL_lenc)
      //     {nsamp_cL_lenc_allyr(yrs_cL_lenc(iyear))=nsamp_cL_lenc(iyear);
      //      nfish_cL_lenc_allyr(yrs_cL_lenc(iyear))=nfish_cL_lenc(iyear);}}
  //for (iyear=1; iyear<=nyr_GR_lenc; iyear++)
      //   {if (nsamp_GR_lenc(iyear)>=minSS_GR_lenc)
      //      {nsamp_GR_lenc_allyr(yrs_GR_lenc(iyear))=nsamp_GR_lenc(iyear);
      //       nfish_GR_lenc_allyr(yrs_GR_lenc(iyear))=nfish_GR_lenc(iyear);}}
  for (iyear=1; iyear<=nyr_GR_agec; iyear++)
         {if (nsamp_GR_agec(iyear)>=minSS_GR_agec)
           {nsamp_GR_agec_allyr(yrs_GR_agec(iyear))=nsamp_GR_agec(iyear);
             nfish_GR_agec_allyr(yrs_GR_agec(iyear))=nfish_GR_agec(iyear);}}

//fill in Fs for msy and per-recruit analyses
  F_msy(1)=0.0;
  for (ff=2;ff<=n_iter_msy;ff++) {F_msy(ff)=F_msy(ff-1)+iter_inc_msy;}
  F_spr(1)=0.0;
  for (ff=2;ff<=n_iter_spr;ff++) {F_spr(ff)=F_spr(ff-1)+iter_inc_spr;}


//fill in F's, Catch matrices, and log rec dev with zero's
  F_comm.initialize(); L_comm_num.initialize();
  //F_cL.initialize(); L_cL_num.initialize();
  // F_HB.initialize(); L_HB_num.initialize();
  F_GR.initialize(); L_GR_num.initialize();

  F_comm_out.initialize();
  //F_cL_out.initialize();
  // F_HB_out.initialize();
  F_GR_out.initialize();

  sel_comm.initialize();
  sel_comm_vec.initialize();
  sel_HB.initialize();
  sel_GR.initialize();


  //sel_comm_block1.initialize();
  //sel_comm_block2.initialize();
  //sel_cL_block1.initialize();
  //sel_cL_block2.initialize();
  sel_HB_block1.initialize();
  sel_HB_block2.initialize();
  sel_GR_block1.initialize();
  sel_GR_block2.initialize();


  log_rec_dev_output.initialize();
  log_rec_dev=set_log_rec_dev_vals;
  log_Nage_dev_output.initialize();
  log_Nage_dev=set_log_Nage_dev_vals;


//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
//##--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>--><>
TOP_OF_MAIN_SECTION
  time(&start);
```

```
  arrmblsize=20000000;
  gradient_structure::set_MAX_NVAR_OFFSET(1600);
  gradient_structure::set_GRADSTACK_BUFFER_SIZE(2000000);
  gradient_structure::set_CMPDIF_BUFFER_SIZE(2000000);
  gradient_structure::set_NUM_DEPENDENT_VARIABLES(10000);

//>-->&lt;>-->&lt;>-->&lt;>-->&lt;>
//##-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>-->&lt;>
PROCEDURE_SECTION

 //cout<<"start"<<endl;

 //get_M_at_age(); //Needed only if M is estimated

  get_length_weight_at_age();
  //cout << "got length, weight, fecundity transitions" <<endl;
  get_reprod();
  //cout << "got reprod" << endl;
  get_length_at_age_dist();
  //cout<< "got predicted length at age distribution"<<endl;
  get_weight_at_age_landings();
  //cout<< "got weight at age of landings"<<endl;
  get_spr_F0();
  //cout << "got F0 spr" << endl;
  get_selectivity();
  //cout << "got selectivity" << endl;
  get_mortality();
  // cout << "got mortalities" << endl;
  get_bias_corr();
  //cout<< "got recruitment bias correction" << endl;
  get_numbers_at_age();
  //cout << "got numbers at age" << endl;
  get_landings_numbers();
  //cout << "got landings in numbers" << endl;
  get_landings_wgt();
  //cout << "got landings in wgt" << endl;
  // get_dead_discards();
  //cout << "got dead discards in num and wgt" << endl;
  get_catchability_fcns();
  //cout << "got catchability_fcns" << endl;
  get_indices();
  //cout << "got indices" << endl;
  get_length_comps();
  // cout<< "got length comps"<< endl;
   get_age_comps();
  //cout<< "got age comps"<< endl;
   evaluate_objective_function();
   //cout << "objective function calculations complete" << endl;


FUNCTION get_length_weight_at_age
//population total length in mm
    //compute mean length (mm TL) and weight (whole) at age
    meanlen_TL=Linf*(1.0-mfexp(-K*(agebins-t0+0.5))); //Actually fork length
    wgt_kg=wgtpar_a*pow(meanlen_TL,wgtpar_b);             //whole wgt in kg
    wgt_g=wgt_kg/g2kg;                                    //convert wgt in kg to weight in g
    wgt_mt=wgt_g*g2mt;                                    //convert weight in g to weight in mt
    wgt_klb=mt2klb*wgt_mt;                                //1000 lb of whole wgt
    wgt_lb=mt2lb*wgt_mt;                                  //lb of whole wgt

//All fisheries
meanlen_TL_L=Linf_L*(1.0-mfexp(-K_L*(agebins-t0_L+0.5)));    //Landings total length in mm
    wgt_kg_L=wgtpar_a*pow(meanlen_TL_L,wgtpar_b);             //whole wgt in kg
    wgt_g_L=wgt_kg_L/g2kg;                                    //convert wgt in kg to weight in g
    wgt_mt_L=wgt_g_L*g2mt;                                    //convert weight in g to weight in mt
    wgt_klb_L=mt2klb*wgt_mt_L;                               //1000 lb of whole wgt
    wgt_lb_L=mt2lb*wgt_mt_L;                                 //1000 lb of whole wgt

//Females
meanlen_TL_F=Linf_F*(1.0-mfexp(-K_F*(agebins-t0_F+0.5)));    //Landings total length in mm
    wgt_kg_F=wgtpar_a*pow(meanlen_TL_F,wgtpar_b);             //whole wgt in kg
    wgt_g_F=wgt_kg_F/g2kg;                                    //convert wgt in kg to weight in g
    wgt_mt_F=wgt_g_F*g2mt;                                    //convert weight in g to weight in mt
    wgt_klb_F=mt2klb*wgt_mt_F;                               //1000 lb of whole wgt
    wgt_lb_F=mt2lb*wgt_mt_F;                                 //1000 lb of whole wgt

//batchfec = mfexp(batchfecpar_a + batchfecpar_b*meanlen_TL);  // batch fecundity at length [should be batchfec = exp(a+bL) based on Harris 2004]
//fec = batchfec*nbatch/fecpar_scale;                          // annual fecundity at length scaled to fecpar_scale units

FUNCTION get_reprod

    //reprod=elem_prod(prop_f,elem_prod(maturity_f,fec));
reprod=elem_prod(elem_prod(prop_f,maturity_f),wgt_mt_F);
reprodknum=elem_prod(prop_f,maturity_f)/1000.0;
//+elem_prod(prop_m,maturity_m)),wg_mt);

FUNCTION get_length_at_age_dist
  //compute matrix of length at age, based on the normal distribution
    //population
for (iage=1;iage<=nages;iage++)
   {len_cv(iage)=len_cv_val;
    len_sd(iage)=meanlen_TL(iage)*len_cv(iage);
zscore_lzero=(0.0-meanlen_TL(iage))/len_sd(iage);
cprob_lzero=cumd_norm(zscore_lzero);
```

```
    //All fishery dependent
//len_cv_L(iage)=mfexp(log_len_cv_L+log_len_cv_dev_L(iage));
    len_cv_L(iage)=len_cv_val_L;
    len_sd_L(iage)=meanlen_TL_L(iage)*len_cv_L(iage);
zscore_lzero_L=(0.0-meanlen_TL_L(iage))/len_sd_L(iage);
cprob_lzero_L=cumd_norm(zscore_lzero_L);

//Females
//len_cv_L(iage)=mfexp(log_len_cv_L+log_len_cv_dev_L(iage));
    len_cv_F(iage)=len_cv_val_F;
    len_sd_F(iage)=meanlen_TL_F(iage)*len_cv_F(iage);
zscore_lzero_F=(0.0-meanlen_TL_F(iage))/len_sd_F(iage);
cprob_lzero_F=cumd_norm(zscore_lzero_F);

    //first length bin
//population
    zscore_len=((lenbins(1)+0.5*lenbins_width)-meanlen_TL(iage)) / len_sd(iage);
    cprob_lenvec(1)=cumd_norm(zscore_len);          //includes any probability mass below zero
    lenprob(iage,1)=cprob_lenvec(1)-cprob_lzero;    //removes any probability mass below zero

//All fishery dependent
    zscore_len_L=((lenbins(1)+0.5*lenbins_width)-meanlen_TL_L(iage)) / len_sd_L(iage);
    cprob_lenvec_L(1)=cumd_norm(zscore_len_L);          //includes any probability mass below zero
    lenprob_L(iage,1)=cprob_lenvec_L(1)-cprob_lzero_L;    //removes any probability mass below zero

//Females
    zscore_len_F=((lenbins(1)+0.5*lenbins_width)-meanlen_TL_F(iage)) / len_sd_F(iage);
    cprob_lenvec_F(1)=cumd_norm(zscore_len_F);          //includes any probability mass below zero
    lenprob_F(iage,1)=cprob_lenvec_F(1)-cprob_lzero_F;    //removes any probability mass below zero

    //most other length bins
    //population
    for (ilen=2;ilen<nlenbins;ilen++)
      {
        zscore_len=((lenbins(ilen)+0.5*lenbins_width)-meanlen_TL(iage)) / len_sd(iage);
cprob_lenvec(ilen)=cumd_norm(zscore_len);
        lenprob(iage,ilen)=cprob_lenvec(ilen)-cprob_lenvec(ilen-1);
      }

//All fishery dependent
    for (ilen=2;ilen<nlenbins;ilen++)
      {
        zscore_len_L=((lenbins(ilen)+0.5*lenbins_width)-meanlen_TL_L(iage)) / len_sd_L(iage);
cprob_lenvec_L(ilen)=cumd_norm(zscore_len_L);
        lenprob_L(iage,ilen)=cprob_lenvec_L(ilen)-cprob_lenvec_L(ilen-1);
      }

//Females
    for (ilen=2;ilen<nlenbins;ilen++)
      {
        zscore_len_F=((lenbins(ilen)+0.5*lenbins_width)-meanlen_TL_F(iage)) / len_sd_F(iage);
cprob_lenvec_F(ilen)=cumd_norm(zscore_len_F);
        lenprob_F(iage,ilen)=cprob_lenvec_F(ilen)-cprob_lenvec_F(ilen-1);
      }

    //last length bin is a plus group
//population
    zscore_len=((lenbins(nlenbins)-0.5*lenbins_width)-meanlen_TL(iage)) / len_sd(iage);
lenprob(iage,nlenbins)=1.0-cumd_norm(zscore_len);
      lenprob(iage)=lenprob(iage)/(1.0-cprob_lzero);  //renormalize to account for any prob mass below size=0

//All fishery dependent
    zscore_len_L=((lenbins(nlenbins)-0.5*lenbins_width)-meanlen_TL_L(iage)) / len_sd_L(iage);
lenprob_L(iage,nlenbins)=1.0-cumd_norm(zscore_len_L);
      lenprob_L(iage)=lenprob_L(iage)/(1.0-cprob_lzero_L);  //renormalize to account for any prob mass below size=0

//Females
    zscore_len_F=((lenbins(nlenbins)-0.5*lenbins_width)-meanlen_TL_F(iage)) / len_sd_F(iage);
lenprob_F(iage,nlenbins)=1.0-cumd_norm(zscore_len_F);
      lenprob_F(iage)=lenprob_F(iage)/(1.0-cprob_lzero_F);  //renormalize to account for any prob mass below size=0
   }

  //fleet and survey specific length probs, all assumed here to equal the popn
  lenprob_comm=lenprob_L;
  //lenprob_cL=lenprob;
  lenprob_HB=lenprob;
  //lenprob_GR=lenprob;

FUNCTION get_weight_at_age_landings  ///***in whole weight

  for (iyear=styr; iyear<=endyr; iyear++)
  {
    len_comm_mm(iyear)=meanlen_TL_L;
    wholewgt_comm_klb(iyear)=wgt_klb_L;
    //len_cL_mm(iyear)=meanlen_TL;
    //wholewgt_cL_klb(iyear)=wgt_klb;
    len_HB_mm(iyear)=meanlen_TL_L;
    wholewgt_HB_klb(iyear)=wgt_klb_L;
    len_GR_mm(iyear)=meanlen_TL_L;
    wholewgt_GR_klb(iyear)=wgt_klb_L;
  }


FUNCTION get_spr_F0
  //at mdyr, apply half this yr's mortality, half next yr's
```

```
  N_spr_F0(1)=1.0*mfexp(-1.0*M(1)*spawn_time_frac); //at peak spawning time
  N_bpr_F0(1)=1.0;      //at start of year
  for (iage=2; iage<=nages; iage++)
  { N_spr_F0(iage)=N_spr_F0(iage-1)*mfexp(-1.0*(M(iage-1)*(1.0-spawn_time_frac) + M(iage)*spawn_time_frac));
    N_bpr_F0(iage)=N_bpr_F0(iage-1)*mfexp(-1.0*(M(iage-1)));
  }
  N_spr_F0(nages)=N_spr_F0(nages)/(1.0-mfexp(-1.0*M(nages))); //plus group (sum of geometric series)
  N_bpr_F0(nages)=N_bpr_F0(nages)/(1.0-mfexp(-1.0*M(nages)));

  spr_F0=sum(elem_prod(N_spr_F0,reprod));
  bpr_F0=sum(elem_prod(N_bpr_F0,wgt_mt));



FUNCTION get_selectivity
  sel_comm_vec=logistic(agebins, selpar_A50_comm1, selpar_slope_comm1);
  sel_GR_block1=logistic(agebins, selpar_A50_GR1, selpar_slope_GR1);
  sel_GR_block2=logistic(agebins, selpar_A50_GR2, selpar_slope_GR2);
  sel_HB_block1=sel_GR_block1; // Use GR selectivity for HB
  sel_HB_block2=sel_GR_block1; // Use GR selectivity for HB

  //-------- comm --------//
  for (iyear=styr; iyear<=endyr; iyear++)
{sel_comm(iyear) = sel_comm_vec;}

  //---- GR and HB ----//
  //BLOCK 1 for selex
  for (iyear=styr; iyear<=endyr_selex_phase1_GR; iyear++)
   {
    sel_HB(iyear)=sel_HB_block1;
    sel_GR(iyear)=sel_GR_block1;
   }
  //BLOCK 2 for selex
  for (iyear=(endyr_selex_phase1_GR+1); iyear<=endyr; iyear++)//iyear<=endyr_selex_phase2_GR; iyear++)
   {
    sel_HB(iyear)=sel_HB_block2;
    sel_GR(iyear)=sel_GR_block2;
   }


FUNCTION get_mortality
  Fsum.initialize();
  Fapex.initialize();
  F.initialize();
  //initialization F is avg from first 3 yrs of observed landings
  log_F_dev_init_comm=sum(log_F_dev_comm(styr_comm_L,(styr_comm_L+2)))/3.0;
  //log_F_dev_init_cL=sum(log_F_dev_cL(styr_cL_L,(styr_cL_L+2)))/3.0;
  log_F_dev_init_GR=sum(log_F_dev_GR(styr_GR_L,(styr_GR_L+2)))/3.0;

  for (iyear=styr; iyear<=endyr; iyear++)
  {
    if(iyear>=styr_comm_L & iyear<=endyr_comm_L) //spans full time series
{F_comm_out(iyear)=mfexp(log_avg_F_comm+log_F_dev_comm(iyear));}
    F_comm(iyear)=sel_comm(iyear)*F_comm_out(iyear);
    Fsum(iyear)+=F_comm_out(iyear);


if(iyear>=styr_GR_L & iyear<=endyr_GR_L) //starts in 1981
{F_GR_out(iyear)=mfexp(log_avg_F_GR+log_F_dev_GR(iyear));}
    if (iyear<styr_GR_L)
{F_GR_out(iyear)=mfexp(log_avg_F_GR+log_F_dev_init_GR);}
F_GR(iyear)=sel_GR(iyear)*F_GR_out(iyear);
    Fsum(iyear)+=F_GR_out(iyear);

    //Total F at age
    F(iyear)=F_comm(iyear);  //first in additive series (NO +=)
    //F(iyear)+=F_cL(iyear);
    // F(iyear)+=F_HB(iyear);
    F(iyear)+=F_GR(iyear);

    Fapex(iyear)=max(F(iyear));
    Z(iyear)=M+F(iyear);

   }  //end iyear

FUNCTION get_bias_corr
  var_rec_dev=norm2(log_rec_dev(styr_rec_dev,endyr_rec_dev)-
             sum(log_rec_dev(styr_rec_dev,endyr_rec_dev))/nyrs_rec)
             /(nyrs_rec-1.0);
  //if (set_BiasCor <= 0.0) {BiasCor=mfexp(var_rec_dev/2.0);}   //bias correction based on empirical residuals
  rec_sigma_sq=square(rec_sigma);
  if (set_BiasCor <= 0.0) {BiasCor=mfexp(rec_sigma_sq/2.0);}   //bias correction based on Rsigma
  else {BiasCor=set_BiasCor;}

FUNCTION get_numbers_at_age
//Initialization
  R0=mfexp(log_R0);
  S0=spr_F0*R0;
  //R_virgin=SR_eq_func(R0, steep, spr_F0, spr_F0, BiasCor, SR_switch);
  R_virgin=BiasCor*R0; //changed to move away from an SR relationship
  B0=bpr_F0*R_virgin;
  B0_q_DD=R_virgin*sum(elem_prod(N_bpr_F0(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));

  // Commented out code block from Erik's ASPM for red snapper
  F_init_denom=mfexp(log_avg_F_comm+log_F_dev_init_comm)+mfexp(log_avg_F_GR+log_F_dev_init_GR); //+mfexp(log_avg_F_cL+log_F_dev_init_cL)
```

```
  F_init_comm_prop= mfexp(log_avg_F_comm+log_F_dev_init_comm)/F_init_denom;
  //F_init_cL_prop= mfexp(log_avg_F_cL+log_F_dev_init_cL)/F_init_denom;
  F_init_GR_prop= mfexp(log_avg_F_GR+log_F_dev_init_GR)/F_init_denom;

  F_initial=sel_comm(styr)*F_init*F_init_comm_prop+
            //sel_cL(styr)*F_init*F_init_cL_prop+
            sel_GR(styr)*F_init*F_init_GR_prop;

//F_initial=sel_initial*F_init;
  Z_initial=M+F_initial;

//Initial equilibrium age structure
  N_spr_initial(1)=1.0*mfexp(-1.0*Z_initial(1)*spawn_time_frac); //at peak spawning time;
  for (iage=2; iage<=nages; iage++)
    {
      N_spr_initial(iage)=N_spr_initial(iage-1)*
                   mfexp(-1.0*(Z_initial(iage-1)*(1.0-spawn_time_frac) + Z_initial(iage)*spawn_time_frac));
    }
  N_spr_initial(nages)=N_spr_initial(nages)/(1.0-mfexp(-1.0*Z_initial(nages))); //plus group
  spr_initial=sum(elem_prod(N_spr_initial,reprod));
  //if (styr==styr_rec_dev) {R1=SR_eq_func(R0, steep, spr_F0, spr_initial, 1.0, SR_switch);} //without bias correction (deviation added later)
  //else {R1=SR_eq_func(R0, steep, spr_F0, spr_initial, BiasCor, SR_switch);} //with bias correction
  if (styr==styr_rec_dev) {R1=R0;} //without bias correction (deviation added later)
  else {R1=BiasCor*R0;} //with bias correction

  if(R1<10.0) {R1=10.0;} //Avoid unrealistically low popn sizes during search algorithm

//Compute equilibrium age structure for first year
  N_initial_eq(1)=R1;
  for (iage=2; iage<=nages; iage++)
  {
    N_initial_eq(iage)=N_initial_eq(iage-1)*
        mfexp(-1.0*(Z_initial(iage-1)));
  }
  //plus group calculation
  N_initial_eq(nages)=N_initial_eq(nages)/(1.0-mfexp(-1.0*Z_initial(nages))); //plus group

//Add deviations to initial equilibrium N
  N(styr)(2,nages)=elem_prod(N_initial_eq(2,nages),mfexp(log_Nage_dev));

  if (styr==styr_rec_dev) {N(styr,1)=N_initial_eq(1)*mfexp(log_rec_dev(styr_rec_dev));}
  else {N(styr,1)=N_initial_eq(1);}

  N_mdyr(styr)(1,nages)=elem_prod(N(styr)(1,nages),(mfexp(-1.*(Z_initial(1,nages))*0.5))); //mid year
  N_spawn(styr)(1,nages)=elem_prod(N(styr)(1,nages),(mfexp(-1.*(Z_initial(1,nages))*spawn_time_frac))); //peak spawning time

  SSB(styr)=sum(elem_prod(N_spawn(styr),reprod));
  SSB_knum(styr)=sum(elem_prod(N_spawn(styr),reprodknum));
  B_q_DD(styr)=sum(elem_prod(N(styr)(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));

//Rest of years
  for (iyear=styr; iyear<endyr; iyear++)
  {
    if(iyear<(styr_rec_dev-1)||iyear>(endyr_rec_dev-1)) //recruitment follows S-R curve (with bias correction) exactly
    {
N(iyear+1,1)=BiasCor*R0; //Changed to use ave rec instead of SR relationship
//N(iyear+1,1)=BiasCor*SR_func(R0, steep, spr_F0, SSB(iyear),SR_switch);
        N(iyear+1)(2,nages)=++elem_prod(N(iyear)(1,nages-1),(mfexp(-1.*Z(iyear)(1,nages-1))));
        N(iyear+1,nages)+=N(iyear,nages)*mfexp(-1.*Z(iyear,nages)); //plus group
        N_mdyr(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*0.5))); //mid year
        N_spawn(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*spawn_time_frac))); //peak spawning time
        SSB(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprod));
SSB_knum(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprodknum));
B_q_DD(iyear+1)=sum(elem_prod(N(iyear+1)(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));
    }
    else   //recruitment follows S-R curve with lognormal deviation
    {
        N(iyear+1,1)=R0*mfexp(log_rec_dev(iyear+1)); //Changed to use ave rec instead of SR relationship
        //N(iyear+1,1)=SR_func(R0, steep, spr_F0, SSB(iyear),SR_switch)*mfexp(log_rec_dev(iyear+1));
        N(iyear+1)(2,nages)=++elem_prod(N(iyear)(1,nages-1),(mfexp(-1.*Z(iyear)(1,nages-1))));
        N(iyear+1,nages)+=N(iyear,nages)*mfexp(-1.*Z(iyear,nages)); //plus group
        N_mdyr(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*0.5))); //mid year
        N_spawn(iyear+1)(1,nages)=elem_prod(N(iyear+1)(1,nages),(mfexp(-1.*(Z(iyear+1)(1,nages))*spawn_time_frac))); //peak spawning time
        SSB(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprod));
SSB_knum(iyear+1)=sum(elem_prod(N_spawn(iyear+1),reprodknum));
        B_q_DD(iyear+1)=sum(elem_prod(N(iyear+1)(set_q_DD_stage,nages),wgt_mt(set_q_DD_stage,nages)));
    }
  }

  //last year (projection) has no recruitment variability
  N(endyr+1,1)=BiasCor*R0; //Changed to use ave rec instead of SR relationship
  //N(endyr+1,1)=BiasCor*SR_func(R0, steep, spr_F0, SSB(endyr),SR_switch);
  N(endyr+1)(2,nages)=++elem_prod(N(endyr)(1,nages-1),(mfexp(-1.*Z(endyr)(1,nages-1))));
  N(endyr+1,nages)+=N(endyr,nages)*mfexp(-1.*Z(endyr,nages)); //plus group


FUNCTION get_landings_numbers //Baranov catch eqn
  for (iyear=styr; iyear<=endyr; iyear++)
  {
    for (iage=1; iage<=nages; iage++)
    {
      L_comm_num(iyear,iage)=N(iyear,iage)*F_comm(iyear,iage)*
        (1.-mfexp(-1.*Z(iyear,iage)))/Z(iyear,iage);
      //L_cL_num(iyear,iage)=N(iyear,iage)*F_cL(iyear,iage)*
        //(1.-mfexp(-1.*Z(iyear,iage)))/Z(iyear,iage);
```

```
      L_GR_num(iyear,iage)=N(iyear,iage)*F_GR(iyear,iage)*
        (1.-mfexp(-1.*Z(iyear,iage)))/Z(iyear,iage);
    }
    pred_comm_L_knum(iyear)=sum(L_comm_num(iyear))/1000.0;
//pred_cL_L_knum(iyear)=sum(L_cL_num(iyear))/1000.0;
    pred_GR_L_knum(iyear)=sum(L_GR_num(iyear))/1000.0;
  }


FUNCTION get_landings_wgt
  for (iyear=styr; iyear<=endyr; iyear++)
  {
    L_comm_klb(iyear)=elem_prod(L_comm_num(iyear),wholewgt_comm_klb(iyear));     //in 1000 lb whole weight
//L_cL_klb(iyear)=elem_prod(L_cL_num(iyear),wholewgt_cL_klb(iyear));     //in 1000 lb whole weight
    // L_HB_klb(iyear)=elem_prod(L_HB_num(iyear),wholewgt_HB_klb(iyear));     //in 1000 lb whole weight
    L_GR_klb(iyear)=elem_prod(L_GR_num(iyear),wholewgt_GR_klb(iyear));     //in 1000 lb whole weight

    pred_comm_L_klb(iyear)=sum(L_comm_klb(iyear));
//pred_cL_L_klb(iyear)=sum(L_cL_klb(iyear));
    // pred_HB_L_klb(iyear)=sum(L_HB_klb(iyear));
    pred_GR_L_klb(iyear)=sum(L_GR_klb(iyear));
  }

FUNCTION get_catchability_fcns
 //Get rate increase if estimated, otherwise fixed above
  if (set_q_rate_phase>0.0)
  {

      for (iyear=styr_HB_cpue; iyear<=endyr_HB_cpue; iyear++)
      {   if (iyear>styr_HB_cpue & iyear <=2003)
          {//q_rate_fcn_HB(iyear)=(1.0+q_rate)*q_rate_fcn_HB(iyear-1); //compound
             q_rate_fcn_HB(iyear)=(1.0+(iyear-styr_HB_cpue)*q_rate)*q_rate_fcn_HB(styr_HB_cpue);  //linear
          }
          if (iyear>2003) {q_rate_fcn_HB(iyear)=q_rate_fcn_HB(iyear-1);}
      }
  } //end q_rate conditional

 //Get density dependence scalar (=1.0 if density independent model is used)
  if (q_DD_beta>0.0)
  {
    B_q_DD+=dzero;
    for (iyear=styr;iyear<=endyr;iyear++)
        {q_DD_fcn(iyear)=pow(B0_q_DD,q_DD_beta)*pow(B_q_DD(iyear),-q_DD_beta);}
          //{q_DD_fcn(iyear)=1.0+4.0/(1.0+mfexp(0.75*(B_q_DD(iyear)-0.1*B0_q_DD))); }
  }


FUNCTION get_indices
//---Predicted CPUEs------------------------

 //HB  cpue
  q_HB(styr_HB_cpue)=mfexp(log_q_HB);
  for (iyear=styr_HB_cpue; iyear<=endyr_HB_cpue; iyear++)
  {
      N_HB(iyear)=elem_prod(N_mdyr(iyear),sel_HB(iyear));
      pred_HB_cpue(iyear)=q_HB(iyear)*q_rate_fcn_HB(iyear)*q_DD_fcn(iyear)*sum(N_HB(iyear));
      if (iyear<endyr_HB_cpue){q_HB(iyear+1)=q_HB(iyear)*mfexp(q_RW_log_dev_HB(iyear));}
  }

FUNCTION get_length_comps

  //comm lines

  for (iyear=1;iyear<=nyr_comm_lenc_pool;iyear++)
   {pred_comm_lenc_yr(iyear)=(L_comm_num(yrs_comm_lenc_pool(iyear))*lenprob_comm)/sum(L_comm_num(yrs_comm_lenc_pool(iyear)));}

  pred_comm_lenc.initialize();
  for (iyear=1;iyear<=nyr_comm_lenc_pool;iyear++)
    {pred_comm_lenc(1) += nfish_comm_lenc_pool(iyear) * pred_comm_lenc_yr(iyear);}
  pred_comm_lenc(1)=pred_comm_lenc(1)/sum(nfish_comm_lenc_pool);

  ////comm longline
  //for (iyear=1;iyear<=nyr_cL_lenc;iyear++)
  //{pred_cL_lenc(iyear)=(L_cL_num(yrs_cL_lenc(iyear))*lenprob_cL)/sum(L_cL_num(yrs_cL_lenc(iyear)));}

  //general rec
  //for (iyear=1;iyear<=nyr_GR_lenc;iyear++)
  //{pred_GR_lenc(iyear)=(L_GR_num(yrs_GR_lenc(iyear))*lenprob_GR)/sum(L_GR_num(yrs_GR_lenc(iyear)));}

FUNCTION get_age_comps

  //Recreational
  for (iyear=1;iyear<=nyr_GR_agec;iyear++)
  {
    ErrorFree_GR_agec(iyear)=L_GR_num(yrs_GR_agec(iyear))/sum(L_GR_num(yrs_GR_agec(iyear)));
    pred_GR_agec_allages(iyear)=age_error*ErrorFree_GR_agec(iyear);
    for (iage=1; iage<=nages_agec; iage++) {pred_GR_agec(iyear,iage)=pred_GR_agec_allages(iyear,iage);}
    //for (iage=(nages_agec+1); iage<=nages; iage++) {pred_GR_agec(iyear,nages_agec)+=pred_GR_agec_allages(iyear,iage);} //plus group
  }

////-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_weighted_current
  F_temp_sum=0.0;
  F_temp_sum+=mfexp((selpar_n_yrs_wgted*log_avg_F_comm+
        sum(log_F_dev_comm((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted);
```

```
  F_temp_sum+=mfexp((selpar_n_yrs_wgted*log_avg_F_GR+
        sum(log_F_dev_GR((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted);

  F_comm_prop=mfexp((selpar_n_yrs_wgted*log_avg_F_comm+
        sum(log_F_dev_comm((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted)/F_temp_sum;

  F_GR_prop=mfexp((selpar_n_yrs_wgted*log_avg_F_GR+
        sum(log_F_dev_GR((endyr-selpar_n_yrs_wgted+1),endyr)))/selpar_n_yrs_wgted)/F_temp_sum;

  log_F_dev_end_comm=sum(log_F_dev_comm((endyr-selpar_n_yrs_wgted+1),endyr))/selpar_n_yrs_wgted;
  //log_F_dev_end_cL=sum(log_F_dev_cL((endyr-selpar_n_yrs_wgted+1),endyr))/selpar_n_yrs_wgted;
  log_F_dev_end_GR=sum(log_F_dev_GR((endyr-selpar_n_yrs_wgted+1),endyr))/selpar_n_yrs_wgted;

  F_end_L=sel_comm(endyr)*mfexp(log_avg_F_comm+log_F_dev_end_comm)+
          //sel_cL(endyr)*mfexp(log_avg_F_cL+log_F_dev_end_cL)+
  sel_GR(endyr)*mfexp(log_avg_F_GR+log_F_dev_end_GR);

  F_end=F_end_L;
  F_end_apex=max(F_end);

  sel_wgted_tot=F_end/F_end_apex;
  sel_wgted_L=elem_prod(sel_wgted_tot, elem_div(F_end_L,F_end));

  wgt_wgted_L_denom=F_comm_prop+F_GR_prop;  //+F_HB_prop+F_cL_prop
  wgt_wgted_L_klb=F_comm_prop/wgt_wgted_L_denom*wholewgt_comm_klb(endyr)+
  //F_cL_prop/wgt_wgted_L_denom*wholewgt_cL_klb(endyr)+
  F_GR_prop/wgt_wgted_L_denom*wholewgt_GR_klb(endyr);

FUNCTION get_msy

  //compute values as functions of F
  for(ff=1; ff<=n_iter_msy; ff++)
  {
    //uses fishery-weighted F's
    Z_age_msy=0.0;
    F_L_age_msy=0.0;

    F_L_age_msy=F_msy(ff)*sel_wgted_L;
    Z_age_msy=M+F_L_age_msy;

    N_age_msy(1)=1.0;
    for (iage=2; iage<=nages; iage++)
      {N_age_msy(iage)=N_age_msy(iage-1)*mfexp(-1.*Z_age_msy(iage-1));}
    N_age_msy(nages)=N_age_msy(nages)/(1.0-mfexp(-1.*Z_age_msy(nages)));
    N_age_msy_spawn(1,(nages-1))=elem_prod(N_age_msy(1,(nages-1)),
                              mfexp((-1.*Z_age_msy(1,(nages-1)))*spawn_time_frac));
    N_age_msy_spawn(nages)=(N_age_msy_spawn(nages-1)*(mfexp(-1.*(Z_age_msy(nages-1)*(1.0-spawn_time_frac) +
                          Z_age_msy(nages)*spawn_time_frac) )))/(1.0-mfexp(-1.*Z_age_msy(nages)));

    spr_msy(ff)=sum(elem_prod(N_age_msy_spawn,reprod));

    //R_eq(ff)=SR_eq_func(R0, steep, spr_msy(1), spr_msy(ff), BiasCor, SR_switch);
    R_eq(ff)=BiasCor*R0;

    if (R_eq(ff)<dzero) {R_eq(ff)=dzero;}
    N_age_msy*=R_eq(ff);
    N_age_msy_spawn*=R_eq(ff);

    for (iage=1; iage<=nages; iage++)
    {
      L_age_msy(iage)=N_age_msy(iage)*(F_L_age_msy(iage)/Z_age_msy(iage))*
                      (1.-mfexp(-1.*Z_age_msy(iage)));
    }

    SSB_eq(ff)=sum(elem_prod(N_age_msy_spawn,reprod));
SSB_eq_knum(ff)=sum(elem_prod(N_age_msy_spawn,reprodknum));
B_eq(ff)=sum(elem_prod(N_age_msy,wgt_mt));
    L_eq_klb(ff)=sum(elem_prod(L_age_msy,wgt_wgted_L_klb)); //in whole weight
    L_eq_knum(ff)=sum(L_age_msy)/1000.0;
  }

  msy_klb_out=max(L_eq_klb); //msy in whole weight

  for(ff=1; ff<=n_iter_msy; ff++)
  {
   if(L_eq_klb(ff) == msy_klb_out)
      {
        SSB_msy_out=SSB_eq(ff);
        B_msy_out=B_eq(ff);
        R_msy_out=R_eq(ff);
        msy_knum_out=L_eq_knum(ff);
        F_msy_out=F_msy(ff);
        spr_msy_out=spr_msy(ff);
      }
  }

//--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_per_recruit_stuff

  //static per-recruit stuff

  for(iyear=styr; iyear<=endyr; iyear++)
  {
    N_age_spr(1)=1.0;
```

```
    for(iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z(iyear,iage-1));}
    N_age_spr(nages)=N_age_spr(nages)/(1.0-mfexp(-1.*Z(iyear,nages)));
    N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                mfexp(-1.*Z(iyear)(1,(nages-1))*spawn_time_frac));
    N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                          (mfexp(-1.*(Z(iyear)(nages-1)*(1.0-spawn_time_frac) + Z(iyear)(nages)*spawn_time_frac) )))
                          /(1.0-mfexp(-1.*Z(iyear)(nages)));
    spr_static(iyear)=sum(elem_prod(N_age_spr_spawn,reprod))/spr_F0;
  }

  //compute SSB/R and YPR as functions of F
  for(ff=1; ff<=n_iter_spr; ff++)
  {
    //uses fishery-weighted F's, same as in MSY calculations
    Z_age_spr=0.0;
    F_L_age_spr=0.0;

    F_L_age_spr=F_spr(ff)*sel_wgted_L;
    Z_age_spr=M+F_L_age_spr;

    N_age_spr(1)=1.0;
    for (iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z_age_spr(iage-1));}
    N_age_spr(nages)=N_age_spr(nages)/(1-mfexp(-1.*Z_age_spr(nages)));
    N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                   mfexp((-1.*Z_age_spr(1,(nages-1)))*spawn_time_frac));
    N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                          (mfexp(-1.*(Z_age_spr(nages-1)*(1.0-spawn_time_frac) + Z_age_spr(nages)*spawn_time_frac) )))
                          /(1.0-mfexp(-1.*Z_age_spr(nages)));
    spr_spr(ff)=sum(elem_prod(N_age_spr_spawn,reprod));
    L_spr(ff)=0.0;
    for (iage=1; iage<=nages; iage++)
    {
      L_age_spr(iage)=N_age_spr(iage)*(F_L_age_spr(iage)/Z_age_spr(iage))*
                      (1.-mfexp(-1.*Z_age_spr(iage)));
      L_spr(ff)+=L_age_spr(iage)*wgt_wgted_L_klb(iage)*1000.0; //in lb whole wgt
    }
  }
  spr_ratio=spr_spr/spr_F0;
  F20_dum=min(fabs(spr_ratio-0.2));
  F30_dum=min(fabs(spr_ratio-0.3));
  F40_dum=min(fabs(spr_ratio-0.4));
  for(ff=1; ff<=n_iter_spr; ff++)
  {
      if (fabs(spr_ratio(ff)-0.2)==F20_dum) {F20_out=F_spr(ff);}
  if (fabs(spr_ratio(ff)-0.3)==F30_dum) {F30_out=F_spr(ff);}
  if (fabs(spr_ratio(ff)-0.4)==F40_dum) {F40_out=F_spr(ff);}
  }
  rec=column(N,1);
  rec_mean=sum(rec(styr_rec_spr, endyr_rec_spr))/nyrs_rec_spr;
  R_F30_out=rec_mean;
  F_L_age_spr=F30_out*sel_wgted_L;
  Z_age_spr=M+F_L_age_spr;

  N_age_spr(1)=R_F30_out;
  for (iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z_age_spr(iage-1));}
  N_age_spr(nages)=N_age_spr(nages)/(1-mfexp(-1.*Z_age_spr(nages)));
  N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                   mfexp((-1.*Z_age_spr(1,(nages-1)))*spawn_time_frac));
  N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                          (mfexp(-1.*(Z_age_spr(nages-1)*(1.0-spawn_time_frac) + Z_age_spr(nages)*spawn_time_frac) )))
                          /(1.0-mfexp(-1.*Z_age_spr(nages)));

  for (iage=1; iage<=nages; iage++)
    {
      L_age_F30(iage)=N_age_spr(iage)*(F_L_age_spr(iage)/Z_age_spr(iage))*
                      (1.-mfexp(-1.*Z_age_spr(iage)));
    }
  SSB_F30_out=sum(elem_prod(N_age_spr_spawn,reprod));
  SSB_F30_knum_out=sum(elem_prod(N_age_spr_spawn,reprodknum));
  B_F30_out=sum(elem_prod(N_age_spr,wgt_mt));
  L_F30_klb_out=sum(elem_prod(L_age_F30,wgt_wgted_L_klb)); //in whole weight
  L_F30_knum_out=sum(L_age_F30)/1000.0;


 //F40 calcs
  rec=column(N,1);
  rec_mean=sum(rec(styr_rec_spr, endyr_rec_spr))/nyrs_rec_spr;
  R_F40_out=rec_mean;
  F_L_age_spr=F40_out*sel_wgted_L;
  Z_age_spr=M+F_L_age_spr;

  N_age_spr(1)=R_F40_out;
  for (iage=2; iage<=nages; iage++)
     {N_age_spr(iage)=N_age_spr(iage-1)*mfexp(-1.*Z_age_spr(iage-1));}
  N_age_spr(nages)=N_age_spr(nages)/(1-mfexp(-1.*Z_age_spr(nages)));
  N_age_spr_spawn(1,(nages-1))=elem_prod(N_age_spr(1,(nages-1)),
                                   mfexp((-1.*Z_age_spr(1,(nages-1)))*spawn_time_frac));
  N_age_spr_spawn(nages)=(N_age_spr_spawn(nages-1)*
                          (mfexp(-1.*(Z_age_spr(nages-1)*(1.0-spawn_time_frac) + Z_age_spr(nages)*spawn_time_frac) )))
                          /(1.0-mfexp(-1.*Z_age_spr(nages)));

  for (iage=1; iage<=nages; iage++)
```

```
    {
      L_age_F40(iage)=N_age_spr(iage)*(F_L_age_spr(iage)/Z_age_spr(iage))*
                    (1.-mfexp(-1.*Z_age_spr(iage)));
    }
  SSB_F40_out=sum(elem_prod(N_age_spr_spawn,reprod));
  SSB_F40_knum_out=sum(elem_prod(N_age_spr_spawn,reprodknum));
  B_F40_out=sum(elem_prod(N_age_spr,wgt_mt));
  L_F40_klb_out=sum(elem_prod(L_age_F40,wgt_wgted_L_klb)); //in whole weight
  L_F40_knum_out=sum(L_age_F40)/1000.0;


//-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_miscellaneous_stuff

//switch here if var_rec_dev <=dzero
  if(var_rec_dev>0.0)
   {sigma_rec_dev=sqrt(var_rec_dev);} //sample SD of predicted residuals (may not equal rec_sigma)
   else{sigma_rec_dev=0.0;}

  len_cv=elem_div(len_sd,meanlen_TL);
  len_cv_L=elem_div(len_sd_L,meanlen_TL_L);
  len_cv_F=elem_div(len_sd_F,meanlen_TL_F);

  //compute total landings- and discards-at-age in 1000 fish and klb whole weight
  L_total_num.initialize();
  L_total_klb.initialize();
  L_total_knum_yr.initialize();
  L_total_klb_yr.initialize();

  for(iyear=styr; iyear<=endyr; iyear++)
  {
        L_total_klb_yr(iyear)=pred_comm_L_klb(iyear)+pred_GR_L_klb(iyear);//+pred_HB_L_klb(iyear)+pred_cL_L_klb(iyear)
        L_total_knum_yr(iyear)=pred_comm_L_knum(iyear)+pred_GR_L_knum(iyear);//+pred_HB_L_knum(iyear)+pred_cL_L_knum(iyear)

        B(iyear)=elem_prod(N(iyear),wgt_mt);
        totN(iyear)=sum(N(iyear));
        totB(iyear)=sum(B(iyear));
  }

  L_total_num=L_comm_num+L_GR_num;//+L_HB_num+L_cL_num   //landings at age in number fish
  L_total_klb=L_comm_klb+L_GR_klb;//+L_HB_klb+L_cL_klb   //landings at age in klb whole weight

  //Time series of interest
  B(endyr+1)=elem_prod(N(endyr+1),wgt_mt);
  totN(endyr+1)=sum(N(endyr+1));
  totB(endyr+1)=sum(B(endyr+1));
  SdS0=SSB/S0;

  Fend_mean_temp=1.0;
  for (iyear=1; iyear<=selpar_n_yrs_wgted; iyear++) {Fend_mean_temp*=Fapex(endyr-iyear+1);}
  Fend_mean=pow(Fend_mean_temp,(1.0/selpar_n_yrs_wgted));
  if(F_msy_out>0)
    {
      FdF_msy=Fapex/F_msy_out;
      FdF_msy_end=FdF_msy(endyr);
      FdF_msy_end_mean=Fend_mean/F_msy_out;
    }
  if(SSB_msy_out>0)
    {
      SdSSB_msy=SSB/SSB_msy_out;
      SdSSB_msy_end=SdSSB_msy(endyr);
    }

if(F30_out>0)
    {
  FdF30=Fapex/F30_out;
  FdF30_end_mean=Fend_mean/F30_out;
}
  if(SSB_F30_out>0)
    {
      SdSSB_F30=SSB/SSB_F30_out;
  Sdmsst_F30=SSB/(smsy2msst75*SSB_F30_out);
      SdSSB_F30_end=SdSSB_F30(endyr);
  Sdmsst_F30_end=Sdmsst_F30(endyr);
    }

if(F40_out>0)
    {
  FdF40=Fapex/F40_out;
  FdF40_end_mean=Fend_mean/F40_out;
}
  if(SSB_F40_out>0)
    {
      SdSSB_F40=SSB/SSB_F40_out;
  Sdmsst_F40=SSB/(smsy2msst75*SSB_F40_out);
      SdSSB_F40_end=SdSSB_F40(endyr);
  Sdmsst_F40_end=Sdmsst_F40(endyr);
    }
   //fill in log recruitment deviations for yrs they are nonzero
   for(iyear=styr_rec_dev; iyear<=endyr_rec_dev; iyear++)
     {log_rec_dev_output(iyear)=log_rec_dev(iyear);}
   //fill in log Nage deviations for ages they are nonzero (ages2+)
   for(iage=2; iage<=nages; iage++)
     {log_Nage_dev_output(iage)=log_Nage_dev(iage);}
```

```
//-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
FUNCTION get_projection

    switch(Fproj_switch){
       case 1: //F=Fcurrent
          F_reg_proj=Fend_mean;
          break;
       case 2: //F=Fmsy
          F_reg_proj=F_msy_out;
          break;
       case 3: //F=F30
          F_reg_proj=F30_out;
          break;
       case 4: //F=F40
          F_reg_proj=F40_out;
          break;
       default: // no such switch available
          cout << "Error in input: Projection switch Fproj_switch must be set to 1, 2, 3, or 4." << endl;
          cout << "Presently it is set to " << Fproj_switch <<"."<< endl;
          exit(0);
   }

  N_proj(styr_proj)=N(endyr+1); //initial conditions computed previously

  for (iyear=styr_proj; iyear<=endyr_proj; iyear++) //recruitment follows S-R curve (with bias correction) exactly
  {
        if (iyear<styr_regs) {F_proj(iyear)=Fend_mean;}
else {F_proj(iyear)=Fproj_mult*F_reg_proj;}

FL_age_proj=sel_wgted_L*F_proj(iyear);

        Z_proj(iyear)=M+FL_age_proj;//+FD_age_proj;
        N_spawn_proj(iyear)(1,nages)=elem_prod(N_proj(iyear)(1,nages),(mfexp(-1.*(Z_proj(iyear)(1,nages))*spawn_time_frac))); //peak spawning time
SSB_proj(iyear)= sum(elem_prod(N_spawn_proj(iyear),reprod));
        B_proj(iyear)=sum(elem_prod(N_proj(iyear),wgt_mt)); //uses spawning weight

for (iage=1; iage<=nages; iage++)
{L_age_proj(iyear,iage)=N_proj(iyear,iage)*FL_age_proj(iage)*(1.-mfexp(-1.*Z_proj(iyear,iage)))/Z_proj(iyear,iage);
}
        L_knum_proj(iyear)=sum(L_age_proj(iyear))/1000.0;
    L_klb_proj(iyear)=sum(elem_prod(L_age_proj(iyear),wgt_wgted_L_klb));     //in 1000 lb

if (iyear<endyr_proj) {
N_proj(iyear+1,1)=BiasCor*R0; //Changed to move away from an SR relationship
//N_proj(iyear+1,1)=BiasCor*SR_func(R0, steep, spr_F0, SSB_proj(iyear),SR_switch);
N_proj(iyear+1)(2,nages)=++elem_prod(N_proj(iyear)(1,nages-1),(mfexp(-1.*Z_proj(iyear)(1,nages-1))));
N_proj(iyear+1,nages)+=N_proj(iyear,nages)*mfexp(-1.*Z_proj(iyear,nages)); //plus group
}
  }
   R_proj=column(N_proj,1);
//-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------


FUNCTION evaluate_objective_function
  //fval=square(xdum-9.0);

  fval=0.0;
  fval_data=0.0;
//---likelihoods---------------------------

//---Indices-------------------------------

  f_HB_cpue=0.0;
  f_HB_cpue=lk_lognormal(pred_HB_cpue, obs_HB_cpue, HB_cpue_cv, w_I_HB);
  fval+=f_HB_cpue;
  fval_data+=f_HB_cpue;

//---Landings-------------------------------

  //f_comm_L in 1000 lb whole wgt
  f_comm_L=lk_lognormal(pred_comm_L_klb(styr_comm_L,endyr_comm_L), obs_comm_L(styr_comm_L,endyr_comm_L),
                    comm_L_cv(styr_comm_L,endyr_comm_L), w_L);
  fval+=f_comm_L;
  fval_data+=f_comm_L;

  //f_GR_L in 1000 fish
  f_GR_L=lk_lognormal(pred_GR_L_knum(styr_GR_L,endyr_GR_L), obs_GR_L(styr_GR_L,endyr_GR_L),
                    GR_L_cv(styr_GR_L,endyr_GR_L), w_L);
  fval+=f_GR_L;
  fval_data+=f_GR_L;

//---Length comps-------------------------------

  //f_comm_lenc
  //f_comm_lenc=lk_robust_multinomial(nsamp_comm_lenc, pred_comm_lenc, obs_comm_lenc, nyr_comm_lenc, double(nlenbins), minSS_comm_lenc, w_lc_comm);
  //f_comm_lenc=lk_logistic_normal(nsamp_comm_lenc, pred_comm_lenc, obs_comm_lenc, nyr_comm_lenc, double(nlenbins), minSS_comm_lenc);
  f_comm_lenc=lk_dirichlet_multinomial(nsamp_comm_lenc, pred_comm_lenc, obs_comm_lenc, nyr_comm_lenc, double(nlenbins), minSS_comm_lenc, log_dm_comm_lc);
  fval+=f_comm_lenc;
  fval_data+=f_comm_lenc;


//---Age comps-------------------------------

//f_GR_agec
  //f_GR_agec=lk_robust_multinomial(nsamp_GR_agec, pred_GR_agec, obs_GR_agec, nyr_GR_agec, double(nages_agec), minSS_GR_agec, w_ac_GR);
```

```
  //f_GR_agec=lk_logistic_normal(nsamp_GR_agec, pred_GR_agec, obs_GR_agec, nyr_GR_agec, double(nages_agec), minSS_GR_agec);
  f_GR_agec=lk_dirichlet_multinomial(nsamp_GR_agec, pred_GR_agec, obs_GR_agec, nyr_GR_agec, double(nages_agec), minSS_GR_agec, log_dm_GR_ac);
  fval+=f_GR_agec;
  fval_data+=f_GR_agec;
//-----------Constraints and penalties--------------------------------

  //Light penalty applied to log_Nage_dev for deviation from zero. If not estimated, this penalty equals zero.
  f_Nage_init=norm2(log_Nage_dev);
  fval+=w_Nage_init*f_Nage_init;

  f_rec_dev=0.0;
  //rec_sigma_sq=square(rec_sigma);
  rec_logL_add=nyrs_rec*log(rec_sigma);
  f_rec_dev=(square(log_rec_dev(styr_rec_dev) + rec_sigma_sq/2.0)/(2.0*rec_sigma_sq));
  for(iyear=(styr_rec_dev+1); iyear<=endyr_rec_dev; iyear++)
  {f_rec_dev+=(square(log_rec_dev(iyear)-R_autocorr*log_rec_dev(iyear-1) + rec_sigma_sq/2.0)/
               (2.0*rec_sigma_sq));}
  f_rec_dev+=rec_logL_add;
  fval+=w_rec*f_rec_dev;

  f_rec_dev_early=0.0; //possible extra constraint on early rec deviations
  if (w_rec_early>0.0)
    { if (styr_rec_dev<endyr_rec_phase1)
        {
          for(iyear=styr_rec_dev; iyear<=endyr_rec_phase1; iyear++)
          //{f_rec_dev_early+=(square(log_rec_dev(iyear)-R_autocorr*log_rec_dev(iyear-1) + rec_sigma_sq/2.0)/
          //                   (2.0*rec_sigma_sq)) + rec_logL_add;}
          {f_rec_dev_early+=square(log_rec_dev(iyear));}
        }
  fval+=w_rec_early*f_rec_dev_early;
  }

  f_rec_dev_end=0.0; //possible extra constraint on ending rec deviations
  if (w_rec_end>0.0)
  { if (endyr_rec_phase2<endyr_rec_dev)
        {
          for(iyear=(endyr_rec_phase2+1); iyear<=endyr_rec_dev; iyear++)
          //{f_rec_dev_end+=(square(log_rec_dev(iyear)-R_autocorr*log_rec_dev(iyear-1) + rec_sigma_sq/2.0)/
          //                 (2.0*rec_sigma_sq)) + rec_logL_add;}
          {f_rec_dev_end+=square(log_rec_dev(iyear));}
        }
      fval+=w_rec_end*f_rec_dev_end;
   }

  //Ftune penalty: does not apply in last phase
  f_Ftune=0.0;
  if (w_Ftune>0.0)
  {if (set_Ftune>0.0 && !last_phase()) {f_Ftune=square(Fapex(set_Ftune_yr)-set_Ftune);}
   fval+=w_Ftune*f_Ftune;
  }

  //Penalty if apical F exceeds 3.0
  f_fullF_constraint=0.0;
  if (w_fullF>0.0)
  {for (iyear=styr; iyear<=endyr; iyear++)
        {if(Fapex(iyear)>3.0) {f_fullF_constraint+=(mfexp(Fapex(iyear)-3.0)-1.0);}}
   fval+=w_fullF*f_fullF_constraint;
  }

 //Random walk components of fishery dependent indices
 //f_comm_RWq_cpue=0.0;
 //for (iyear=styr_comm_cpue; iyear<endyr_comm_cpue; iyear++)
 //    {f_comm_RWq_cpue+=square(q_RW_log_dev_comm(iyear))/(2.0*set_RWq_var);}
 //fval+=f_comm_RWq_cpue;
 //
 //f_cL_RWq_cpue=0.0;
 //for (iyear=styr_cL_cpue; iyear<endyr_cL_cpue; iyear++)
 //    {f_cL_RWq_cpue+=square(q_RW_log_dev_cL(iyear))/(2.0*set_RWq_var);}
 //fval+=f_cL_RWq_cpue;
 //
 f_HB_RWq_cpue=0.0;
 for (iyear=styr_HB_cpue; iyear<endyr_HB_cpue; iyear++)
     {f_HB_RWq_cpue+=square(q_RW_log_dev_HB(iyear))/(2.0*set_RWq_var);}
 fval+=f_HB_RWq_cpue;

//---Priors---------------------------------------------------
//neg_log_prior arguments: estimate, prior mean, prior var/-CV, pdf type
//Variance input as a negative value is considered to be CV in arithmetic space (CV=-1 implies loose prior)
//pdf type 1=none, 2=lognormal, 3=normal, 4=beta
  f_priors=0.0;
  f_priors+=neg_log_prior(len_cv_val,set_len_cv(5),set_len_cv(6),set_len_cv(7));

  f_priors+=neg_log_prior(steep,set_steep(5),set_steep(6),set_steep(7));
  f_priors+=neg_log_prior(log_R0,set_log_R0(5),set_log_R0(6),set_log_R0(7));
  f_priors+=neg_log_prior(R_autocorr,set_R_autocorr(5),set_R_autocorr(6),set_R_autocorr(7));
  f_priors+=neg_log_prior(rec_sigma,set_rec_sigma(5),set_rec_sigma(6),set_rec_sigma(7));

  f_priors+=neg_log_prior(selpar_A50_comm1,set_selpar_A50_comm1(5), set_selpar_A50_comm1(6), set_selpar_A50_comm1(7));
  f_priors+=neg_log_prior(selpar_slope_comm1,set_selpar_slope_comm1(5), set_selpar_slope_comm1(6), set_selpar_slope_comm1(7));
  //f_priors+=neg_log_prior(selpar_A50_comm2,set_selpar_A50_comm2(5), set_selpar_A50_comm2(6), set_selpar_A50_comm2(7));
  //f_priors+=neg_log_prior(selpar_slope_comm2,set_selpar_slope_comm2(5), set_selpar_slope_comm2(6), set_selpar_slope_comm2(7));
  // f_priors+=neg_log_prior(selpar_A502_comm2,set_selpar_A502_comm2(5), set_selpar_A502_comm2(6), set_selpar_A502_comm2(7));
  // f_priors+=neg_log_prior(selpar_slope2_comm2,set_selpar_slope2_comm2(5), set_selpar_slope2_comm2(6), set_selpar_slope2_comm2(7));
  //f_priors+=neg_log_prior(selpar_A50_comm3,set_selpar_A50_comm3(5), set_selpar_A50_comm3(6), set_selpar_A50_comm3(7));
  //f_priors+=neg_log_prior(selpar_slope_comm3,set_selpar_slope_comm3(5), set_selpar_slope_comm3(6), set_selpar_slope_comm3(7));
```

```
  f_priors+=neg_log_prior(selpar_A50_GR1,set_selpar_A50_GR1(5), set_selpar_A50_GR1(6), set_selpar_A50_GR1(7));
  f_priors+=neg_log_prior(selpar_slope_GR1,set_selpar_slope_GR1(5), set_selpar_slope_GR1(6), set_selpar_slope_GR1(7));
  f_priors+=neg_log_prior(selpar_A50_GR2,set_selpar_A50_GR2(5), set_selpar_A50_GR2(6), set_selpar_A50_GR2(7));
  f_priors+=neg_log_prior(selpar_slope_GR2,set_selpar_slope_GR2(5), set_selpar_slope_GR2(6), set_selpar_slope_GR2(7));

   f_priors+=neg_log_prior(log_q_HB,set_log_q_HB(5),set_log_q_HB(6),set_log_q_HB(7));

  f_priors+=neg_log_prior(log_dm_comm_lc,set_log_dm_comm_lc(5),set_log_dm_comm_lc(6),set_log_dm_comm_lc(7));
  //f_priors+=neg_log_prior(log_dm_cL_lc,set_log_dm_cL_lc(5),set_log_dm_cL_lc(6),set_log_dm_cL_lc(7));
  f_priors+=neg_log_prior(log_dm_GR_ac,set_log_dm_GR_ac(5),set_log_dm_GR_ac(6),set_log_dm_GR_ac(7));
  //f_priors+=neg_log_prior(log_dm_GR_lc,set_log_dm_GR_lc(5),set_log_dm_GR_lc(6),set_log_dm_GR_lc(7));

  f_priors+=neg_log_prior(F_init,set_F_init(5),set_F_init(6),set_F_init(7));

  fval+=f_priors;

//---------------------------------------------------------------------------------
//Logistic function: 2 parameters
FUNCTION dvar_vector logistic(const dvar_vector& ages, const dvariable& A50, const dvariable& slope)
  //ages=vector of ages, A50=age at 50% selectivity, slope=rate of increase
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=1./(1.+mfexp(-1.*slope*(ages-A50))); //logistic;
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Logistic-exponential: 4 parameters (but 1 is fixed)
FUNCTION dvar_vector logistic_exponential(const dvar_vector& ages, const dvariable& A50, const dvariable& slope, const dvariable& sigma, const dvariable& joint)
  //ages=vector of ages, A50=age at 50% sel (ascending limb), slope=rate of increase, sigma=controls rate of descent (descending)
  //joint=age to join curves
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=1.0;
  for (iage=1; iage<=nages; iage++)
  {
   if (ages(iage)<joint) {Sel_Tmp(iage)=1./(1.+mfexp(-1.*slope*(ages(iage)-A50)));}
   if (ages(iage)>joint){Sel_Tmp(iage)=mfexp(-1.*square((ages(iage)-joint)/sigma));}
  }
  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Logistic function: 4 parameters
FUNCTION dvar_vector logistic_double(const dvar_vector& ages, const dvariable& A501, const dvariable& slope1, const dvariable& A502, const dvariable& slope2)
  //ages=vector of ages, A50=age at 50% selectivity, slope=rate of increase, A502=age at 50% decrease additive to A501, slope2=slope of decrease
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=elem_prod( (1./(1.+mfexp(-1.*slope1*(ages-A501)))),(1.-(1./(1.+mfexp(-1.*slope2*(ages-(A501+A502)))))) );
  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Jointed logistic function: 6 parameters (increasing and decreasing logistics joined at peak selectivity)
FUNCTION dvar_vector logistic_joint(const dvar_vector& ages, const dvariable& A501, const dvariable& slope1, const dvariable& A502, const dvariable& slope2, const dvariable& satval, const dvariable& joint)
  //ages=vector of ages, A501=age at 50% sel (ascending limb), slope1=rate of increase,A502=age at 50% sel (descending), slope1=rate of increase (ascending),
  //satval=saturation value of descending limb, joint=location in age vector to join curves (may equal age or age + 1 if age-0 is included)
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  Sel_Tmp=1.0;
  for (iage=1; iage<=nages; iage++)
  {
   if (double(iage)<joint) {Sel_Tmp(iage)=1./(1.+mfexp(-1.*slope1*(ages(iage)-A501)));}
   if (double(iage)>joint){Sel_Tmp(iage)=1.0-(1.0-satval)/(1.+mfexp(-1.*slope2*(ages(iage)-A502)));}
  }
  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Double Gaussian function: 6 parameters (as in SS3)
FUNCTION dvar_vector gaussian_double(const dvar_vector& ages, const dvariable& peak, const dvariable& top, const dvariable& ascwid, const dvariable& deswid, const dvariable& init, const dvariable& final)
  //ages=vector of ages, peak=ascending inflection location (as logistic), top=width of plateau, ascwid=ascent width (as log(width))
  //deswid=descent width (as log(width))
  RETURN_ARRAYS_INCREMENT();
  dvar_vector Sel_Tmp(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step1(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step2(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step3(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step4(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step5(ages.indexmin(),ages.indexmax());
  dvar_vector sel_step6(ages.indexmin(),ages.indexmax());
  dvar_vector pars_tmp(1,6); dvar_vector sel_tmp_iq(1,2);

  pars_tmp(1)=peak;
  pars_tmp(2)=peak+1.0+(0.99*ages(nages)-peak-1.0)/(1.0+mfexp(-top));
  pars_tmp(3)=mfexp(ascwid);
  pars_tmp(4)=mfexp(deswid);
  pars_tmp(5)=1.0/(1.0+mfexp(-init));
  pars_tmp(6)=1.0/(1.0+mfexp(-final));
```

```
  sel_tmp_iq(1)=mfexp(-(square(ages(1)-pars_tmp(1))/pars_tmp(3)));
  sel_tmp_iq(2)=mfexp(-(square(ages(nages)-pars_tmp(2))/pars_tmp(4)));

  sel_step1=mfexp(-(square(ages-pars_tmp(1))/pars_tmp(3)));
  sel_step2=pars_tmp(5)+(1.0-pars_tmp(5))*(sel_step1-sel_tmp_iq(1))/(1.0-sel_tmp_iq(1));
  sel_step3=mfexp(-(square(ages-pars_tmp(2))/pars_tmp(4)));
  sel_step4=1.0+(pars_tmp(6)-1.0)*(sel_step3-1.0)/(sel_tmp_iq(2)-1.0);
  sel_step5=1.0/ (1.0+mfexp(-(20.0* elem_div((ages-pars_tmp(1)), (1.0+sfabs(ages-pars_tmp(1)))) )));
  sel_step6=1.0/(1.0+mfexp(-(20.0*elem_div((ages-pars_tmp(2)),(1.0+sfabs(ages-pars_tmp(2)))) )));

  Sel_Tmp=elem_prod(sel_step2,(1.0-sel_step5))+
          elem_prod(sel_step5,((1.0-sel_step6)+ elem_prod(sel_step4,sel_step6)) );

  Sel_Tmp=Sel_Tmp/max(Sel_Tmp);
  RETURN_ARRAYS_DECREMENT();
  return Sel_Tmp;

//-----------------------------------------------------------------------------------
//Spawner-recruit function (Beverton-Holt or Ricker)
FUNCTION dvariable SR_func(const dvariable& R0, const dvariable& h, const dvariable& spr_F0, const dvariable& SSB, int func)
  //R0=virgin recruitment, h=steepness, spr_F0=spawners per recruit @ F=0, SSB=spawning biomass
  //func=1 for Beverton-Holt, 2 for Ricker
  RETURN_ARRAYS_INCREMENT();
  dvariable Recruits_Tmp;
  switch(func) {
    case 1: //Beverton-Holt
      Recruits_Tmp=((0.8*R0*h*SSB)/(0.2*R0*spr_F0*(1.0-h)+(h-0.2)*SSB));
    break;
    case 2: //Ricker
      Recruits_Tmp=((SSB/spr_F0)*mfexp(h*(1-SSB/(R0*spr_F0))));
    break;
  }
  RETURN_ARRAYS_DECREMENT();
  return Recruits_Tmp;

//-----------------------------------------------------------------------------------
//Spawner-recruit equilibrium function (Beverton-Holt or Ricker)
FUNCTION dvariable SR_eq_func(const dvariable& R0, const dvariable& h, const dvariable& spr_F0, const dvariable& spr_F, const dvariable& BC, int func)
  //R0=virgin recruitment, h=steepness, spr_F0=spawners per recruit @ F=0, spr_F=spawners per recruit @ F, BC=bias correction
  //func=1 for Beverton-Holt, 2 for Ricker
  RETURN_ARRAYS_INCREMENT();
  dvariable Recruits_Tmp;
  switch(func) {
    case 1: //Beverton-Holt
      Recruits_Tmp=(R0/((5.0*h-1.0)*spr_F))*(BC*4.0*h*spr_F-spr_F0*(1.0-h));
    break;
    case 2: //Ricker
      Recruits_Tmp=R0/(spr_F/spr_F0)*(1.0+log(BC*spr_F/spr_F0)/h);
    break;
  }
  RETURN_ARRAYS_DECREMENT();
  return Recruits_Tmp;

//-----------------------------------------------------------------------------------
//compute multinomial effective sample size for a single yr
FUNCTION dvariable multinom_eff_N(const dvar_vector& pred_comp, const dvar_vector& obs_comp)
  //pred_comp=vector of predicted comps, obscomp=vector of observed comps
  dvariable EffN_Tmp; dvariable numer; dvariable denom;
  RETURN_ARRAYS_INCREMENT();
  numer=sum( elem_prod(pred_comp,(1.0-pred_comp)) );
  denom=sum( square(obs_comp-pred_comp) );
  if (denom>0.0) {EffN_Tmp=numer/denom;}
  else {EffN_Tmp=-missing;}
  RETURN_ARRAYS_DECREMENT();
  return EffN_Tmp;

//-----------------------------------------------------------------------------------
//Likelihood contribution: lognormal
FUNCTION dvariable lk_lognormal(const dvar_vector& pred, const dvar_vector& obs, const dvar_vector& cv, const dvariable& wgt_dat)
  //pred=vector of predicted vals, obs=vector of observed vals, cv=vector of CVs in arithmetic space, wgt_dat=constant scaling of CVs
  //small_number is small value to avoid log(0) during search
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  dvar_vector var(cv.indexmin(),cv.indexmax()); //variance in log space
  var=log(1.0+square(cv/wgt_dat));   // convert cv in arithmetic space to variance in log space
  LkvalTmp=sum(0.5*elem_div(square(log(elem_div((pred+small_number),(obs+small_number)))),var) );
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//-----------------------------------------------------------------------------------
//Likelihood contribution: multinomial
FUNCTION dvariable lk_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const double& minSS, const dvariable& wgt_dat)
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, minSS=min N threshold, wgt_dat=scaling of N's
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  LkvalTmp=0.0;
  for (int ii=1; ii<=ncomp; ii++)
  {if (nsamp(ii)>=minSS)
    {LkvalTmp-=wgt_dat*nsamp(ii)*sum(elem_prod((obs_comp(ii)+small_number),
               log(elem_div((pred_comp(ii)+small_number), (obs_comp(ii)+small_number)))));
    }
  }
  RETURN_ARRAYS_DECREMENT();
```

```
  return LkvalTmp;

//--------------------------------------------------------------------------------
//Likelihood contribution: robust multinomial
FUNCTION dvariable lk_robust_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS, const dvariable& wgt
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold, wgt_dat=scaling of N's
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  LkvalTmp=0.0;
  dvar_matrix Eprime=elem_prod((1.0-obs_comp), obs_comp)+0.1/mbin; //E' of Francis 2011, p.1131
  dvar_vector nsamp_wgt=nsamp*wgt_dat;
  //cout<<nsamp_wgt<<endl;
  for (int ii=1; ii<=ncomp; ii++)
  {if (nsamp(ii)>=minSS)
    {LkvalTmp+= sum(0.5*log(Eprime(ii))-log(small_number+mfexp(elem_div((-square(obs_comp(ii)-pred_comp(ii))) , (Eprime(ii)*2.0/nsamp_wgt(ii)) ))) );
    }
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//--------------------------------------------------------------------------------
//Likelihood contribution: Dirichlet-multinomial
FUNCTION dvariable lk_dirichlet_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS, const dvariable&
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold, wgt_dat=scaling of N's
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.00001;
  LkvalTmp=0.0;
  dvar_vector nsamp_adjust=nsamp*mfexp(log_dir_par);
   //dvar_vector nsamp_adjust=mfexp(log_dir_par);
  for (int ii=1; ii<=ncomp; ii++)
  {
if (nsamp(ii)>=minSS)
    {
LkvalTmp-=gammln(nsamp_adjust(ii))-gammln(nsamp(ii)+nsamp_adjust(ii));
LkvalTmp-=sum(gammln(nsamp(ii)*obs_comp(ii)+nsamp_adjust(ii)*pred_comp(ii)+small_number));
LkvalTmp+=sum(gammln(nsamp_adjust(ii)*pred_comp(ii)+small_number));
    }
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

// //Likelihood contribution: Dirichlet-multinomial
// FUNCTION dvariable lk_dirichlet_multinomial(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS, const dvariabl
  // //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold, wgt_dat=scaling of N's
  // RETURN_ARRAYS_INCREMENT();
  // dvariable LkvalTmp;
  // LkvalTmp=0.0;
  // dvar_vector nsamp_adjust=nsamp*mfexp(log_dir_par);
  // //dvar_vector nsamp_adjust=mfexp(log_dir_par);
  // for (int ii=1; ii<=ncomp; ii++)
  // {
// if (nsamp(ii)>=minSS)
    // {
// LkvalTmp-=gammln(nsamp_adjust(ii))-gammln(nsamp(ii)+nsamp_adjust(ii));
// LkvalTmp-=sum(gammln(nsamp(ii)*obs_comp(ii)+nsamp_adjust(ii)*pred_comp(ii)));
        // LkvalTmp+=sum(gammln(nsamp_adjust(ii)*pred_comp(ii)));
    // }
  // }
  // RETURN_ARRAYS_DECREMENT();
  // return LkvalTmp;


//--------------------------------------------------------------------------------
//Likelihood contribution: logistic normal (aka multivariate logistic in iSCAM; logistic normal in Francis' terminology)
FUNCTION dvariable lk_logistic_normal(const dvar_vector& nsamp, const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const double& ncomp, const dvariable& mbin, const double& minSS)
  //nsamp=vector of N's, pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, ncomp = number of yrs in matrix, mbin=number of bins, minSS=min N threshold
  RETURN_ARRAYS_INCREMENT();
  dvariable LkvalTmp;
  dvariable small_number=0.0001;
  LkvalTmp=0.0;
  dvar_matrix nu=pred_comp+0.0;
  dvar_matrix pred_plus=pred_comp+small_number;
  dvar_matrix obs_plus=obs_comp+small_number;

  dvariable nu_mean;
  dvariable nu_sum_sq;
  dvariable tau_hat_sq;
  dvariable year_count; //keeps track of years included in likelihood (i.e., that meet the sample size requirement)

  LkvalTmp=0.0;
  nu_sum_sq=0.0;
  year_count=0.0;
  for (int ii=1; ii<=ncomp; ii++)
  {if (nsamp(ii)>=minSS)
    {
year_count+=1.0;
nu_mean=sum( log(obs_plus(ii))-log(pred_plus(ii))  )/mbin; //year-specific mean log residual
for (int jj=1; jj<=mbin;jj++)
{
nu(ii,jj) = log(obs_plus(ii,jj)) - log(pred_plus(ii,jj)) - nu_mean;
nu_sum_sq += square(nu(ii,jj));
}
    }
```

```
  }
  if (year_count>0.0)
  {
  tau_hat_sq = nu_sum_sq/((mbin-1.0)*year_count);
  LkvalTmp = (mbin-1.0)*year_count*log(tau_hat_sq);
  }
  RETURN_ARRAYS_DECREMENT();
  return LkvalTmp;

//-----------------------------------------------------------------------------------
//-----------------------------------------------------------------------------------
//Likelihood contribution: priors
FUNCTION  dvariable neg_log_prior(dvariable pred, const double& prior, dvariable var, int pdf)
  //prior=prior point estimate, var=variance (if negative, treated as CV in arithmetic space), pred=predicted value, pdf=prior type (1=none, 2=lognormal, 3=normal, 4=beta)
    dvariable LkvalTmp;
    dvariable alpha, beta, ab_iq;
    dvariable big_number=1e10;
    LkvalTmp=0.0;
    // compute generic pdf's
    switch(pdf) {
        case 1: //option to turn off prior
          LkvalTmp=0.0;
          break;
        case 2: // lognormal
          if(prior<=0.0) cout << "YIKES: Don't use a lognormal distn for a negative prior" << endl;
          else if(pred<=0) LkvalTmp=big_number=1e10;
          else {
            if(var<0.0) var=log(1.0+var*var) ;      // convert cv to variance on log scale
            LkvalTmp= 0.5*( square(log(pred/prior))/var + log(var) );
          }
        break;
        case 3: // normal
          if(var<0.0 && prior!=0.0) var=square(var*prior);       // convert cv to variance on observation scale
          else if(var<0.0 && prior==0.0) var=-var;               // cv not really appropriate if prior value equals zero
          LkvalTmp= 0.5*( square(pred-prior)/var + log(var) );
          break;
        case 4: // beta
          if(var<0.0) var=square(var*prior);          // convert cv to variance on observation scale
          if(prior<=0.0 || prior>=1.0) cout << "YIKES: Don't use a beta distn for a prior outside (0,1)" << endl;
          ab_iq=prior*(1.0-prior)/var - 1.0; alpha=prior*ab_iq; beta=(1.0-prior)*ab_iq;
          if(pred>=0 && pred<=1) LkvalTmp= (1.0-alpha)*log(pred)+(1.0-beta)*log(1.0-pred)-gammln(alpha+beta)+gammln(alpha)+gammln(beta);
          else LkvalTmp=big_number;
          break;
        default: // no such prior pdf currently available
          cout << "The prior must be either 1(lognormal), 2(normal), or 3(beta)." << endl;
          cout << "Presently it is " << pdf << endl;
          exit(0);
    }
    return LkvalTmp;

//-----------------------------------------------------------------------------------
//SDNR: age comp likelihood (assumes fits are done with the robust multinomial function)
FUNCTION dvariable sdnr_multinomial(const double& ncomp, const dvar_vector& ages, const dvar_vector& nsamp,
                                    const dvar_matrix& pred_comp, const dvar_matrix& obs_comp, const dvariable& wgt_dat)
  //ncomp=number of years of data, ages=vector of ages, nsamp=vector of N's,
  //pred_comp=matrix of predicted comps, obs_comp=matrix of observed comps, wgt_dat=likelihood weight for data source
  RETURN_ARRAYS_INCREMENT();
  dvariable SdnrTmp;
  dvar_vector o(1,ncomp);
  dvar_vector p(1,ncomp);
  dvar_vector ose(1,ncomp);
  dvar_vector res(1,ncomp);
  SdnrTmp=0.0;
  for (int ii=1; ii<=ncomp; ii++)
  {
    o(ii)=sum(elem_prod(ages,obs_comp(ii)));
    p(ii)=sum(elem_prod(ages,pred_comp(ii)));
    ose(ii)=sqrt((sum(elem_prod(square(ages),pred_comp(ii)))-square(p(ii)))/(nsamp(ii)*wgt_dat));
  }
  res=elem_div((o-p),ose);
  SdnrTmp=sqrt(sum(square(res-(sum(res)/ncomp))/(ncomp-1.0)));
  RETURN_ARRAYS_DECREMENT();
  return SdnrTmp;

//-----------------------------------------------------------------------------------
//SDNR: lognormal likelihood
FUNCTION dvariable sdnr_lognormal(const dvar_vector& pred, const dvar_vector& obs, const dvar_vector& cv, const dvariable& wgt_dat)
  //nyr=number of years of data, pred=vector of predicted data, obs=vector of observed data, cv=vector of cv's, wgt_dat=likelihood weight for data source
  RETURN_ARRAYS_INCREMENT();
  dvariable SdnrTmp;
  dvariable small_number=0.00001;
  dvariable n;
  dvar_vector res(cv.indexmin(),cv.indexmax());
  SdnrTmp=0.0;
  res=elem_div(log(elem_div(obs+small_number,pred+small_number)),sqrt(log(1+square(cv/wgt_dat))));
  n=cv.indexmax()-cv.indexmin()+1;
  SdnrTmp=sqrt(sum(square(res-(sum(res)/n))/(n-1.0)));
  RETURN_ARRAYS_DECREMENT();
  return SdnrTmp;

//-----------------------------------------------------------------------------------
REPORT_SECTION

  if (last_phase())
  {
```

```
    cout<<"start report"<<endl;
     //cout<<"xdum = "<<xdum<<endl;
get_weighted_current();
     cout<<"got weighted"<<endl;
    get_msy();
     cout<<"got msy"<<endl;
    get_per_recruit_stuff();
     cout<<"got per recruit"<<endl;
    get_miscellaneous_stuff();
     cout<<"got misc stuff"<<endl;
get_projection();
 cout<<"got projection"<<endl;

    grad_max=objective_function_value::pobjfun->gmax;
    time(&finish);
elapsed_time=difftime(finish,start);
hour=long(elapsed_time)/3600;
minute=long(elapsed_time)%3600/60;
second=(long(elapsed_time)%3600)%60;
cout<<endl<<endl<<"*********************************************"<<endl;
cout<<"--Start time: "<<ctime(&start)<<endl;
cout<<"--Finish time: "<<ctime(&finish)<<endl;
cout<<"--Runtime: ";
cout<<hour<<" hours, "<<minute<<" minutes, "<<second<<" seconds"<<endl;
cout << "--TotalLikelihood: " << fval << endl;
    cout<<"--Final gradient: "<<objective_function_value::pobjfun->gmax << endl;
cout<<"*********************************************"<<endl;

    cout <<endl;
    cout << "><>--><>--><>--><>--><>--><>--><>--><>--><>--><>"  <<endl;
    cout << "F40=" << F40_out<< "   SSB.F40=" << SSB_F40_out <<endl;
    cout <<"F status="<<FdF_msy_end<<endl;
    cout <<"Pop status="<<SdSSB_msy_end<<endl;
    cout << "R0="<<R0<<endl;
    //cout << "xdum " << xdum << endl;
    cout << "><>--><>--><>--><>--><>--><>--><>--><>--><>--><>"  <<endl;

    report << "TotalLikelihood " << fval << endl;
    report << "N" << endl;
    report << N<<endl;
    report << "F" << endl;
    report << F <<endl;
    // report << "prob_belowsizelim_block3" << endl;
// report<<prob_belowsizelim_block3<<endl;

    sdnr_I_HB=sdnr_lognormal(pred_HB_cpue, obs_HB_cpue, HB_cpue_cv, w_I_HB);

    //#################################################################################################
    //##  Passing parameters to vector for bounds check plotting
    //#################################################################################################
     Linf_out(8)=Linf; Linf_out(1,7)=set_Linf;
     K_out(8)=K; K_out(1,7)=set_K;
     t0_out(8)=t0; t0_out(1,7)=set_t0;
     len_cv_val_out(8)=len_cv_val; len_cv_val_out(1,7)=set_len_cv;

 Linf_L_out(8)=Linf_L; Linf_L_out(1,7)=set_Linf_L;
     K_L_out(8)=K_L; K_L_out(1,7)=set_K_L;
     t0_L_out(8)=t0_L; t0_L_out(1,7)=set_t0_L;
     len_cv_val_L_out(8)=len_cv_val_L; len_cv_val_L_out(1,7)=set_len_cv_L;

 Linf_F_out(8)=Linf_F; Linf_F_out(1,7)=set_Linf_F;
     K_F_out(8)=K_F; K_F_out(1,7)=set_K_F;
     t0_F_out(8)=t0_F; t0_F_out(1,7)=set_t0_F;
     len_cv_val_F_out(8)=len_cv_val_F; len_cv_val_F_out(1,7)=set_len_cv_F;

     log_R0_out(8)=log_R0; log_R0_out(1,7)=set_log_R0;
     M_constant_out(8)=M_constant; M_constant_out(1,7)=set_M_constant;
     steep_out(8)=steep; steep_out(1,7)=set_steep;
     rec_sigma_out(8)=rec_sigma; rec_sigma_out(1,7)=set_rec_sigma;
     R_autocorr_out(8)=R_autocorr; R_autocorr_out(1,7)=set_R_autocorr;

 log_dm_comm_lc_out(8)=log_dm_comm_lc; log_dm_comm_lc_out(1,7)=set_log_dm_comm_lc;
 //log_dm_cL_lc_out(8)=log_dm_cL_lc; log_dm_cL_lc_out(1,7)=set_log_dm_cL_lc;
 //log_dm_GR_lc_out(8)=log_dm_GR_lc; log_dm_GR_lc_out(1,7)=set_log_dm_GR_lc;
     log_dm_GR_ac_out(8)=log_dm_GR_ac; log_dm_GR_ac_out(1,7)=set_log_dm_GR_ac;

     selpar_A50_comm1_out(8)=selpar_A50_comm1; selpar_A50_comm1_out(1,7)=set_selpar_A50_comm1;
     selpar_slope_comm1_out(8)=selpar_slope_comm1; selpar_slope_comm1_out(1,7)=set_selpar_slope_comm1;

 selpar_A50_GR1_out(8)=selpar_A50_GR1; selpar_A50_GR1_out(1,7)=set_selpar_A50_GR1;
     selpar_slope_GR1_out(8)=selpar_slope_GR1; selpar_slope_GR1_out(1,7)=set_selpar_slope_GR1;
 selpar_A50_GR2_out(8)=selpar_A50_GR2; selpar_A50_GR2_out(1,7)=set_selpar_A50_GR2;
     selpar_slope_GR2_out(8)=selpar_slope_GR2; selpar_slope_GR2_out(1,7)=set_selpar_slope_GR2;

     log_q_HB_out(8)=log_q_HB; log_q_HB_out(1,7)=set_log_q_HB;

     log_avg_F_comm_out(8)=log_avg_F_comm; log_avg_F_comm_out(1,7)=set_log_avg_F_comm;
 //log_avg_F_cL_out(8)=log_avg_F_cL; log_avg_F_cL_out(1,7)=set_log_avg_F_cL;
     log_avg_F_GR_out(8)=log_avg_F_GR; log_avg_F_GR_out(1,7)=set_log_avg_F_GR;
     F_init_out(8)=F_init; F_init_out(1,7)=set_F_init;

     log_rec_dev_out(styr_rec_dev, endyr_rec_dev)=log_rec_dev;
     log_F_dev_comm_out(styr_comm_L,endyr_comm_L)=log_F_dev_comm;
 //log_F_dev_cL_out(styr_cL_L,endyr_cL_L)=log_F_dev_cL;
     log_F_dev_GR_out(styr_GR_L,endyr_GR_L)=log_F_dev_GR;
```

```
  #include "co22_make_Robject4.cxx"   // write the R-compatible report

 } //endl last phase loop
```

SEDAR

Southeast Data, Assessment, and Review

SEDAR 58

Atlantic Cobia

SECTION V: Research Recommendations

December 2019

SEDAR
4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

Table of Contents

1. Stock ID Workshop

1.1 Genetics

- Collect and analyze more samples from Jacksonville, Florida through Brunswick, Georgia along the Atlantic coast.
- Evaluate potential substructure within the Gulf of Mexico stock, including potential population substructure in Tampa Bay, along the Florida panhandle, and in the existing sample distribution gap off of Louisiana.
- Additional life history studies to document spawning locations outside of coastal South Carolina.
- Examine inshore versus offshore genetic structure in other states that harbor year-round inshore populations.
- Samples should be distributed temporally throughout the spawning season, which can vary by location. Samples obtained outside of the spawning season may not reflect the genetic stock being sampled, given observed movement of some individuals from spawning grounds.

1.2 Life History/Biology

1. More, randomly-collected age samples throughout the range of Cobia are needed.

   Cobia are exploited primarily by the charter boat fleet and private recreational fishery. Randomly collected biological samples of Cobia from the recreational fishery will provide essential data inputs to stock assessments. Only 130 new age data points spanning 18 years from the GOM have been made available since SEDAR 28. The majority of all age samples were collected from South Carolina and Virginia. Most of those samples were from carcass collection programs from the recreational fishery, which may not be able to be used to characterize the fishery landings due to the non-random sample collection method.

2. Reproductive biological information throughout the range of Cobia are needed. No reproductive data exists for the east coast of Florida and the Florida Keys. More specific information on the locations of spawning is needed, and in particular from both estuarine and offshore waters. Estimates of fecundity need to be made throughout the range of Cobia.

   Since SEDAR 28, no significant additional reproductive sampling has been conducted. The majority of the data used in that assessment was published in 2001 and 2002 with some newer data from South Carolina. In SEDAR 28, it was noted that few fish were sampled at small sizes (ages 0-2) before they enter the fishery at age 3 and that even the 3 year olds may have been the largest 3 year olds due to the size regulations. Relying on fishery dependent sampling, where the recreational minimum size limit is 33 inches FL in the Gulf of Mexico and increasing to 36 inches FL in the south Atlantic, results in only sampling fish likely to be mature. Additional sampling, particularly at smaller sizes and younger ages, would help to better define the steepness of the maturity curve and the proportion mature at age. Fish in this size range have traditionally been difficult to locate and sample so having information on fish at these sizes would also help to delineate habitat requirements for juvenile fish.

It was also noted in the stock ID workshop that none of the samples collected for Brown-Peterson et al. (2001) were from the southeastern portion of Florida or the Florida Keys (Figure 13) and sampling was likely minimal from the east coast of Florida in general. This data gap is important to fill, particularly given the acoustic tagging data that suggests the possibility of a resident Florida group and not having clear information on from where these east coast Florida fish recruit (e.g. are they migrants from other areas or is there reproduction occurring in this area?).

3. Information on larval dispersion is needed to elucidate stock structure of Cobia.

   While larval data was submitted late to the workshop (see SEDAR 58 Working Paper S58-SID09), most of the larval data collected at this point comes from the Gulf of Mexico with less effort conducted in the Atlantic. While Cobia larvae were present in many of the Gulf of Mexico samples, very few positive Cobia larvae tows were observed in the South Atlantic. Previous work in South Carolina (Lefebvre and Denson 2012) and Chesapeake Bay (Joseph et al. 1964) suggest that Cobia on the east coast use some estuaries for spawning, although there is likely an offshore spawning contingent also. More information on larval presence/absence, particularly from the east coast of the United States, could help to better define where fish are spawning and suggest other unique spawning sub-groups. A better understanding of spawning locations may also allow for predictions on how and where larvae are dispersed, providing support for the observed genetic differences, and possibly helping to define the stock boundary area.

4. A fishery-independent survey is needed to monitor Cobia and obtain biological information on Cobia below the minimum size limits imposed on the fishery.

5. Ecosystem studies are needed for Cobia with regards to prey availability and energetics to better understand growth differences of the species throughout its range.

1.3 Spatial Distribution / Movement

Priorities

- Refine understanding of ATL-GOM boundary and zone of uncertainty by installing acoustic arrays between Canaveral FL and Brunswick GA, plus more tagging in this region.
- Try to detect overwintering fish by extending acoustic arrays to shelf break
- Determine spawning grounds by sampling for ripe adults / ichthyoplankton
- The Spatial Working Group felt that it was important to undertake another stock ID process in approximately three years, and before the next assessment, to incorporate data that is anticipated in the next few years (there are many acoustically-tagged cobia presently at large).

Telemetry

Stock boundary and zone of uncertainty

- Improve spatial resolution near the existing stock boundary (GA-FL line) by adding additional acoustic arrays between Canaveral FL and Brunswick GA.
- Tag additional fish in the same area and extend tagging to Savannah GA using acoustic, conventional, and PSAT tags, with distribution of tagging effort across seasons.

Onshore-offshore movement and overwintering

- Extend existing acoustic receiver arrays to the shelf break and add additional receiver arrays between Canaveral FL and Brunswick GA. In some cases this will mean that acoustic receivers cannot be deployed and recovered by divers, but there may be buoys that can be attached to. In addition, acoustic releases can be used to deploy and recover receivers in deep water, depending on presence of bottom-trawl fisheries or other hazards.
- PSAT tagging of fish from FL to VA, and northern GOM, to understand over-wintering habitat, which can provide locations where there are no receivers and no fishing effort.
- Since there is presently decreased fishing effort in the putative over-wintering areas (e.g., offshore), increased sampling in these areas could be useful.

Existing detection network

- It is very important that the existing acoustic network remains in place and functional, which will require ongoing funding and effort (e.g., Chesapeake Bay, Pensacola Bay, offshore areas of NC). Some of the existing receiver arrays may be in projects that are closing down, so there is some risk that portions of the tracking network will be removed in the near future (e.g., Navy array at Chesapeake Bay mouth).

Conventional tagging

- More conventional tagging data is needed in data poor areas of Georgia and North Florida, along with the Cape Canaveral area, where little recent tagging data is available. In areas where cobia are available for much of the year, programs should focus on tagging over multiple seasons to ensure that any differing movement behaviors are represented.
- Cooperative tagging programs exist in VA and NC and in GOM; increase cooperative tagging in SC, and begin tagging in GA and the FL east coast.
- Ideally, auxiliary experiments to estimate tag shedding (e.g. double tagging) and tag reporting (e.g. high and low reward tags) are done as part of new or ongoing conventional tagging studies. This auxiliary information allows for estimation of fishing and natural mortality rates from the conventional tag returns.

Other topics

- Analyze existing PSAT data to get environmental preferences, particularly for overwintering individuals.
- Use oceanographic databases to determine temperature for time-location detections of cobia in acoustic dataset, and fishery presence-absence survey data.
- Look for existing plankton survey data. Determine if new ichthyoplankton research is planned or possible.
- Establish/continue collection programs to help identify spawning locations in all regions. This would include collecting gonads, otoliths, and genetics. NC and SC are collecting from dock sampling programs (genetics) and carcass collection programs (gonads). Similar programs in other regions would yield useful data.

Overall

- In addition to the research recommendations above, the Panel recommends that Cobia stock ID should be re-evaluated in three to five years.

1.4 Stock ID Review Workshop

1.) An enhanced understanding of the spatial distribution and interannual variability in recreational fishing effort is needed to understand if recent increases in landings have been driven by changes in stock abundance, effort, or spatial distribution of the exploited stocks. This appears to be a critical element to determine if recent harvest levels represent overfishing or a growing stock. The commercial landings data are minimally informative given short seasons, limited harvest allocations, and that most landings are the result of incidental catch during other targeted fisheries.

2.) Future research should further explore if discrete genetic stocks exist along the Atlantic Coast and Gulf of Mexico. Existing data supports at least some population substructure along the Atlantic Coast, and there are some indications of additional substructure along the Gulf Coast. Concerns were voiced from the public that local stocks may be overexploited under a coastwide management framework. If substructure occurs, the overall abundance of coastwide stocks are expected to show increased stability (e.g., a portfolio effect *sensu* Shindler *et al*. 2010), but overfishing of specific stocks may lead to reduced overall catch.

3.) Existing fishery independent surveys encounter few cobia, and offer little information on trends in abundance. It would be very beneficial to develop a survey design that characterizes temporal trends in the abundance of stocks. At the present, it is very difficult to distinguish changes in abundances versus changes in fishing effort.

4.) Genomic markers for stock delineation should be considered. The microsatellite studies to date estimated large effective population sizes, which suggests slow rates of neutral genetic drift among populations, especially if some gene flow occurs. As a result, relatively small levels of genetic differentiation exist between units, and the power of genetic assignment testing is limited. A genomic approach with a much larger number of SNP loci may offer enhanced resolution of stocks. In particular SNP loci that are under selection may show much higher levels of differentiation (and thus discriminatory ability) than microsatellites. Several new population genomics approaches (e.g. Genotyping-by-thousands and Rapture) and rapidly decreasing sequencing costs are making population-scale genomics increasingly tractable.

5.) Additional studies are needed to understand the migratory patterns of cobia, particularly during the winter months when offshore habitat use may be more prevalent. Studies using offshore receiver arrays or pop-off satellite archival tags may be particularly instructive. Stable isotope analysis of bony structures may also be informative.

2. Data Workshop

2.1 Life History Research Recommendations

Carcass donations

- Validate the carcass collection programs as representing the recreational fishery. E.g., Side-by-side comparison to a random port sampling program.
- State agencies should work together to achieve more consistency in their programs.
- Increase public education for the importance of the programs.
- Expand the geographic range of the donation sites.

Reproductive recommendations

- Histological processing of all gonad tissue to better estimate the maturity schedule of Atlantic Cobia. In particular, focus on the fish aged 0 – 3 years and cover full geographic range of the species.

- Determine the contribution to the population from the inshore spawning stock and the offshore spawning stock.
- Obtain estimates of fecundity and periodicity of the Atlantic Cobia stock.

Stock ID

- Use otolith chemistry techniques to elucidate the contribution of inshore and offshore spawned Cobia to the Atlantic population.
- Expand genetics studies to refine the possible stock separation of the inshore and offshore segments of the population.

Tagging studies

- Direct tagging studies to obtain estimates of mortality
- Determine tag retention and reporting rates
- Hold a workshop to ensure consistent tagging methods across states at the program level.

2.2 Commercial Research Recommendations

- Programmatic funding should be allocated to expand existing observer coverage to ensure complete spatial coverage for the South Atlantic.
- Funding should be allocated towards the development of standardized map products.
- This includes various federal and state logbook grids from Maine to Texas.
- All grids need to include SDO registration.
- Includes translation tables between each grid.
- Creation of map products that compare commercial fishing effort between the CFLP and state trip ticket data.
- Develop statistically robust discard estimation techniques.
- Standardize how effort data are collected, processed, and utilized in relation to catch.
- There may be inconsistencies among commercial data sets for effort, since there is not a vessel permit required for cobia rather an individual catch limit.
- A single trip ticket may group multiple individual catches together with total effort, while multiple trip tickets may separate individual catch yet replicate the vessel effort.
- Create outreach strategies to further enhance the implementation plan for the commercial electronic logbook and include state partners. This will increase the data validity.
- This data collection effort will greatly improve reporting periodicity, reduce recall basis, provide increased spatial trends, provide more robust discard data, this list is endless, but should address where this data will fill in data gaps within a SEDAR
- The group recommends a workshop to establish a best practice for converting landings (e.g., gutted to whole weight).
- This workshop should address multiple species and jurisdictions.
- The group suggests that the partners include cobia in an RFP for updating federal and state specific conversion factors.
- The group recommends a workshop to establish a best practice for assigning uncertainty to landing series, as recommended in the best practices workshop.

2.3 Recreational Research recommendations

- Increase proportion of fish with biological data within MRFSS sampling.
- Efforts are ongoing to collect more biological data such as length and weight for fish sampled within MRIP.
- Continue to develop methods to collect a higher degree of information on released fish (length, condition, etc.) in the recreational fishery.
- In 2016, Virginia developed a Cobia permit data application that specifically collects information on released fish. Full description of this program can be found in section 4.3.4.
- North Carolina is also working on a coast-wide discard application that could provide information in the future.
- Require mandatory reporting for all charterboats state and federal.
- Establishment of federal logbooks for charter captains that have valid federal finfish permits is pending approval and implementation is expected in summer of 2019.
- State logbook are still a work in progress with no current actions pending.
- Continue development of electronic mandatory reporting for for-hire sector.
- Southeast For-Hire Integrated Electronic Reporting (SEFHIER) is currently working to provide more robust for-hire data that is timely and can be integrated with existing programs.
- Continued research efforts to incorporate/require logbook reporting from recreational anglers.
- Two applications that have been created and are currently used by the recreational fishery along the Atlantic coast are My Fish Count and VA cobia permit. There is one pending application from North Carolina that will be a coast-wide application for released fish.
- Establish a review panel to evaluate methods for reconstructing historical landings (SWAS, FWS, etc.).
- FHWAR method was reviewed by assessment panels and established as “Best Practice” in SEDAR Data Best Practices procedural workshop.
- Quantify historical fishing photos for use in reconstructing recreational historical landings.
- SAFMC FIS funded 2018-2019
- Narrow down the sampling universe. Identify angler preference and effort. Require a reef fish stamp for anglers targeting reef fish, pelagic stamp for migratory species, and deep water complex stamp for deep-water species. The program would be similar to the federal duck stamp required of hunters. This would allow the managers to identify what anglers were fishing for.
- National Saltwater Angler Registry
- VA cobia permit
- Continue and expand fishery dependent at-sea-observer surveys to collect discard information, which would provide for a more accurate index of abundance.
- Continued in Atlantic but expansion is funding limited
- Research recommendations
- Improve recreational reporting applications –

- Standardized across states (i.e., Harbor Light Scamp app, My Fish Count app).
- Capable of capturing length with photo.
- Standardize carcass collection protocols across states.
- Increase recreational biological sampling (i.e., NC, GA).
- Increase citizen Science involvement in tagging and tissue collection efforts.

2.4 Indices research recommendations

- SEDAR 28 DW - Explore SEFIS video data as a potential fishery independent index of abundance for cobia.
- The SEFIS video data are collected in association with the chevron trap survey and were evaluated for use in SEDAR 58. This survey focuses on bottom species and takes place outside of the primary cobia season. Cobia have been observed on very few occasions (1-3%) in the videos. It is unlikely that this survey would provide a useful index of cobia abundance.

- SEDAR 28 DW - Using simulation analysis, evaluate the utility of including interaction terms in the development of a standardized index and identify the potential effects these interaction terms have on stock assessments.
- Simulation analyses evaluating the utility of including interaction terms in developing a standardized index, to our group's knowledge, have not been attempted for cobia.

- SEDAR 28 AW - Develop a fishery-independent sampling program for abundance of cobia and other coastal migratory species. Fishery -dependent abundance indices used in this assessment were uncertain in part due to the lack of an effective sampling methodology.
- No new fishery-independent surveys have been implemented for cobia and other coastal migratory species.
- Research Recommendations
- Develop a fishery-independent sampling program for abundance of cobia and other coastal migratory species.
- Improve MRIP coverage for rare event species
- Improve validation methods for SC Charter Logbook
- Improve effort definition of gear and target species within trips (mixed effort)

2.5 Discard mortality Research recommendations

- SEDAR 28-During discussion at the data workshop it was noted that the logbook categories for discards (all dead, majority dead, majority alive, all alive) are not useful for informing discard mortality. Consider simplified logbook language in regard to discards (e.g., list them as dead or alive).
- New recommendation based on same concern: The group recommends that the SEDAR send a recommendation to the Southeast Fisheries Science Center (SEFSC) Fisheries Statistics Division Director clarifying the discard disposition. The group also noted that

obtaining adequate discard data is best achieved by collaboration with stakeholder and state/federal partners.

- SEDAR 28- Further research is needed on cobia release mortality.
- The discard mortality ad-hoc group addressed this recommendation from SEDAR 28 and agree that additional research is still needed on cobia release mortality.
- New SEDAR 58 recommendations:
- The group recommends continuing electronic tagging to estimate release mortality and total mortality. Increases in spatial coverage (i.e. receiver arrays) and the number of tags both spatially and temporally to increase the precision of mortality estimates. Furthermore, elucidating the effect of temperature on discard mortality through the use of temperature tags.
- The group recommends the use of conventional tagging. The tagging of telemetered fish informs the fates (i.e. harvest or catch and release of the telemetered fish). For all conventionally tagged fish, high value tags are need to estimate tag reporting rate and estimates of tag loss.
- The group recommends a SEDAR/council/state or regional management (ASMFC) sponsored tagging workshop to codify methodologies.

2.6 Ecosystem research recommendations

- Determine locations of all genetically distinct population segments
- Identify spawning aggregations and duration and timing of spawning
- Further characterize spawning habitat: salinity, water temperature, day length, habitat type (i.e. structured, vegetated, sandy)
- Identify the habitat of 0-2 year olds juveniles and sub-adults
- Determine habitat use during the winter
- Document the distribution and mechanism for transport of eggs, larvae and post-larvae
- Evaluate the impacts of increased temperature, increased eutrophication of estuarine and nearshore waters, and decreased salinity on egg, larvae and juvenile survival
- Evaluate the impacts of increased temperature, increased eutrophication of estuarine and nearshore waters, and decreased salinity on the food web supporting larvae and juveniles
- Determine factors affecting changes in growth, maturity at age, egg production, and sex ratio as temperature increases forcing a change in habitat use
- Identify threats to different life stages by invasive species
- Better understand the relationship between prey species and co-occurring species (blue crab, calico crab, hardhead catfish, eels, cownose rays etc.)
- Identify levels of pollutants (mercury, microplastics, ethinyl-estradiol) affecting cobia and determine the impacts on growth, maturity at age, egg production, sex ratio and behavior

2.7 Socio economic research recommendations

- Obtain better data (e.g., more comprehensive and timely) to estimate the annual economic impacts, net benefits, and economic contributions of recreational and commercial Atlantic cobia fishing on coastal communities and regions.

- Obtain cost and expenditure data for recreational fishing trips targeting cobia by fishing mode, for different states, and for anglers returning to private sites, who would not be sampled by the MRIP.
- Estimate willingness-to-pay associated with recreational cobia angling.

3. Assessment Process

1. Develop a fishery independent sampling program for abundance of cobia and other coastal migratory species.
2. Fishery dependent abundance indices used in this assessment were uncertain in part due to the lack of an effective sampling methodology.
3. Implement a systematic age sampling program for the general recreational sector. Age samples were important in this assessment for identifying strong year classes but sample sizes were relatively small and disparate in time and space.
4. Better characterize reproductive parameters including age at maturity, batch fecundity, spawning seasonality, and spawning frequency.
5. Age-dependent natural mortality was estimated by indirect methods for this assessment of cobia. Telemetry- and conventional-tag programs for cobia should be maintained as they may prove useful for estimating mortality.
6. Better characterize the migratory dynamics of the stock and the degree of fidelity to spawning areas.

4. Review Workshop

The RP reviewed the large list of research recommendations made by the DW and AW groups. The RP recommends that the following DA and AW research recommendations should be given high priority because of the importance to the stock assessment model:

1. Because the fishery-dependent index ended in 2015, development of a new index, either fishery-dependent or preferably fishery-independent, should be given top priority. Without an index of abundance, it is unlikely that stock status would be able to be estimated with any reliability in future. The RP recommend exploring other fisheries-dependent CPUE sources if available, developing fisheries-independent surveys such as egg/larvae surveys or close-kin methods, expanding analysis of the ten-year SERFS baited trap-video survey for cobia, or exploring the use of tag-data as potential indices of abundance.
2. Given that age composition data are an important source of information for the assessment model, methods to increase sample size (such as expanding carcass collection locations and establishing similar programs in other states) should be implemented. In addition, development of sampling programs to collect size and age information on fish released in the recreational fishery should be a priority.
3. The uncertainty in the stock status would be improved if better information on age-at-maturity and annual sex ratios were collected.
4. Natural mortality is an important parameter that affects model estimates of recruitment and spawning stock biomass. The RP recommends that estimates of natural mortality be made using tagging data or other analytical approaches (e.g., meta-analysis, catch-curves, etc.) for use in the model or to ground-truth the life-history invariant method used currently.

SEDAR

Southeast Data, Assessment, and Review

SEDAR 58

Atlantic Cobia

SECTION VI: Review Workshop Report

December 2019

SEDAR
4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

1. Introduction

1.1. Workshop Time and Place

The Review Workshop for SEDAR-58 Atlantic cobia stock assessment was held on November 19-21, 2019 in Beaufort, NC.

1.2. Terms of Reference

1. Evaluate the data used in the assessment addressing the following:
   - Are data decisions made by the DW and AW sound and robust?
   - Are data uncertainties acknowledged, reported, and within normal or expected levels?
   - Are data applied appropriately within the assessment model?
   - Are input data series reliable and sufficient to support the assessment approach and findings?

2. Evaluate the methods used to assess the stock, taking into account the available data.
   - Are methods scientifically sound and robust? Do the methods follow accepted scientific practices?
   - Are assessment models configured appropriately and applied consistent with accepted scientific practices?
   - Are the methods appropriate for the available data?

3. Evaluate the assessment findings with respect to the following:
   - Are population estimates (model output – e.g. abundance, exploitation, biomass) reliable, consistent with input data and population biological characteristics, and useful to support status inferences?
   - Is the stock overfished? What information helps you reach this conclusion?
   - Is the stock undergoing overfishing? What information helps you reach this conclusion?
   - Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?
   - Are the quantitative estimates of the status determination criteria for this stock appropriate for management use? If not, are there other indicators that may be used to inform managers about stock trends and conditions?

4. Evaluate the stock projections, addressing the following:
   - Are the methods consistent with accepted practices and available data?
   - Are the methods appropriate for the assessment model and outputs?
   - Are the results informative and robust, and useful to support inferences of probably future conditions?
   - Are key uncertainties acknowledged, discussed, and reflected in projection results?

5. Consider how uncertainties in the assessment, and their potential consequences, are addressed.
   - Comment on the degree to which methods used to evaluate uncertainty reflect and capture all sources of uncertainty in the population, data sources, and assessment methods.
   - Are the implications of uncertainty in technical conclusions clearly stated?

6. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted.
   - Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
   - Provide recommendations on possible ways to improve the SEDAR process.

7. Provide suggestions on improvements in data or modeling approaches which should be considered when scheduling the next assessment.

8. Prepare a Peer Review Summary of the Panel's evaluation of the stock assessment, addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Peer Review Summary Report in accordance with project guidelines.

1.3. List of Participants

Review Panelist	
Jeff Buckel	ASMFC Review Panel Chair
Gary Nelson	ASMFC Reviewer
Alistair Dunn	CIE Reviewer
John Casey	CIE Reviewer
Matt Cieri	CIE Reviewer
Appointed Observers	
Collins Doughtie*	SAFMC Mack/Cobia AP
Bill Gorham	SAFMC Mack/Cobia AP
Wes Blow	SAFMC Mack/Cobia AP
Analytical Representatives	
Katie Siegfried	SEFSC Beaufort Lead analyst
Kyle Shertzer	SEFSC Beaufort
Erik Williams	SEFSC Beaufort
Rob Cheshire	SEFSC Beaufort
Council and Agency Staff	
Kathleen Howington	SEDAR
Cierra Graham	SAFMC
Mike Schmidtke	ASMFC
Review Workshop Attendees	
Jie Cao	NC State Morehead City, NC
Erik Fitzpatrick	NOAA Beaufort, NC
Amy Scheuller	NOAA Beaufort, NC
Matt Damiano	NC State Morehead City, NC
Riley Gallagher	NC State Morehead City, NC
Joseph W. Smith	Morehead City, NC
Amanda Tong	NCDMF Morehead City, NC
Chris Batsavage	NCDMF Morehead City, NC

**Participants noted with an Asterix were unable to attend the workshop*

1.4. List of Review Workshop Working Papers & Documents

Documents Prepared for the Review Workshop		
SEDAR58-RW01	An Age Structured Production Model for Atlantic Cobia	Siegfried, 2019
SEDAR58-RW02	Public Comment Forum	SEDAR 2019
Reference Documents		
SEDAR58-RD46	The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural systems and aquaculture	Lorenzen, 1996
SEDAR58-RD47	Bias in common catch-curve methods applied to age frequency data from fish surveys	Nelson, 2019

2. Review Panel Report

2.1. Executive Summary

The Review Workshop for SEDAR-58 Atlantic cobia stock assessment was held on November 19-21, 2019 in Beaufort, NC. The Atlantic cobia assessment team (AT) provided an assessment report and presentations that were reviewed by the Review Panel (RP). The RP consisted of three CIE reviewers, an ASMFC appointed reviewer, and an ASMFC appointed chair. The AT provided presentations on the background of the stock assessment, sensitivities, and projections. Additionally, the RP requested other sensitivities and ensemble runs that were addressed during the review workshop and are described below. The RP responded to seven Terms of Reference (ToRs, see above) that covered data used, assessment methods, assessment findings and projections, uncertainty, research recommendations, and improvements to data or modeling approaches.

The Data Workshop (DW) satisfactorily assembled data, time series, and the necessary life history information needed for the model; however, the RP did not see justification for certain data decisions made by the DW (e.g., change in methodology to estimate natural mortality). The uncertainty in data inputs was well described and the RP identified four major sources of data uncertainty: commercial and recreational removals, age compositions for the recreation fishery before 2007, length compositions for the commercial fishery, and the assumed rate of natural mortality. Additionally, the RP recommended further examination of the 1996 and 2015 recreational removals.

Data were used appropriately in the age-structured assessment (Beaufort Assessment Model) and the methods were scientifically sound, followed accepted scientific practices, were configured appropriately, and were appropriate for the available data. There was no clear stock-recruitment relationship and the use of mean recruitment with deviations was appropriate. The RP asked why the time-block selectivity (i.e., two selectivities, one for the early and one for the late period of the head-boat index) was applied to the head-boat index given that the explanation for time-varying selectivity in the targeted fishery would likely not apply to the non-targeted head-boat fishery. The AT agreed and compared age-composition fits with and without time-block selectivity. The time-invariant selectivity for the head-boat index had better fits in recent years and was consistent with the fishery; this model was chosen as the revised base model for Atlantic Cobia.

The modeled population estimates (e.g., abundance, exploitation, and biomass estimates) were reliable given the assessment assumptions and observations. The assessment panel proposed reference points of $F_{40\%}$ as a proxy for F_{MSY}, $SSB_{F40\%}$ as a proxy for SSB_{MSY}, and 75% of $F_{40\%}$ and 75%SSB as target reference points. The estimates of SSB and F for Atlantic Cobia show the population has been above $SSB_{F40\%}$ and below $F_{40\%}$ since the beginning of the modeled period (1986); thus, the stock is not overfished and overfishing is not occurring. The RP noted that the model estimates of population size, status, and trend were consistent with the known and assumed population parameters, and that the model used the best available science and was adequate to support stock biomass and stock status inferences. For example, the trends in biomass estimates from the assessment were consistent with the head-boat index.

Projections were carried out appropriately using accepted practices given the data available and were appropriate for the assessment model and required outputs. Projections for removals in numbers, F, SSB (mt) and recruits (numbers at age 1) were carried out for the years 2020-2024 at $F = F_{current}$, $F = F_{40\%}$, and $F = 75\%\ F_{40\%}$. The mean deterministic and median stochastic estimates of SSB were greater than $SSB_{40\%}$ for these years. However, given the uncertainty around inputs, there was a small (12%, $F_{current}$) to moderate (50%, $F = F_{40\%}$) percentage of stochastic simulations that resulted in an overfished status (SSB< $SSB_{F40\%}$). The RP concluded that the projection results are informative and robust and are useful to support inferences of future stock status and biomass. The key uncertainties were reflected in projection results.

The key uncertainties within the assessment model were well described by the AT in the assessment document (SEDAR-58-addendum). The main uncertainty was in estimates of natural mortality (M) and less significant uncertainties in the choice of steepness (h) of the stock-recruit relationship and the estimated maturation ogive. Ensemble model bootstraps used estimates of M based on 2x the standard error of the M around the regression line for the estimated mean size of Cobia at age. The RP noted that that while the estimates of M were very uncertain, the outcomes of the assessment showed that the stock was highly unlikely to be below the $SSB_{F40\%}$ reference point.

The following research recommendations should be given high priority because of the importance to the stock assessment model: develop a new index of abundance, increase sample size (such as expanding carcass collection locations and establishing similar programs in other states) of size- and age-compositions in harvested and released fish, improve information on age-at-maturity and annual sex ratios, and use tagging data or other analytical approaches (e.g., meta-analysis, catch-curves, etc.) to ground-truth the estimate of natural mortality. Additionally, the RP recommended that additional research on steepness (h) and a full description of landings changes from SEDAR-28 through SEDAR-58 be conducted. Lastly, there was small evidence of lack of fit to age-composition data and the RP recommended that the AT consider alternative selectivity shapes in future assessments.

The assessment has only a single index of abundance (the head-boat CPUE index). Due to recent management closures, this index was not available for years since 2015. The RP noted that if there were future closures then this index of abundance will not be available in future years. Currently there are no other suitable indices of abundance available. The RP strongly recommended that additional indices of abundance be developed and that preferably, these be fishery-independent.

The RP noted that the SEDAR stock assessment review process would be improved if the Chair of the Data Working Group were to attend the review panel meeting, and be available to assist the AT describe decisions relating to the choice of data. The RP recommends that SEDAR request a document or DW report section that summarizes main decisions and descriptions of why that decision was made at the data workshop. Additionally, a separate document that contains information pertaining to final data streams used in the assessment, including the summary of the rationale for the data choices, would be helpful.

While the AT has proposed $SSB_{40\%}$ and $F_{40\%}$ reference points for this stock that are based on a long history of use in other locations and for similar stocks, further work with fishery managers on goals and objectives is advised prior to conducting a new benchmark. Proposed reference points could then be fully evaluated while a new assessment is conducted. The reference points proposed are based on MSY proxies and management could consider reference points consistent with levels of risk tolerance.

The RP reached consensus on all its recommendations and conclusions and there is no minority report.

2.2. Statements addressing each TOR

1. Evaluate the data used in the assessment, addressing the following:

- *Are data decisions made by the DW and AW sound and robust?*

Details on data processing were provided to the RP through Data Workshop (DW) and Assessment Workshop (AW) reports. The DW and AW groups made considerable efforts to provide the best data for use in the assessment. The primary data sources used in the assessment were commercial landings assembled through ACCSP/State records, commercial dead discards derived from standard live discard/landings ratios and a constant discard mortality of 0.55, the MRIP harvest and dead releases derived from live releases and a constant release mortality of 0.05, and length and age data collected primarily through state carcass collection programs.

The relative ratio of recreational to commercial landings are approximately 95:5. The AW had low confidence in data collected prior to 1986, so only data from 1986-2017 were used in the assessment. The RP agreed that the decisions made by the DW and AW during data analysis and assembly were reasonable and sound.

The RP concluded that data working groups satisfactorily assembled data and the necessary life history information needed for the model.

However, the RP noted that the justification for some of the data decisions that may have major influences on the assessment results were not well described; these were the choice of abundance indices, the rate of natural mortality (i.e., switching the value of *M* from Lorenzen (1996) to Charnov et al. (2013)), and the maturity ogive. In a few cases, there were no descriptions of how data were derived (e.g., state gutted to total weight conversion factors).

- *Are data uncertainties acknowledged, reported, and within normal or expected levels?*

The DW and AW identified the major sources of data uncertainty and provided adequate information in the data and assessment reports for the panel to judge the quality of the data sources. In addition, the DW and AW had provided parameter error bounds for use in the sensitivity and ensemble model runs.

The RP identified that the major sources of uncertainty in the assessment were:

1. *Uncertainty in commercial and recreational landings and discards;*
2. *Uncertainty in the age compositions for the recreational fishery for years before 2007 due to small sample sizes;*
3. *Uncertainty in the length compositions for the commercial fishery due to very small sample sizes; and*
4. *The assumed rate of natural mortality (M).*

Coefficients of variation for the commercial landings, recreational landings and discards, and head-boat index were within ranges considered realistic and adequate for assessment purposes. However, CVs for the commercial discards appeared unrealistically high and the RP noted that the values of these CVs should be investigated in the future to ensure that they were correctly estimated. The RP noted that the revised base case (co23, SEDAR-58-Addendum) applied a maximum cap on the CV for commercial discards of 3.0 in the ensemble modeling analysis. However, the RP noted that due to the very small amount of removals associated with commercial discards, that this revision would not have any significant impact on the ensemble modeling outcomes.

The RP identified that the distribution and bounds on the values of the plausible rates of natural mortality (*M*) used in the ensemble modeling were based on the standard error estimates from Charnov et al. (2013) and were likely to be unrealistically narrow. Hence the RP recommended that the distribution and bounds for *M* for the new base ensemble modeling (co23, SEDAR-58-Addendum) use the values from the Charnov et al. (2013) regression equation when the equation slope and intercept were adjusted using $\pm$2 standard errors.

- *Are data applied appropriately within the assessment model?*

The RP concluded that, based on assessment model diagnostics and output, the time series of removals (i.e. catch and dead discard estimates), length and age composition data, and the head-boat CPUE index of abundance were used appropriately in the BAM model.

- *Are input data series reliable and sufficient to support the assessment approach and findings?*

The RP agreed that the data used in the stock assessment were the best available data, and that the working groups satisfactorily characterized removals from all data sources.

The RP had concerns about the reliability of recreational removals in the 1996 and 2015 years, as recreational catch estimates for these where unusually high when compared with the neighboring years. A sensitivity run (SEDAR-58-Addendum) in which the values were replaced with the mean values from the neighboring four years showed these values had little influence on the model results. However, the RP suggested that these high catches should be investigated further to determine the underlying cause for the increases.

The RP noted that the age composition data appeared sufficient and reliable because several cohorts could be tracked through the data over time.

The RP noted that only a single index of abundance was available for this assessment (the head-boat CPUE index), and due to recent management closures of the recreational fishery, this index was not available for years since 2015. The RP noted that if there were future closures then this index of abundance will not be available in future years. Currently, there are no other suitable indices of abundance available.

The RP strongly recommended that additional indices of abundance be developed and that preferably, these be fishery independent. The RP noted that spatial/temporal analyses of catch and effort data (i.e., using gaussian random fields as, for example, implemented in VAST (Thorson 2019)) may provide a means to develop an index of abundance using the recreational catch and effort data. However, the RP recommended that approaches using, for example, the baited trap-camera time series (SERFS) that has been carried out in the region may provide a useful index of abundance if these data were analyzed for Atlantic Cobia.

2. Evaluate the methods used to assess the stock, taking into account the available data.

- *Are methods scientifically sound and robust? Do the methods follow accepted scientific practices?*

The Beaufort Assessment Model (BAM) (Williams & Shertzer 2015) was the primary assessment model, which was implemented with AD-Model Builder software. This model estimated biomass and selectivity parameters using assumed catches and productivity parameters. The estimates were obtained by minimizing an objective function consisting of likelihoods applied to CPUE, age composition data, and length composition data, along with uniform priors on estimated parameters with exception of those that had an assumed functional form. BAM has previously been used in

SEDAR assessments, and has been simulation tested. The version of BAM was set up to match the data availability of Atlantic Cobia.

The AT demonstrated they were familiar with the modeling software and were competent in its application. The model was documented in the assessment report (SEDAR-58-addendum) and the AD-Model Builder code was supplied as an appendix to the assessment report. The RP was confident that the model was scientifically sound, robust, and appropriate for the available data.

The RP closely reviewed output from the non-revised base case run (co22) and revised base case run (co23, see SEDAR-58-addendum). Model diagnostics, model sensitivities, analyses to investigate uncertainties, ensemble models, projections, and some supplementary analyses were examined by the RP (see Section 2.3 for a list of supplementary analyses). A full description of the revised base case assessment model is given in SEDAR-58-addendum.

Model observations were a CPUE index from recreational catch and effort for head-boats, comprising of about 5% of the total catch from recreational fishers, age composition data obtained from carcass samples of recreational landings, and a length composition data for commercial landings. The head-boat CPUE indices suggested a small increase in abundance over the time period of the index (1991-2015).

Estimates of removals (landings and dead discards) were via two fleets: the commercial fleet (comprising of a minority of removals) and the recreational fleet. The model estimated the removals with a low CV to resolve the Baranov catch equation and not to model the uncertainty in removals. Estimated removals from the model were almost identical to the observed removals (Figure 1).

Commercial catch was modelled with a selectivity fitted to the commercial length frequency compositions. The length composition data were an aggregate over the years due to the low annual sample sizes. The RP noted the lack of age data for the commercial catch, but given the low level of commercial catch (about 5% of total catch), the review panel considered that the use of length composition data was adequate for determining the selectivity pattern for the commercial fleet in the assessment model.

Recreational catch was fitted using two selectivity patterns – the first for years between 1986 and 2006, and the second for years since 2007. The head-boat index was initially modelled as the vulnerable abundance using the early period recreational selectivity for the period up to 2006, and the later period selectivity for the period from 2007 (co22, SEDAR-58-assessment model). However, as the head-boat index was only for a small proportion of the recreational fishery that did not target Cobia and was unlikely to have changed its fishing pattern over that period, the RP recommended that the head-boat index be interpreted using the vulnerable abundance from the pre-2007 selectivity pattern (co23, SEDAR-58-Addendum). This revised base case assessment model (co23) was recommended by the RP for the assessment of Atlantic Cobia.

The RP noted that the model convergence was good with analyses of the alternative starting values showing no evidence of failure to converge for the non-revised base model (co22).

While the model was sensitive to the choice of *M*, the RP noted that the Charnov et al. (2013) approach was supported from both external sources as well and internal diagnostics when compared to lower Lorenzen (1996) estimates. Use of *M* lower than the current approach resulted in inferior model diagnostics (Figure 2). However, the Review Panel suggested examination of *M* is warranted for future assessments and recommended starting with the 2015 SEDAR data best practices document.

Recruitment was highly variable with no clear stock-recruitment relationship (see SEDAR-58-addendum). As such the use of mean recruitment with deviations was appropriate.

- *Are assessment models configured appropriately and applied consistent with accepted scientific practices?*

The RP concluded that the model was configured appropriately and applied consistently with accepted scientific practices after recommended changes were made to the base model

The RP supported the use of two fleets with a time block of selectivity for the recreational fleet at 1986- 2006 and a second time block 2007-2017. Changes in management measures and an increase in the VA catch likely increased the targeting of smaller fish since 2007. This change is reflected in the estimated selectivities (Figure 3)

Diagnostics suggested that the starting year of 1986 was appropriate. Data prior to 1986 are likely unreliable. Further sensitivity analysis supported the AT's use of 1986 as a start year for the assessment as there wasn't a clear difference when pushing the start year back to SEDAR-28 value of 1950 (Figure 4).

The RP did recommend changing the base model to have only one block for selectivity (1986 to 2006 recreational selectivity) in the head boat fishery dependent index of abundance. This resulted in a new base case run (revised base case assessment; Co23). The revised base case assessment was more consistent as it was unlikely that the management changes would have affected the head-boat CPUE index, given that it was not targeting cobia. When compared to the base run as recommended by the AT, the revised base case had some small differences in the diagnostics of model fit, but the changes were minor. Further, the revised base case model (with non-revised base case HB weights; sens14a) typically had a lower negative log likelihood for the age composition fits in the most recent years (Table 1).

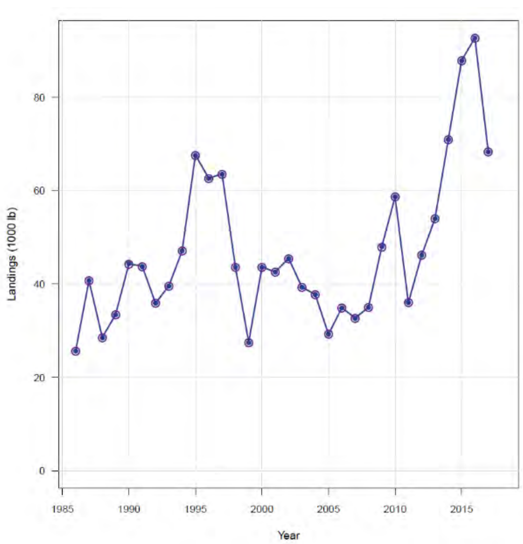
- *Are the methods appropriate for the available data?*

Given that most of the data are catch-at-age composition data, a statistical catch-at-age approach such as the BAM, which fully utilizes these data is likely the best approach. The RP did discuss the potential of other approaches, but these were even less likely to be successful given the importance of compositional age data and the lack of a current index of abundance (the head-boat CPUE index of abundance time series ended two years prior to terminal year).

As such the use of the age data in the assessment seems appropriate and was applied using acceptable methods, especially after moving to the revised base case as recommended by the RP.

Table 1: Yearly negative log likelihoods for age-composition fits from three runs examining selectivity: co22 (non-revised base case), sens14a (2 time blocks for selectivity with first time block applied to head-boat index of abundance), and sens15 (1 time block for selectivity). Sens14a is the revised base case but with likelihood weight on head-boat index from non-revised base case.

	co22	sens14a	sens15
1986	44.778	44.803	43.831
1987	36.087	36.098	38.667
1989	137.910	138.060	137.870
1990	141.306	141.483	138.400
1991	26.599	26.586	27.256
1992	28.823	28.849	29.101
1995	23.531	23.544	24.596
1996	60.886	60.993	61.464
1997	30.925	30.769	30.523
1999	249.833	250.169	251.431
2000	240.678	240.981	242.119
2001	99.538	99.776	98.903
2002	54.123	54.248	55.387
2005	95.815	96.362	99.389
2006	137.570	137.730	137.547
2007	341.990	342.178	342.064
2008	410.445	410.879	410.493
2009	484.010	484.044	485.065
2010	627.468	627.281	628.063
2011	469.958	469.662	469.736
2012	507.673	507.711	508.450
2013	749.187	748.787	749.533
2014	805.321	805.013	804.939
2015	848.079	848.063	847.913
2016	663.435	663.177	663.284
2017	490.955	490.818	491.071



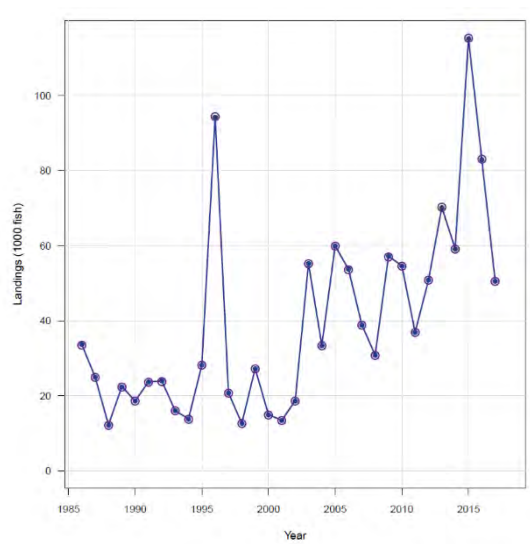


Figure 1: Comparison of estimates verses observed removals for (left) the commercial removals, and (right) the recreational removals. Open circles indicate observed removals and closed circles the estimated removals from the model.

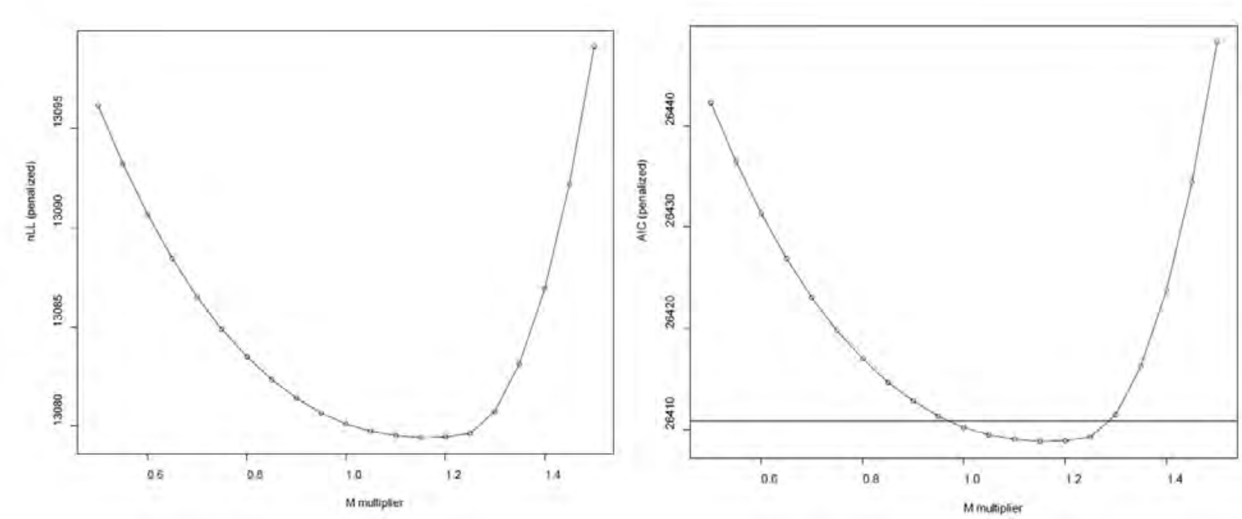
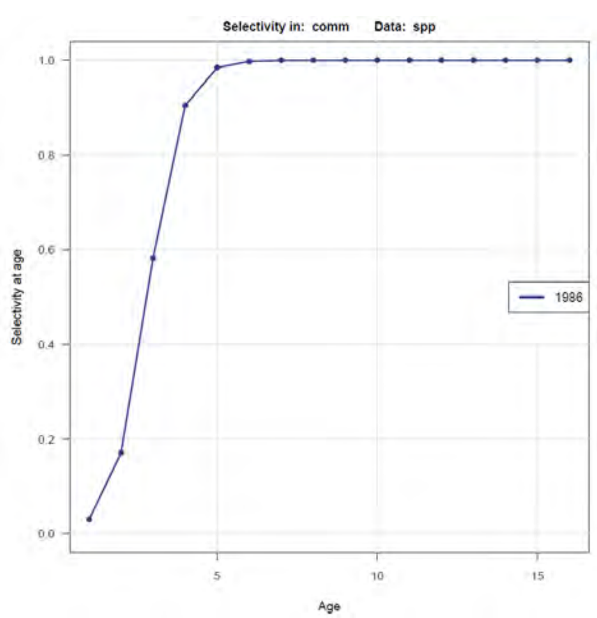


Figure 2: Negative Log likelihood and AIC at various values of natural mortality, shown as a multiplier on the value of M



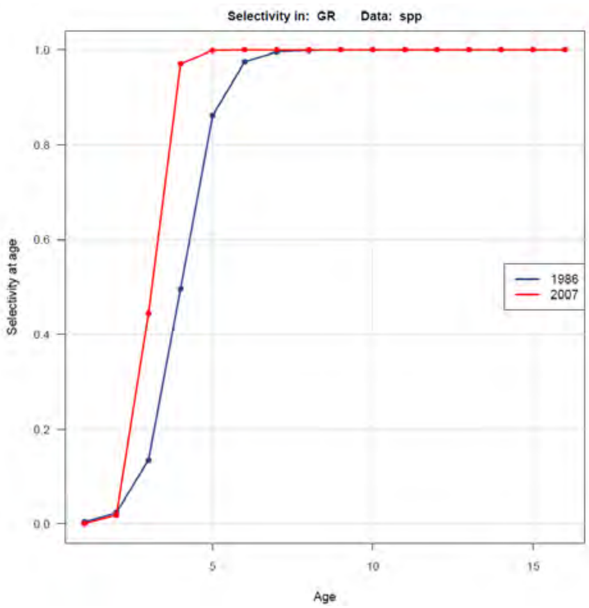


Figure 3: Selectivity curve for the commercial (top) and recreational fishery (bottom). Note that two time blocks on fishery selectivity are used 1986-2006 (blue) and 2007-2017 (red).

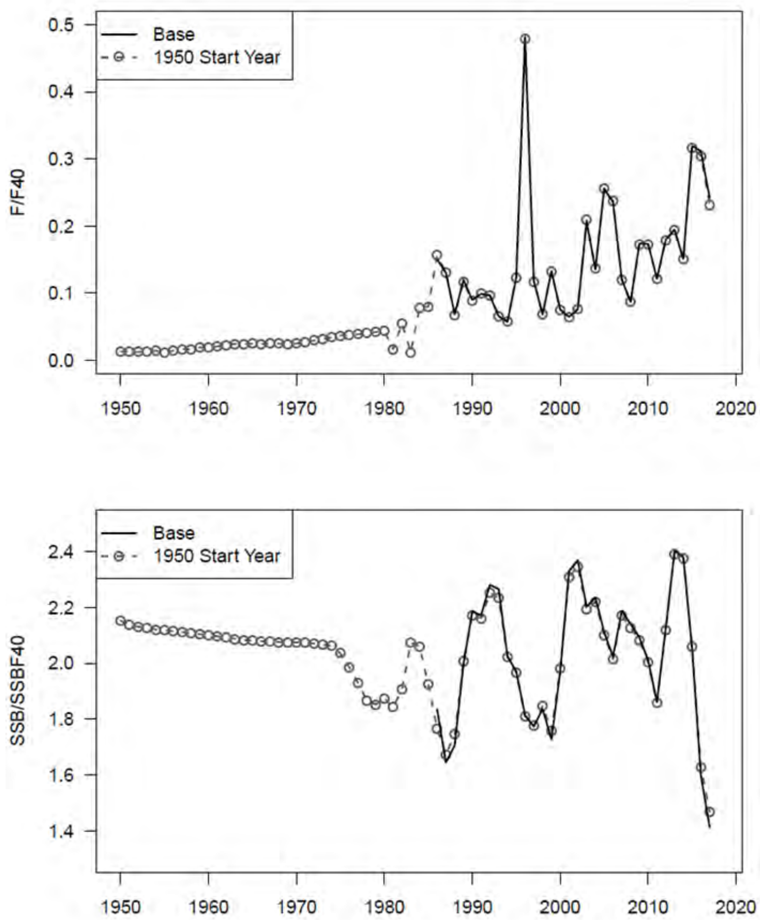


Figure 4: Start year value sensitivity. ratio of F to F40% (top), ratio of SSB to SSBF40% (bottom)

3. Evaluate the assessment findings with respect to the following:

   - *Are population estimates (model output – e.g., abundance, exploitation, biomass) reliable, consistent with input data and population biological characteristics, and useful to support status inferences?*

The RP concluded that the modelled population estimates (e.g., abundance, exploitation, and biomass estimates) were reliable given the assessment assumptions and observations.

The RP noted that the AT had recommended reference points of $F_{40\%}$ as a proxy for F_{MSY} and $SSB_{F40\%}$ as a proxy for SSB_{MSY}. The RP also noted that the AT had provided model outcomes based on 75% of $F_{40\%}$ as the target reference point as this provided an uncertainty buffer around the B_{MSY} proxy.

The AT provided estimates of SSB and F for Atlantic Cobia that showed the population had been above $SSBF_{40\%}$ since the beginning of the modeled period (1986) and had trended up over that time from about 1.5 x $SSB_{F40\%}$ to about 2 x $SSB_{F40\%}$. However, in the most recent three years the biomass had reduced to about 1.5 x $SSB_{F40\%}$ in the terminal year in 2017 (Figure 5 and Figure 6).

The RP found that the biomass estimates were consistent with the head-boat index with no evidence of departure from the assumptions of constant variance or trend in residuals (Figure 6).

Model fits to the recreational catch age composition data were adequate over the time period where these data were available and no evidence of systematic trend in the annual age composition fits (Figure 7). Model fits across ages suggested some small evidence of lack of fit, specifically for ages 4-5 (Figure 8), and the RP panel recommended that the AT consider alternative selectivity shapes that may account for this pattern in future assessments.

The RP noted that only a single index of abundance was available for this fishery (the head-boat CPUE index), and that due to recent management closures of the recreational fishery, this index was not available for years since 2015. The RP noted that if there were future closures then this index of abundance will not be available in future years. Currently there are no other suitable indices of abundance available.

The RP strongly recommended that additional indices of abundance should be developed and that preferably, these be fishery-independent. The RP noted that spatial/temporal analyses of catch and effort data (i.e., using gaussian random fields as, for example, implemented in VAST Thorsen (2019)) may provide a means to develop an index of abundance using recreational data. However, the RP recommended that approaches using, for example, the baited trap camera time series (SERFS) that has been carried out in the region may provide a useful index of abundance if these data were analyzed for Atlantic Cobia.

The RP noted that the model estimates of population size, status, and trend were consistent with the known and assumed population parameters, and that the model used the best available science and was adequate to support stock biomass and stock status inferences.

The key uncertainties within the assessment model were well described by the AT in the assessment document (SEDAR-58-addendum), with the main uncertainty on the assessment outcomes were the estimates of natural mortality (M), and less significant uncertainties in the choice of steepness (h) of the stock-recruit relationship (see later) and the estimated maturation ogive.

Estimates of M were age-dependent, based on the life-history invariant assumptions using the regressions in Charnov et al. (2013). Ensemble model bootstraps used estimates of M based on 2x the standard error of the M around the regression line for the estimated mean size of Cobia at age. The RP noted that that while the estimates of M were very uncertain within the assessment model (co23, SEDAR-58-addendum), the outcomes of the assessment showed that the stock was highly unlikely to be below the $SSB_{F40\%}$ reference point.

The RP noted that the estimates of the maturation ogive in the model were uncertain but noted that a sensitivity that used a slightly right-shifted ogive (model sensitivity 11, see SEDAR-58-Addendum) showed that the model outcomes were relatively insensitive to the choice of the maturity ogive.

- *Is the stock overfished? What information helps you reach this conclusion?*

The reference points were not provided by the current management body to determine stock status. However, the RP noted $SSB_{F40\%}$was recommended as a reference point by the assessment panel. SSBF40% is commonly used in this region and globally as an appropriate management reference point.

The RP concluded that the results of the assessment model showed that the stock was highly unlikely to be below the $SSB_{F40\%}$ reference point for the period 2015 to 2017 (i.e., the terminal years of the model) (Figure 10). The assessment model stock projections (see later) also showed that it was highly unlikely that the stock was below the $SSB_{F40\%}$ reference point in the most recent years (2017—2019).

The RP concludes that in relation to the reference point recommended by the assessment panel ($SSB_{F40\%}$) the stock is not overfished.

- *Is the stock undergoing overfishing? What information helps you reach this conclusion?*

The reference points were not provided by the current management body to determine stock status. The RP noted $F_{40\%}$ was recommended from the assessment panel. $F_{40\%}$ is commonly used in this region and globally as an appropriate management reference point.

The assessment model showed that it was highly unlikely that the stock was above $F_{40\%}$ reference point for the period 2015 to 2017 (i.e., the terminal years of the model) (Figure 10). The assessment model stock projections (see later) also showed that it was highly unlikely that the stock was above $F_{40\%}$ reference point in the most recent years (2017—2019).

The RP concludes that in relation to the reference point recommended by the assessment panel ($F_{40\%}$), overfishing is not occurring.

- *Is there an informative stock recruitment relationship? Is the stock recruitment curve reliable and useful for evaluation of productivity and future stock conditions?*

The revised base case assessment model (co23) and all sensitivities assumed a steepness of h=1 (i.e., no relationship between spawning stock abundance and the mean number of recruits). The RP noted that there was no available information to support estimation of the value of h in the model, as stock size had remained high over the modeled period. Further, given the stock status the RP concluded that the choice of h was unlikely to affect the stock status estimates in the model nor the projections given the current and historical stock status. However, the RP noted that the choice of steepness would affect the value of the target and hence the stock status relative to the target reference points.

The RP recommended that additional research be conducted for the next assessment to consider evidence for the choice of h, for example from meta-analyses or similar approaches to determine plausible values on h to evaluate as sensitivities to the revised base case model

- *Are the quantitative estimates of the status determination criteria for this stock appropriate for management use? If not, are there other indicators that may be used to inform managers about stock trends and conditions?*

The RP noted that the quantitative estimates of the status determination criteria for this stock were appropriate for management, but also noted that there were no defined and approved management targets or thresholds by the current management body. However, the RP noted that this assessment used a proposed reference point of 75% $SSB_{F40\%}$ and $F_{40\%}$, and that $SSB_{F40\%}$ and $F_{40\%}$ were appropriate choices as proxies for Bmsy and MSY, with 75% $SSB_{F40\%}$ and $F_{40\%}$ likely to be appropriate proxies for management targets.

The RP noted that additional work by the AT on catch curve analyses (using regression estimators, Chapman-Robson estimators, and Poisson regression estimators) showed a similar pattern of a slight increase in total mortality Z (i.e., $F + M$) over time with values that were consistent with the assessment modeling results (Figure 11).

The RP did not identify other status indicators that may be appropriate to inform managers.

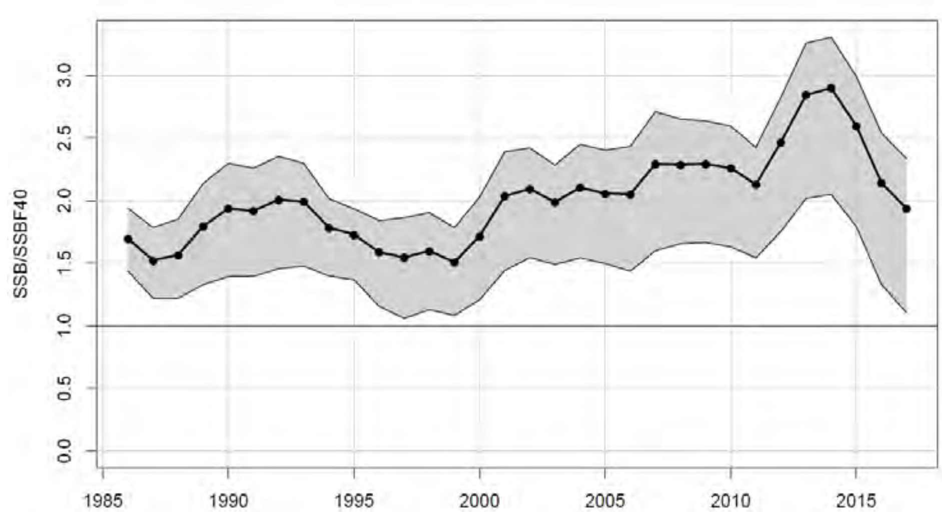


Figure 5: The 95% range for the estimates of SSB/SSBF40 from the ensemble models (grey shaded region) with the revised base case (co23, solid line) for the assessment model for 1986-2017.

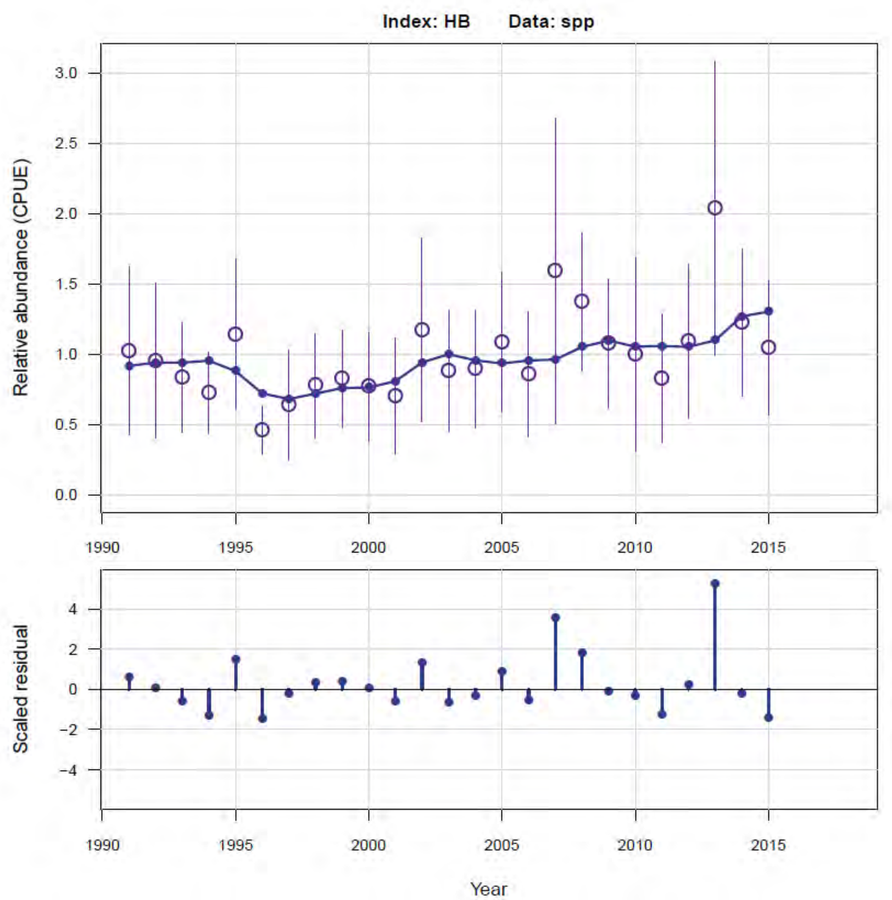


Figure 6: Revised base case model (co23) fits (top) and residuals (bottom) to the head-boat CPUE index of abundance for 1991-2015.

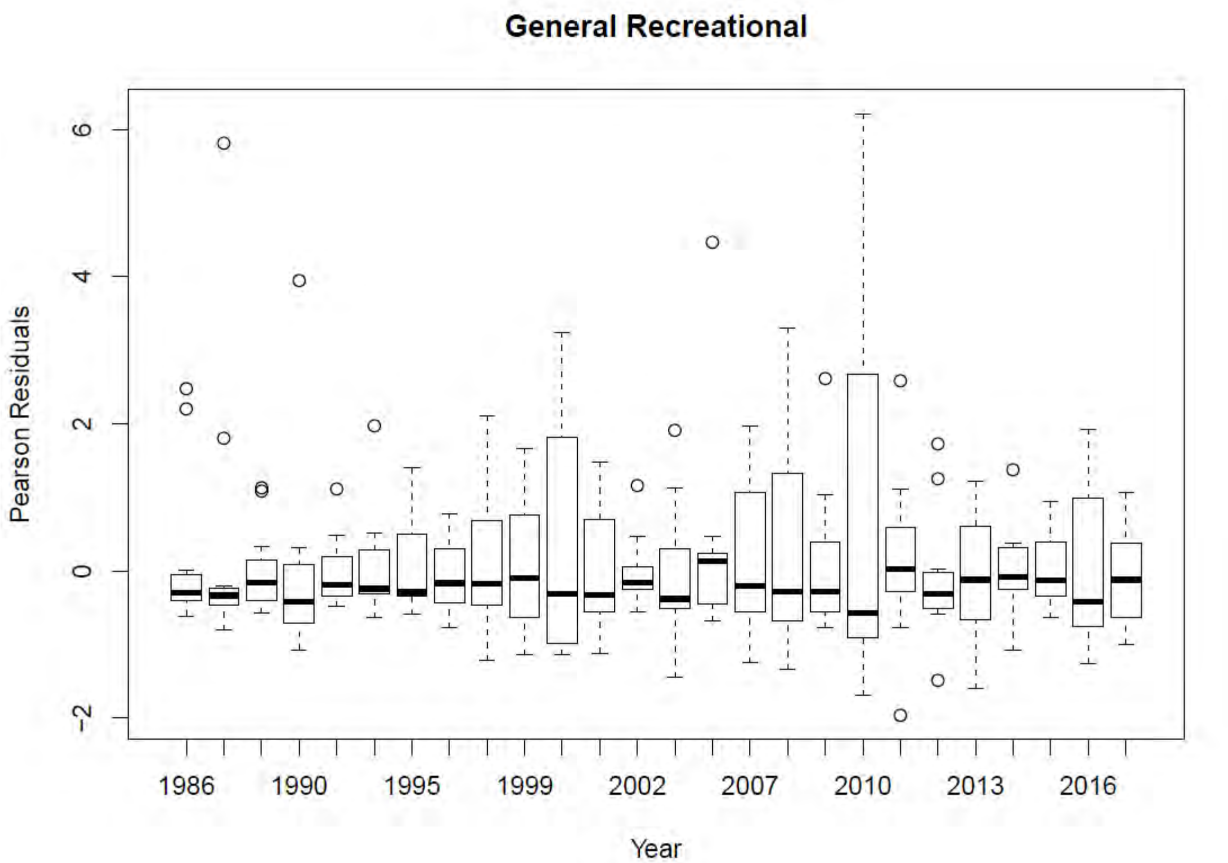


Figure 7: Pearson residuals for the age composition fits for years 1986-2017 for the revised base case model (co23)

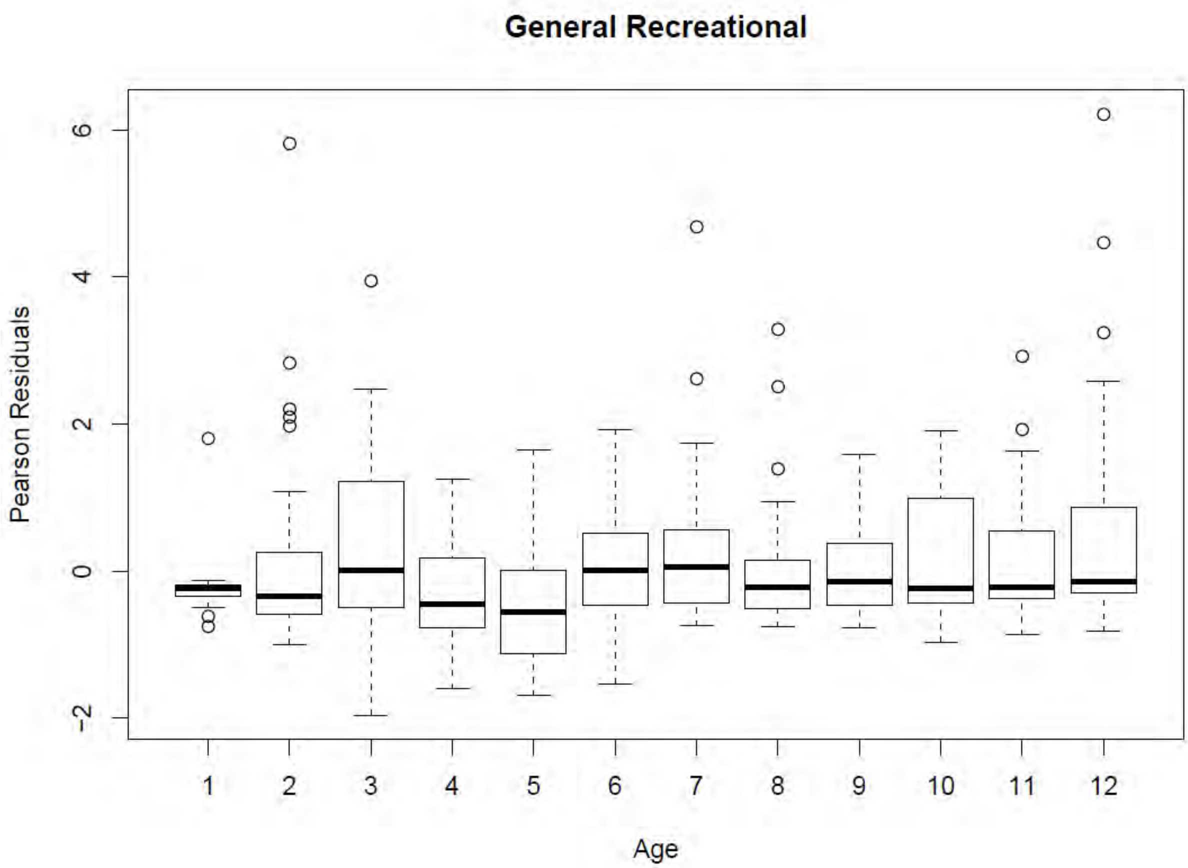


Figure 8: Pearson residuals for the age composition fits for ages 1-12 over the years 1986-2017 for the revised base case model (co23)

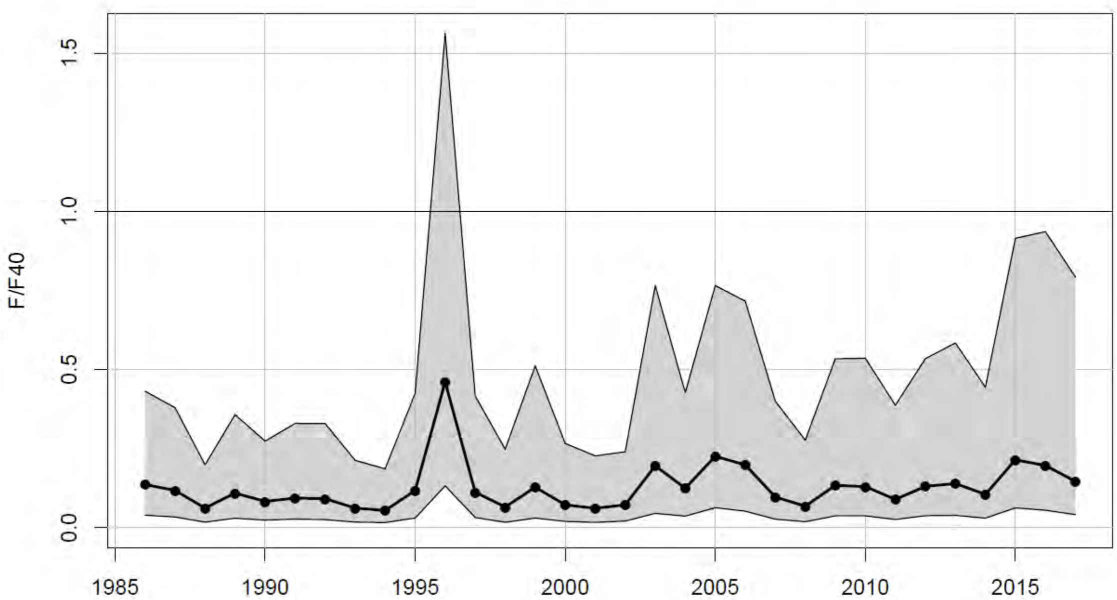


Figure 9: The 95% range for the estimates of F/F40 from the ensemble models (grey shaded region) with the revised base case (co23, solid line) for the assessment model for 1986-2017.

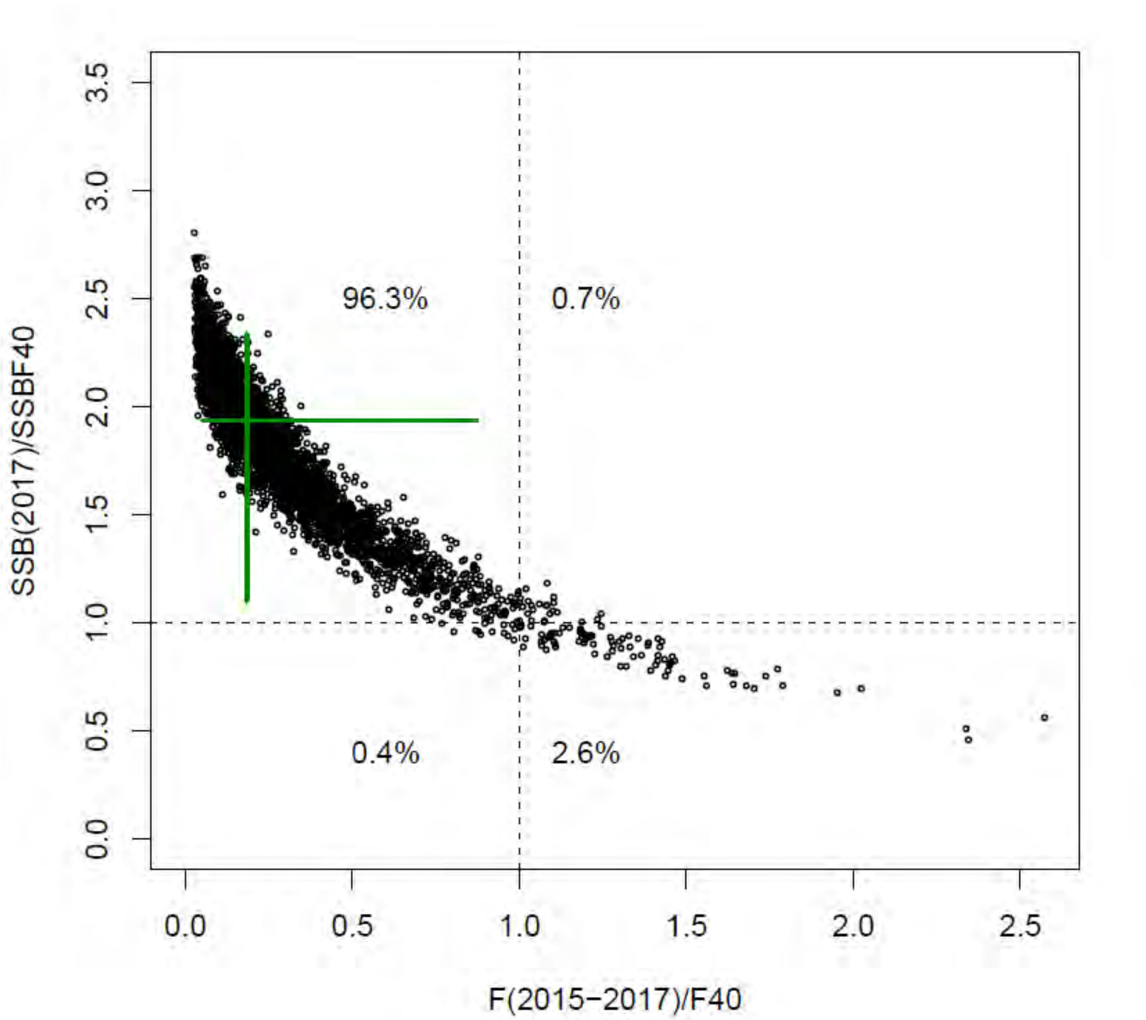


Figure 10: Ensemble model estimates of SSB(2017)/SSBF40 versus F(2015-2017)/F40 showing the proportion of ensemble model runs above and below the potential over-fishing and overfished reference points for Atlantic Cobia from the revised base case model (co23).

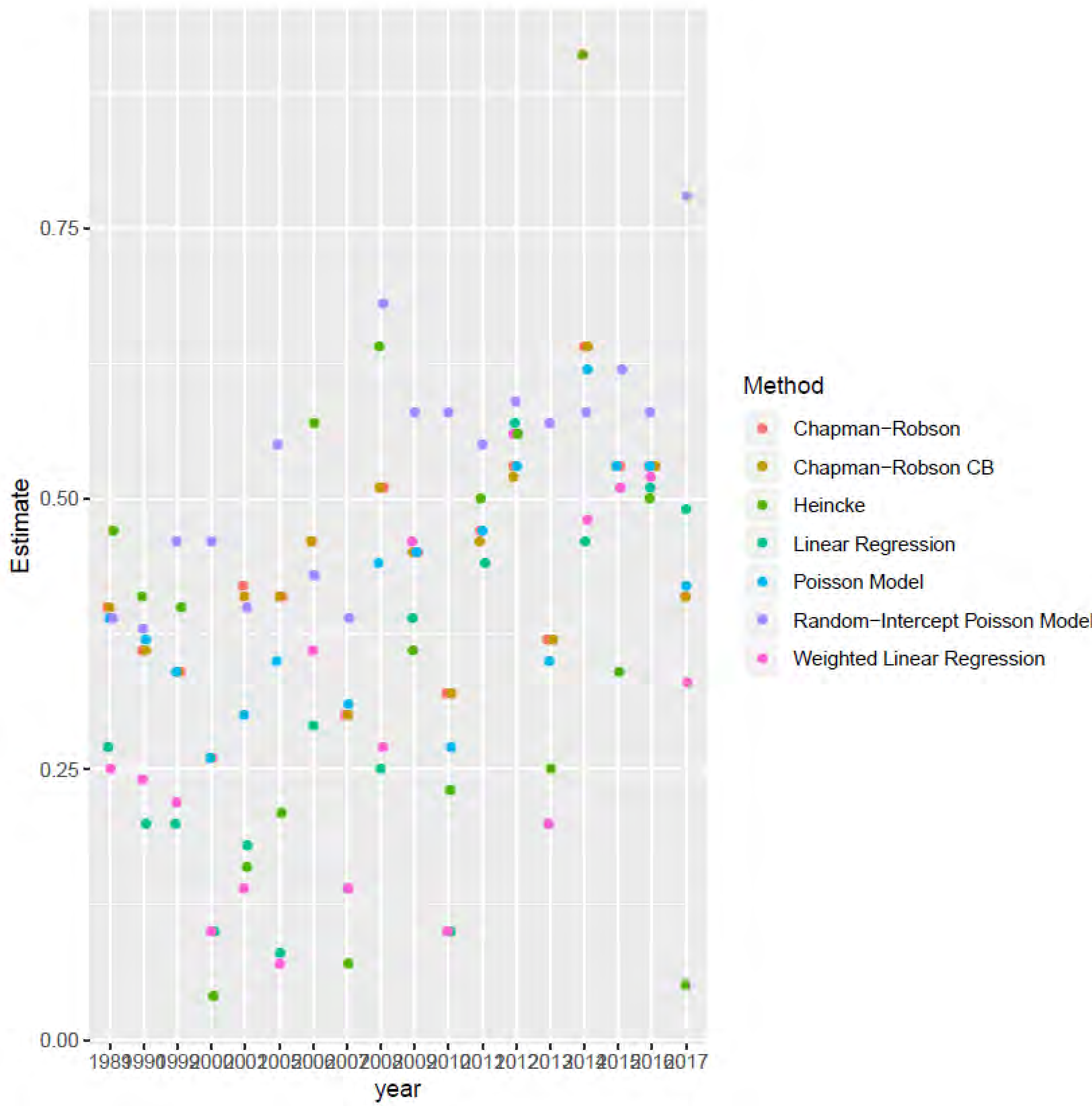


Figure 11: Catch curve estimates for 1989-2017 using regression Chapman-Robson, and Poisson regression estimators for Atlantic Cobia.

4. Evaluate the stock projections, addressing the following:

- *Are the methods consistent with accepted practices and available data?*
- *Are the methods appropriate for the assessment model and outputs?*

The RP concluded that projections were carried out appropriately using accepted practices given the data available and were appropriate for the assessment model and required outputs.

Projections for removals in number, F, SSB (000 mt) and recruits (000's at age 1) were carried out for the years 2020-2024 under 3 different scenarios:

1. *Scenario 1: F = Fcurrent, (where F current is computed as the geometric mean $F_{2015\text{-}2017}$)*
2. *Scenario 2: F = $F_{40\%}$,*
3. *Scenario 3: F = 75% $F_{40\%}$,*

Because the assessment period ended in 2017, the projections required an initialization period (2018 and 2019) for which it was assumed that total removals in weight were the mean removals in weight observed for the years 2015-2017. Given this mean removal in weight, the projection code determined the removal in numbers for 2018 and 2019 based on population attributes using the same equations used in the revised base model. Thus, there is a slight increase in the number of removals in 2019 relative to 2018 because the age- and size-structure of the population differed between the two years.

For each scenario, deterministic and stochastic projections were performed.

Population numbers at ages 2 and older in 2018 were derived from the assessment base run. For deterministic projections numbers at age 1 was arithmetic mean recruitment. For stochastic projections age 1 recruits were drawn from the lognormal distribution of recruitment values.

- *Are the results informative and robust, and useful to support inferences of probably future conditions?*
- *Are key uncertainties acknowledged, discussed, and reflected in projection results?*

The RP concluded that the projection results are informative and robust and are useful to support inferences of future stock status and biomass. The key uncertainties were well described and were reflected in projection results.

Results of projections are given in the Tables below (Tables 18 to 20 from SEDAR-58-Addendum) and Figures 12 to Figure 14.

Projection results for Scenario 1 ($F = F_{current}$), scenario 2 ($F = F_{40\%}$), and scenario 3 ($F = 75\%\ F_{40\%}$).

Table 18. Projection results with fishing mortality rate fixed at $F = F_{\text{current}}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1796	1399	0.16	0.22	6647	5333	82	87	2820	2908
2019	1796	1377	0.19	0.24	6060	5117	84	91	2820	2908
2020	1796	1389	0.10	0.15	6089	5112	46	58	1479	1817
2021	1796	1382	0.10	0.15	6306	5225	49	60	1553	1857
2022	1796	1385	0.10	0.15	6478	5327	51	62	1612	1905
2023	1796	1380	0.10	0.15	6606	5394	53	63	1653	1944
2024	1796	1383	0.10	0.15	6697	5443	54	64	1683	1967

Table 19. Projection results with fishing mortality rate fixed at $F = F_{40\%}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1796	1399	0.16	0.22	6647	5333	82	87	2820	2908
2019	1796	1377	0.19	0.24	6060	5117	84	91	2820	2908
2020	1796	1389	0.69	0.65	5046	4361	254	212	8041	6507
2021	1796	1382	0.69	0.65	4109	3618	205	171	5945	4980
2022	1796	1385	0.69	0.65	3751	3338	188	156	5141	4315
2023	1796	1380	0.69	0.65	3616	3234	181	151	4836	4082
2024	1796	1383	0.69	0.65	3566	3201	179	149	4722	3981

Table 20. Projection results with fishing mortality rate fixed at $F = 75\%F_{40\%}$ starting in 2020. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (mt), L = removals (landings and dead discards) expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb). The extension b indicates expected values (deterministic) from the base run; the extension med indicates median values from the stochastic projections.

Year	R.b	R.med	F.b	F.med	S.b(mt)	S.med(mt)	L.b(n)	L.med(n)	L.b(w)	L.med(w)
2018	1796	1399	0.16	0.22	6647	5333	82	87	2820	2908
2019	1796	1377	0.19	0.24	6060	5117	84	91	2820	2908
2020	1796	1389	0.52	0.49	5326	4591	202	168	6426	5188
2021	1796	1382	0.52	0.49	4602	4041	176	147	5222	4341
2022	1796	1385	0.52	0.49	4277	3804	165	137	4680	3921
2023	1796	1380	0.52	0.49	4132	3697	160	133	4437	3739
2024	1796	1383	0.52	0.49	4069	3656	158	131	4329	3659

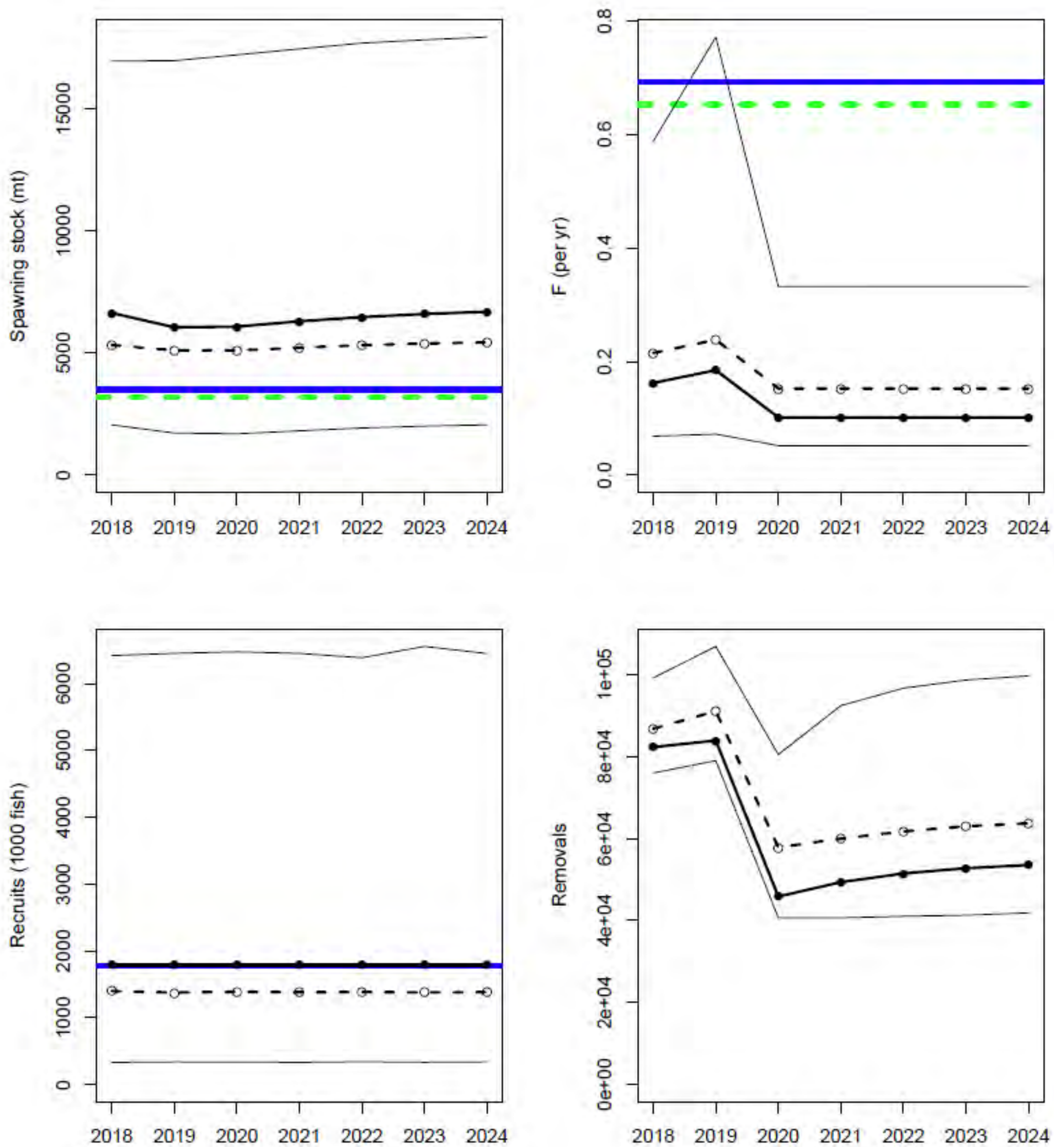


Figure 12: Results of projections for Scenario 1, F=Fcurrent. Solid black line = deterministic projection; dashes black line = median of stochastic simulations; thin black lines = lower (5%) and upper (95%) confidence intervals; green and blue horizontal lines = stochastic and deterministic reference levels respectively. Removals are in numbers.

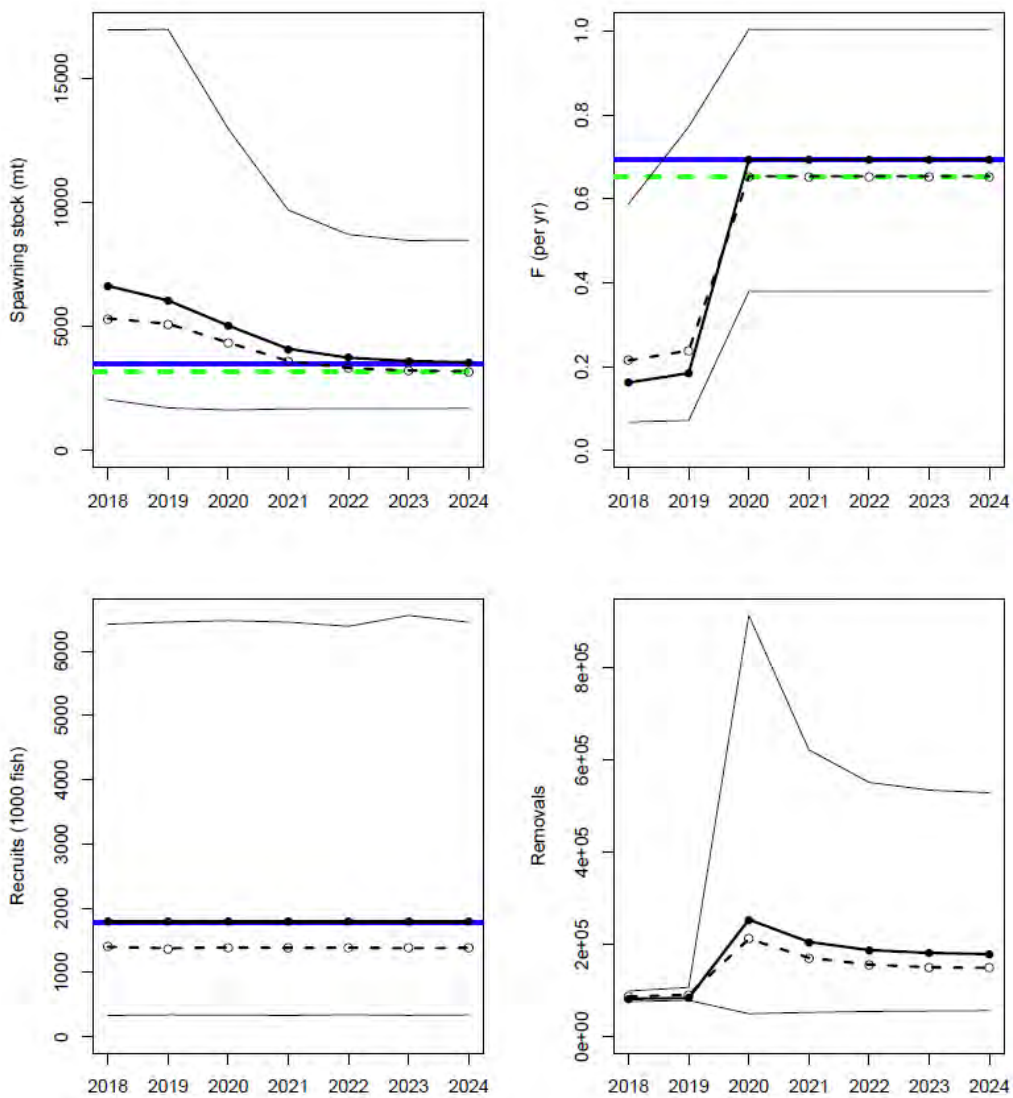


Figure 13: Results of projections for Scenario 2, F=F40%. Solid black line = deterministic projection; dashes black line = median of stochastic simulations; thin black lines = lower (5%) and upper (95%) confidence intervals; green and blue horizontal lines = stochastic and deterministic reference levels respectively. Removals are in numbers.

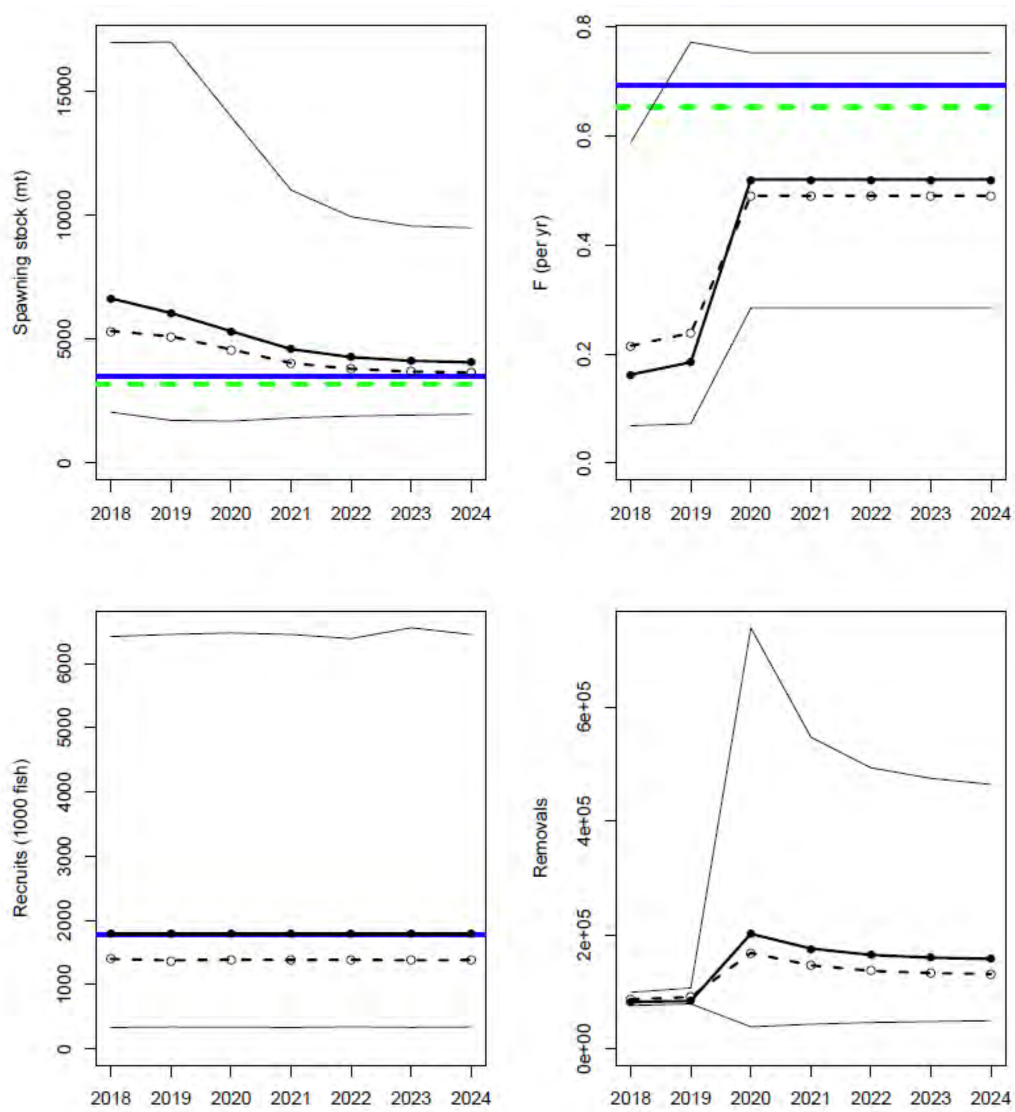


Figure 14: Results of projections for Scenario 3, F=75%F40%. Solid black line = deterministic projection; dashes black line = median of stochastic simulations; thin black lines = lower (5%) and upper (95%) confidence intervals; green and blue horizontal lines = stochastic and deterministic reference levels respectively. Removals are in numbers.

Results of deterministic and median estimates from stochastic projections were broadly similar although the 95% confidence intervals on stochastic estimates were relatively large indicating the uncertainty associated with the projection results. Such uncertainty was primarily driven by future recruit estimates being drawn from the historical variation about the mean recruitment because of an absence of a meaningful stock/recruit relationship. Nevertheless, examination of the proportion of stochastic projections runs where SSB falls below the SSBF40% reference point (Table 2) indicated that,

1. *If F=Fcurrent, the probability of the SSB falling below the biomass corresponding to $SSB_{F40\%}$ between 2020 and 2024 was less than 12%*
2. *If F=75%$F_{40\%}$, the probability of the SSB falling below the biomass corresponding to $SSB_{F40\%}$ between 2020 and 2024 was less than 35%*
3. *If F = $F_{40\%}$, the probability of the SSB falling below the biomass corresponding to $SSB_{F40\%}$ tended to 50% by 2024.*

Table 2: Proportion of stochastic projections where SSB< $SSB_{F40\%}$.

	F40	75% F_{40}	$F_{current}$
2018	0.19	0.07	0.07
2019	0.23	0.11	0.11
2020	0.3	0.14	0.12
2021	0.4	0.23	0.11
2022	0.46	0.31	0.09
2023	0.49	0.34	0.08
2024	0.5	0.35	0.08

5.Consider how uncertainties in the assessment, and their potential consequences, are addressed.

The RP noted that considerable efforts were made by the AW to address uncertainty in assessment model output through sensitivities and using the ensemble modeling approach. For the ensemble modeling, a total of 4000 simulation runs were made (with ~3200 usable) involving bootstrapping of observed input variables (landings, discard, head-boat index estimates, age and length composition data) and fixed variables (natural mortality, discard mortality and recreational landings and discards) using Monte Carlo sampling with the relevant uncertainties.

Sensitivity runs were performed to investigate responses in model output to changes in inputs and to investigate model behavior. Ten alternative sensitivity runs were initially presented. Most of the model runs had a similar status as the base-case run presented in the assessment report (SEDAR-58 assessment report). The sensitivity and ensemble analyses showed that the results were most sensitive to the choice of natural mortality (*M*). While uncertainty in the value of *M* did not significantly impact the status of the stock with regard to the proposed reference points, the RP noted that choice of *M* is important as the stock status will be sensitive to its value.

The RP requested additional sensitivity runs to investigate uncertainty in the input natural mortality at age, maturity at age, and the assumption of 2 time blocks for selectivity for the head-boat index. The sensitivity analyses presented in the assessment report are appropriate, informative, and highlight the sensitivity of model output to *M* at age. This result was further confirmed by the additional sensitivity runs carried out during the review meeting.

Figure 10 summarizes the results of ensemble runs with respect to the reference points for F and SSB. 97% of ensemble runs indicate that the stock of Atlantic cobia is not overfished with respect to the proxy reference point for B_{MSY} ($SSB_{F40\%}$) and that 96.7% indicate that with respect to the F_{MSY} proxy ($F_{40\%}$) that overfishing is not taking place (Figure 10). The small percentage of runs that indicated overfished or overfishing occurred when natural mortality was assumed to be at the very low end of its plausible range.

6.Consider the research recommendations provided by the Data and Assessment Workshops and make any additional recommendations or prioritizations warranted.

- *Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.*

The RP reviewed the large list of research recommendations made by the DW and AW groups. The RP recommends that the following DA and AW research recommendations should be given high priority because of the importance to the stock assessment model:

1. *Because the fishery-dependent index ended in 2015, development of a new index, either fishery-dependent or preferably fishery-independent, should be given top priority. Without an index of abundance, it is unlikely that stock status would be able to be estimated with any reliability in future. The RP recommend exploring other fisheries-dependent CPUE sources if available, developing fisheries-independent surveys such as egg/larvae surveys or close-kin methods, expanding analysis of the ten-year SERFS baited trap-video survey for cobia, or exploring the use of tag-data as potential indices of abundance.*
2. *Given that age composition data are an important source of information for the assessment model, methods to increase sample size (such as expanding carcass collection locations and establishing similar programs in other states) should be implemented. In addition, development of sampling programs to collect size and age information on fish released in the recreational fishery should be a priority.*
3. *The uncertainty in the stock status would be improved if better information on age-at-maturity and annual sex ratios were collected.*
4. *Natural mortality is an important parameter that affects model estimates of recruitment and spawning stock biomass. The RP recommends that estimates of natural mortality be made using tagging data or other analytical approaches (e.g., meta-analysis, catch-curves, etc.) for use in the model or to ground-truth the life-history invariant method used currently.*

- *Provide recommendations on possible ways to improve the SEDAR process.*

The RP noted that the SEDAR stock assessment review process would be improved if the Chair of the Data Working Group were to attend the review panel meeting, and be available to assist the AT describe decisions relating to the choice of data.

The RP noted that the DW report may be improved if summaries of descriptions of the reasons for data choices were provided. In the future, the RP noted that a separate document that contained only information pertaining to final data streams used in the assessment, including the summary of the rationale for the data choices, would be helpful. In this case, where the RP required additional detail on what has been done, then the workshop documents could be consulted. The RP recommends that SEDAR request a document or DW report section that summarizes main decisions and descriptions of why that decision was made at the data workshop.

7. Provide suggestions on improvements in data or modeling approaches which should be considered when scheduling the next assessment.

While the AT has proposed SSB40% and F40% reference points for this stock that are based on a long history of use in other locations and for similar stocks, further work with fishery managers on goals and objectives is advised prior to conducting a new benchmark. Proposed reference points could then be fully evaluated while a new assessment is conducted. The reference points proposed are based on MSY proxies and management could consider reference points consistent with levels of risk tolerance.

During the RW the RP noted some inconsistencies with regards to recreational landings; most notably the 1996 and 2015 catch. Further examination by the AT during the workshop provided no clear answers as to whether this was the result of the MRIP calibration or the result of other changes in the rec catch stream. Prior to the next assessment, a full description of landings changes from SEDAR-28 through SEDAR-58 should be conducted. This examination should be fully and completely documented in time for the next benchmark.

Work on an appropriate fishery-dependent or independent abundance index should be a priority. The current head-boat index as formulated through 2015 may not be useful after SEDAR-58. Additionally, development of a fishery-independent index is preferred. Lack of an appropriate index would likely prevent a quantitative assessment of this stock from moving forward.

The assessment method used and thus stock status is highly sensitive to assumptions of *M*. As such, a full suite of potential *M* estimates, based on life history or other approaches, should be investigated and fully documented in future assessments.

The RP recommended that given the recent break in the head-boat index an additional three years of head-boat index would be required to produce a robust assessment using only that index. This implies that if the head-boat index were to re-commence in 2020, the next assessment would be in

2024 at the earliest. However, the Atlantic Cobia assessment could be done sooner if other information (low recruitment, change in catch) points to issues with the stock.

The RP recommends a more thorough comparison between old and new stock assessments. This comparison would describe model changes and the consequential changes in stock status estimates between assessments. Such a comparison would be valuable to allow the RP to identify those components of the analysis that resulted in changes in stock status between assessments.

The RP recommend that any uncertainty in the maturity ogive be included in future ensemble modeling.

2.3. Summary results of analytical

The RP made a several requests for additional graphs and tables of input data, additional model sensitivity and ensemble runs, and modified projections during the workshop. The requests are listed below along with summaries when appropriate. The AT fulfilled all of these requests during the workshop and the results were instrumental in reaching the conclusions summarized in this report.

List of requests for AT

Model sensitivities and exploration

1. *Undertake a comparison between Lorenzen and Charnov estimates of M using the new population-level VBGF parameters for Lorenzen. Two Lorenzen M versus age curves (SEDAR-28 and with SEDAR-58 VBGF size at age) and the Charnov estimated M versus age with SEDAR-58 VBGF parameters were provided to the RP.*
2. *Evaluate uncertainty in maturity; 75% of age-3 and 100% of age-4 for life history incremental analysis. This sensitivity run gave a similar result as the revised base case model.*
3. *Examine PSEs for recreational landings and discards; captured in ensemble models (see SEDAR-58-addendum).*
4. *Provide a raw time series of F40 and SSB40 (instead of those values relative to benchmarks). RP agreed that R0 values in SEDAR-58-addendum provide the scaling differences between the various sensitivity runs and met request.*
5. *Provide the CVs of the head-boat index. The AT provided these as pre- and post-weighted values; they are given in Table 5.5 of AW report.*
6. *Provide boxplots and bubble plots of absolute and Pearson residuals for age composition data for the previous (SEDAR-28), and the SEDAR-58 base case, and revised base case models; the RP did not find any major concerns resulting from consideration of the diagnostic plots (see RW report above).*
7. *Undertake a model run using a single selectivity for the head-boat index. The AT provided this sensitivity and it was decided by RP and AT that this should be the base case run. Further details are provided in RP report sections addressing the TORs above.*
8. *Provide CPUE index and catch-at-age residual patterns for original and revised base case models.*

9. *Undertake a sensitivity of model results to the relative weighting of the age composition data for the revised base model, by multiplying the Dirichlet N's by 0.5 and 2.0 as sensitivity runs (see report above).*
10. *Provide a likelihood profile for R0 and M (see report above).*
11. *Provide boxplots of the age composition residuals to provide information on whether a robustified distribution (e.g. robust multinomial) would be appropriate to model the age composition data (see report above).*
12. *Provide information on if the 1996 spike in estimated recreational catch was a result of the MRIP calibration*
13. *Provide a plot of distribution of M when standard error of the Charnov regression estimated model slope and intercept was doubled from that provided by Charnov et al. (2013).*
14. *Provide the proportion of total catch that was head-boat catch; less than about 1% in most years, with the highest in any one year of about 3%.*
15. *Describe the numbers of vessels and locations that made up the head-boat index: vessels and locations in Table 4.11.3 in the DW report; Number of cobia in Table 4.11.15 in the DW report; All modes Table 4.11.19 in the DW report; Year and state level summaries in Table 4.11.20 in the DW report; and the head-boat index in Table 5.3 in the DW report.*
16. *Update the ensemble models with revised base case (see SEDAR 58 addendum).*
17. *Cap the commercial discard CV at 3.0 for the ensemble modeling.*
18. *Show the values of the observation and prior likelihood components for the revised base case and the old base case (i.e., for the choice of one vs two selectivity blocks to fit the head-boat index) (see report above).*

Projection comments and requests

1. *Describe the assumption of recent landings for first two years relative to constant F; any means to determine which is best. Recent fishing closures were used as justification for the use of current landings in first two years of projections. Time series of historic F, projected F and time series of historic catch and projected catch.*
2. *Provide tables on the probability of stock status being above and below targets in the projection period (see report above).*
3. *Provide a description of the assumptions on future recruitment used for projections.*
4. *Question on targets. Is there a threshold level for ASMFC? Varies by species.*
5. *Is F40% appropriate?*
6. *Provide analyses to check that SSB goes below target because of low recruitment in 2014; this resulting in the identification of an error in the projections where the bias correction was not applied to the future recruitment deviations; this was corrected by the AT for the projections described in this report.*

2.4. Additional comments

No additional comments were made by the RP.

3. Submitted Comment

The following statements were submitted to the review as comments.

Comments from Bill Gorman (1 of 2):

Hello, I would like to start out by expressing my disappointment in being unable to attend the review workshop due to illness. I have spent a long time waiting for this processes and truly enjoyed being a part of the stock ID workshop. Being an observer at the stock ID workshop I must voice my objection to parts of the summary documents. For example in the genetics work groups they concluded that "the current stock boundary or one that came as a result of SEDAR28 could not be refuted." When reviewing the rational for the current stock boundary, that ultimately being "...for ease of management, and there was no tagging or life history to dispute.." However, it goes on to clearly disclose that genetic did not "prove" nor narrow down the area in that location of the FL/GA boarder. I contend that the current stock ID CAN be refuted with new tagging from VA, both Atags and Sat tags both have fish going into NEFL with a 3rd making it's was prior to a premature release in South GA. Two different studies, both with yes limited samples, but if it were such a small fraction to went and wintered off NEFL than two studies with extremely small samples shouldn't have captured these fish in back to back years. That is BEST AVAILABLE SCIENCE, you cannot tell me nor will anyone accept that these tagged fish are merely "strayers" and are to be overlooked and labeled "it's low sample size" when two UNSEEN fish can account for over 400,000lb of catch, resulting to federal waters being closed the following year and further restricting citizens access to their public resource. This migration pattern is also consistent with Spanish. The NEFL area accounts for the largest area of commercial catch and up to 45% of the EFL annual catch. I agree for ease of management it is likely best to keep the boundary where it is, however, I strongly believe science shows what we fishermen have known, NY to NEFL should be assessed as one management group and even when SC and GA Atag fish go off radar, the fishery in NEFL picks up, and it is shown again in the timing of the VA fish. If fish are leave one fishery and enter into another, they should either be managed or assessed together.

Comment from Bill Gorman (2 of 2):

Reviewers Please take note of the MRIP 2015 and or 2016 catch totals. They were discussed, and addressed in the data workshop report section 4.3.1 (page 73-74, specifically in the catch estimates section), and graphs in section 4.12.1-3 (pg. 104 - 106). However, these data points are important on two ends, if you recall there was one year GA had zero or next to zero reported landings, that is as troubling as catch estimates that reflect daily effort in one day that isn't practical. Reviewers should also recognize that VMRC took over the surveying from subcontractors during this time period. These are important notes, since this assessment is working with extremely limited data, catch data will play a larger roll than one with more data such as independent surveys and or consistent caucus/age sampling across the entire management range. Thank you for your time Bill Gorham

Comment from Collins Doughtie:

I am very sorry for missing this event but hopefully my comments about cobia, and that fishery itself, will finally be taken to heart. I realize some of you rely on your job compiling statistics and such but being out on the ocean as much as I am plus being heavily involved in the cobia research that has, and is, being done here at the Waddell Mariculture Center in Bluffton, SC, I feel the solution to insure healthy cobia populations for the future starts with one change. That is an across the board limit revision. For example, right here in SC there is a six fish per boat, per day limit. With the ever growing coastal population and popularity of cobia, this insanely liberal limit is unsustainable. I realize many of you are not fisherman but one cobia can feed a lot of folks. The yield per fish is substantial. I have caught a whole lot of cobia over the years and though I have pretty much gone to catch and release now, a two fish per boat per day limit is all anyone needs to satisfy those onboard. I know that a three fish limit has floated out there and that would be a good start but it has to be for all our Atlantic coastal states. My comments here are not based on statistics but rather observation and many years of catching these wonderful creatures. I have watched what over fishing has done to our area and unless changes are made quite quickly, I fear the rest of you will experience this very sad scenario in the not so distant future. Thank you for being involved!

4. References

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Lorenzen, K. (1996). The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural ecosystems and aquaculture. Journal of Fish Biology 49, 627–642. https://doi.org/10.1111/j.1095-8649.1996.tb00060.x

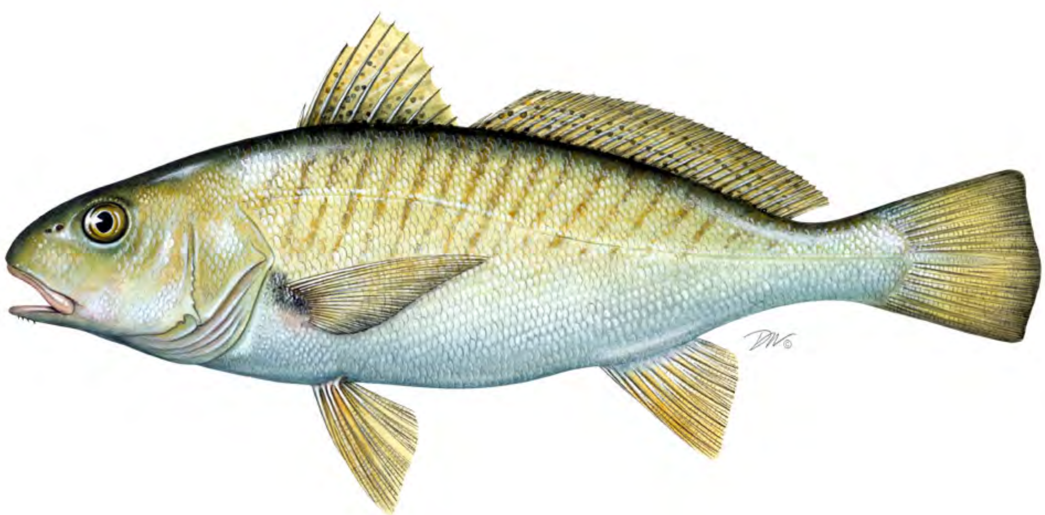
Thorson, J.T. (2019). Guidance for decisions using the Vector Autoregressive Spatio-Temporal (VAST) package in stock, ecosystem, habitat and climate assessments. Fisheries Research. https://doi.org/10.1016/j.fishres.2018.10.013

Williams, E.H.; Shertzer, K.W. (2015). Technical documentation of the Beaufort Assessment Model (BAM). NOAA Technical Memorandum NMFS-SEFSC-671. U.S. Department of Commerce, Springfield, VA 2216, 43 p. https://doi.org/10.7289/V57M05W6

Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM III TO AMENDMENT 1 TO THE INTERSTATE FISHERY MANAGEMENT PLAN FOR ATLANTIC CROAKER FOR PUBLIC COMMENT

Revisions to Management using the Traffic Light Approach



October 2019

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Public Comment Process and Proposed Timeline

In May 2019, the South Atlantic State/Federal Fisheries Management Board initiated the development of an addendum to the Interstate Fishery Management Plan (FMP) for Atlantic Croaker to incorporate updates to the annual Traffic Light Analyses and associated management. This Draft Addendum presents background on the Atlantic States Marine Fisheries Commission's (Commission) management of Atlantic croaker, the addendum process and timeline, and a statement of the problem. This document also provides management options for public consideration and comment.

The public is encouraged to submit comments regarding this document at any time during the public comment period. The final date comments will be accepted is **January 10, 2020 at 5:00 p.m**. Comments may be submitted at state public hearings or by mail, email, or fax. If you have any questions or would like to submit comment, please use the contact information below.

Mail: Dr. Michael Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, VA 22201

Email: comments@asmfc.org
(Subject: Croaker Draft Addendum III)
Phone: (703) 842-0740
Fax: (703) 842-0741

Commission's Process and Timeline

May 2019	South Atlantic Board Tasks PDT to Develop Draft Addendum III
May 2019 – October 2019	PDT Develops Draft Addendum III for Public Comment
October 2019	South Atlantic Board Reviews Draft Addendum III and Considers Its Approval for Public Comment
November 2019 – January 10, 2020	**Board Solicits Public Comment and States Conduct Public Hearings**
February 2020	Board Reviews Public Comment, Selects Management Options and Considers Final Approval of Addendum III
TBD	Provisions of Addendum III are Implemented

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission (ASMFC) is responsible for managing Atlantic croaker (*Micropogonias undulatus*) in state waters (0-3 miles from shore) under the authority of the Atlantic Coastal Fisheries Cooperative Management Act, and has done so through an interstate fishery management plan (FMP) since 1987. Atlantic croaker are currently managed under Amendment 1 to the FMP and Addenda I-II. The states of New Jersey through Florida have a declared interest in the fishery and are responsible for implementing management measures consistent with the interstate FMP as members of the South Atlantic State/Federal Fisheries Management Board (Board).

Addendum II established the Traffic Light Approach (TLA) as a precautionary management framework to evaluate fishery trends and develop management actions. The TLA was originally developed as a management tool for data-poor fisheries, and its application to Atlantic croaker is described in further detail in *Section 2.2.2*.

In recent years, the Atlantic croaker fishery has experienced significant declines in harvest, while such declines have not been evident in fishery-independent survey abundance indices used in the TLA. Furthermore, a 2017 stock assessment was not recommended for management use, due partially to conflicting signals between harvest and fishery-independent indices. These conflicting signals indicate the harvest and fishery-independent characteristics may not be representing comparable aspects or components of the stock, thus making management advice from the TLA unclear.

In response to the recent TLA and assessment results, a 2018 report from the Atlantic Croaker Technical Committee (TC) recommended five updates to the TLA. Additionally, a 2018 report from the Atlantic Croaker and Spot Plan Development Team (PDT) discussed how the management responses required by Addendum II could be updated to better reflect stock characteristics and develop more achievable management goals. Draft Addendum III addresses the recommendations of the TC and PDT by incorporating TC-recommended updates to the TLA analysis and proposing changes to the TLA triggers and management program.

2.0 OVERVIEW

2.1 Statement of the Problem

The TLA has been used since 2014 to monitor the Atlantic croaker population. The lack of a recent assessment approved for management use makes this approach the prominent source of management advice. While strong declines in harvest and reports of poor fishing have prompted concern, management action has not been triggered through the TLA because similar declines have not been observed in abundance indices. These conflicting signals suggest the current abundance indices used in the TLA may not adequately represent coastwide adult abundance and the TLA may not be sensitive enough to trigger management action when changes to the fishery occur that should trigger action. Additionally, current management lacks specificity in measures implemented if management action is triggered and attainability by requiring a percent increase in abundance be achieved through a percent reduction in harvest derived from the TLA analysis. Draft Addendum III incorporates TC-recommended updates to improve the TLA analysis and proposes alternatives to the current management triggers and responses.

2.2 Background

Atlantic croaker are small sciaenid forage species that support commercial and recreational fisheries in the Mid and South Atlantic regions. Atlantic croaker migrate seasonally along the coast, moving northward and inshore to estuaries and bays during warmer months (spring-fall) and southward and offshore to more oceanic waters in the winter. Atlantic croaker feed on planktonic organisms as post-larvae and young of the year, and as juveniles and adults they prey on bottom dwelling organisms such as worms and crustaceans. Atlantic croaker reach maturity by approximately age two and can live up to 17 years, but more commonly live no longer than 10 years.

2.2.1 Stock Status and Assessment

The most recent stock assessment, conducted in 2017, upon peer review was not recommended for management use. Therefore, current stock status is unknown, although the Peer Review Panel did not indicate problems in the Atlantic croaker fishery that would require immediate management action. The Peer Review Panel did recommend continued evaluation of the fishery using the annual TLA.

The last benchmark stock assessment for Atlantic croaker recommended for management use by a peer review was conducted in 2010. Unlike previous assessments it evaluated the resource as a single coastwide stock. The assessment indicated that the resource was not experiencing overfishing, biomass had increased, and age-structure had expanded since the late 1980s. However, it could not determine stock status given uncertain model estimates due to limited data on shrimp trawl discards and fishing mortality. Improvements on estimation of these discards were made in the 2017 assessment, allowing the potential for shrimp trawl discards to be included as supplemental information with the annual TLA. Annual monitoring of shrimp trawl fishery discards is important because these represent a considerable proportion of Atlantic croaker removals, ranging from 7% to 78% annually during 1988-2008, according to the 2010 assessment. Estimates of shrimp trawl discards updated for the 2014 assessment, which were noted by the Peer Review Panel as being derived using current and supported methods, suggest the proportion of removals attributable to this component of the fishery may be higher.

One of the reasons that the 2017 stock assessment was not approved for management use was due to conflicting signals in harvest and abundance characteristics. Theoretically, increases in adult abundance should result in more fish available to be caught by the fishery; thus, fishing would be more efficient (greater catch per unit effort) and harvest would increase in a pattern similar to adult abundance. However, several of the most recent abundance indices have shown increases while harvest has declined to some of the lowest levels on record. One factor that has been identified to contribute to overestimates of adult abundance is an increase in the number of juveniles misclassified as adults in surveys that historically have typically caught adults.

2.2.2 Traffic Light Approach as Applied to Atlantic Croaker

The TLA was originally developed as a precautionary management framework for data poor fisheries whereby reference points could be developed that would allow for some level of evaluation and management of the fishery, particularly in the absence of or between stock assessments. The name comes from assigning a color (red, yellow, or green) to categorize relative levels of different indicators for either a fish population or a fishery. Examples of indicators include growth and reproduction parameters, abundance and stock biomass estimates, recreational harvest, commercial landings, or fishing mortality. Additionally, the indicators can be combined to form composite characteristics within similar categories (e.g. biological, population estimates, or combined fisheries harvest). However, each indicator must be evaluated separately to determine its appropriateness for use in management.

In general practice when applying the TLA, the green/yellow boundary is typically set at the average for a reference time period and the yellow/red boundary is set at 60% of the reference period average, which would indicate a 40% decline (Halliday et al., 2001). Index values in the intermediate zone can be represented by a mixture of either yellow/green or yellow/red depending on where they fall in the transition zone.

Proportions of green and red for an individual component (e.g. recreational harvest) are calculated based on summary statistics for a predefined reference period. Annual values are compared to the reference period average to determine whether they are higher, lower, or the same. If the value is greater than the reference period average, a linear model is used to estimate the proportion green, such that greater values have a higher proportion green. If the value is less than the average, a linear model estimates the proportion red, such that lesser values have a higher proportion red. Yellow proportions are calculated as one minus the proportion green minus the proportion red and will be 100% yellow if the value equals the reference period average. Since an increasing percentage of red reflects a decreased value (e.g. harvest or abundance) below the reference period average, the proportion red offers a way of determining if any management response is necessary.

The color proportions in a composite index are averages of the color proportions for the individual components combined to make up the composite index. For example, if there are two components (e.g. recreational and commercial harvest) combined for the composite index, the proportion red is the average of the proportion red for both components, the proportion green is the average of the proportion green for both components, and the proportion yellow is the average of the proportion yellow for both components.

As an example of how to interpret TLA figures, consider year 2018 of Figure 1 (*Section 2.2.4*) which depicts the coastwide composite harvest characteristic of the Addendum II TLA. Table 1 lists specific values considered for this characteristic and year. The reference period is 1996-2008, with average annual harvests during this time period being 24.5 million pounds and 14.9 million pounds for the commercial and recreational sectors, respectively. In 2018, commercial harvest was 4.2 million pounds. This value is less than the reference period average. Therefore, a linear regression was used to calculate the percent red based on how much less the 2018 value is than the reference period average, resulting in 67.2% red, 32.8% yellow, and 0% green. In 2018, recreational harvest was 3.0 million pounds. This value is less than the reference period average. Therefore, a linear regression was used to calculate the percent red based on how much less the 2018 value is than the reference period average, resulting in 64.2% red, 35.8% yellow, and 0% green. Averaging of sector harvest characteristic values for each color results in the final composite characteristic percentages: 65.7% red, 34.3% yellow, and 0% green.

Table 1. Commercial and recreational harvests and Traffic Light Approach (TLA) percentages for the 2018 Atlantic croaker harvest characteristics (commercial, recreational, and composite), using the 1996-2008 reference period.

1996-2008 Coastwide Average Commercial Harvest	24,545,916 pounds
2018 Coastwide Commercial Harvest	4,192,442 pounds
2018 Commercial Harvest TLA Percentages (Red, Yellow, Green)	67.2%, 32.8%, 0%
1996-2008 Coastwide Average Recreational Harvest	14,885,189 pounds
2018 Coastwide Recreational Harvest	3,006,258 pounds
2018 Recreational Harvest TLA Percentages (Red, Yellow, Green)	64.2%, 35.8%, 0%
2018 Composite Harvest TLA Percentages (Red, Yellow, Green)	65.7%, 34.3%, 0%

For Atlantic croaker, the TLA is used to provide management guidance in between stock assessments. It has two components, a harvest characteristic, comprised of commercial landings and recreational harvest data, and an abundance characteristic, comprised of fishery-independent abundance indices. The TC annually runs the TLA and provides the results to the PRT for the annual FMP Review. To utilize the best data available, the TC and PRT are able to modify the TLA as needed through annual reviews and updates.

2.2.3 Recommended Changes to the TLA and Management Responses

Following the 2017 assessment, the Board tasked the TC with exploring potential updates to improve the TLA. The TC developed five recommendations, which are listed below and are being considered for implementation through this addendum.

1. Incorporation of indices from the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) and the South Carolina Department of Natural Resources (SCDNR) Trammel Net Survey into the adult composite characteristic index, in addition to the currently used indices from the Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey and Southeast Area Monitoring and Assessment Program (SEAMAP).

2. Use of revised adult abundance indices from the surveys mentioned above, in which age-length keys and length composition information are used to estimate the number of adult (age 2+) individuals caught by each survey.
3. Use of regional metrics to characterize the fisheries north and south of the Virginia-North Carolina state border. The ChesMMAP and NEFSC surveys would be used to characterize abundance north of the border, and the SCDNR Trammel Net and SEAMAP surveys would be used to characterize abundance south of the border.
4. Change/establish the reference time period for all surveys to be 2002-2012.
5. Change the triggering mechanism to the following: Management action will be triggered according to the current 30% red and 60% red thresholds if both the abundance and harvest thresholds are exceeded in any 3 of the 4 terminal years.

Some of these changes, such as the selection of fishery-independent surveys used for the abundance characteristic, incorporation of age and length information, and establishment of a new reference time period are already allowed under Addendum II. Addendum III would retain the TC's ability to alter the TLA as needed to best represent trends in Atlantic croaker harvest and abundance, including selection of surveys and methods to analyze and evaluate these data. However, changes to the triggering mechanism are beyond the scope of Addendum II. Thus, they are proposed in this addendum.

After considering the recommended changes to the TLA, the Board tasked the Atlantic Croaker and Spot PDT with exploring potential responses to management triggers that could result after incorporation of these updates. The PDT noted that there are currently no coastwide management requirements for Atlantic croaker. Additionally, due to the strong association of Atlantic croaker abundance with environmental variables, their exhibition of cyclical abundance trends, and the apparent disconnect between Addendum II harvest and abundance characteristics, a reduction in harvest would not necessarily result in a proportional increase in abundance. Therefore, the PDT recommended establishment of base management measures that would reduce fishing impacts to not exacerbate periods of low abundance. Additionally, with the recommended updates incorporating regional TLAs, the PDT noted that this approach was developed to increase survey coverage throughout the stock, but Atlantic croaker are still a single, coastwide stock. Therefore, any management triggers resulting from regional TLAs should incorporate some form of response throughout the management unit.

2.2.4 Population Characteristics

The following figures show composite harvest characteristic TLA analyses for Atlantic croaker through 2018 using the methods of Addendum II (Figure 1) and those of Draft Addendum III (Figures 2 and 3). Changes to analyses being incorporated through Draft Addendum III are shown in bold font in the captions for Figures 2 and 3, including use of regional information and a different reference time period.

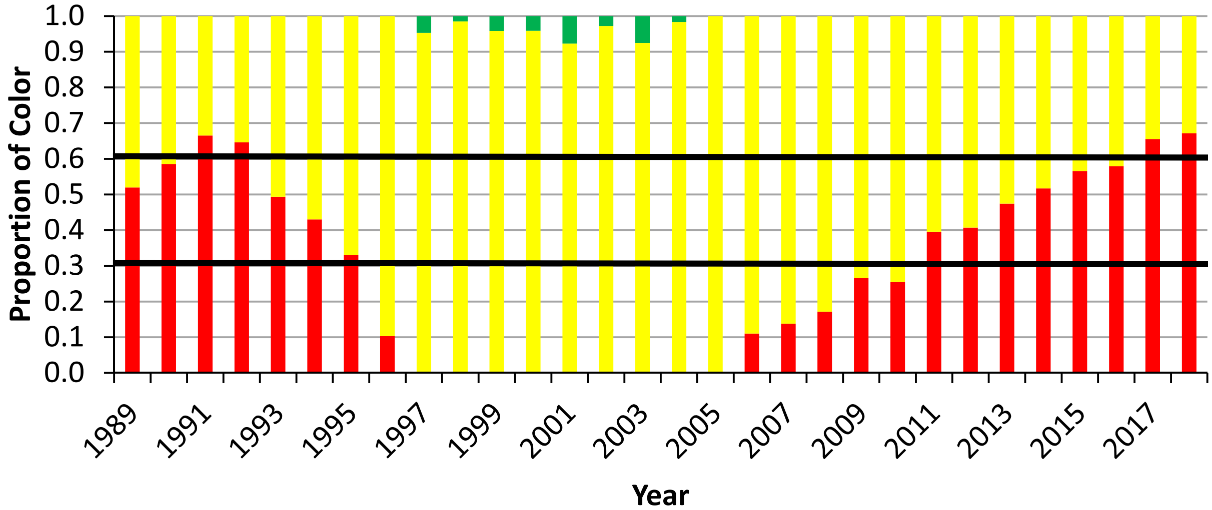


Figure 1. Addendum II Composite TLA analysis using commercial landings and recreational harvest for Atlantic croaker with management thresholds of 30% and 60% proportion red (reference period 1996 – 2008).

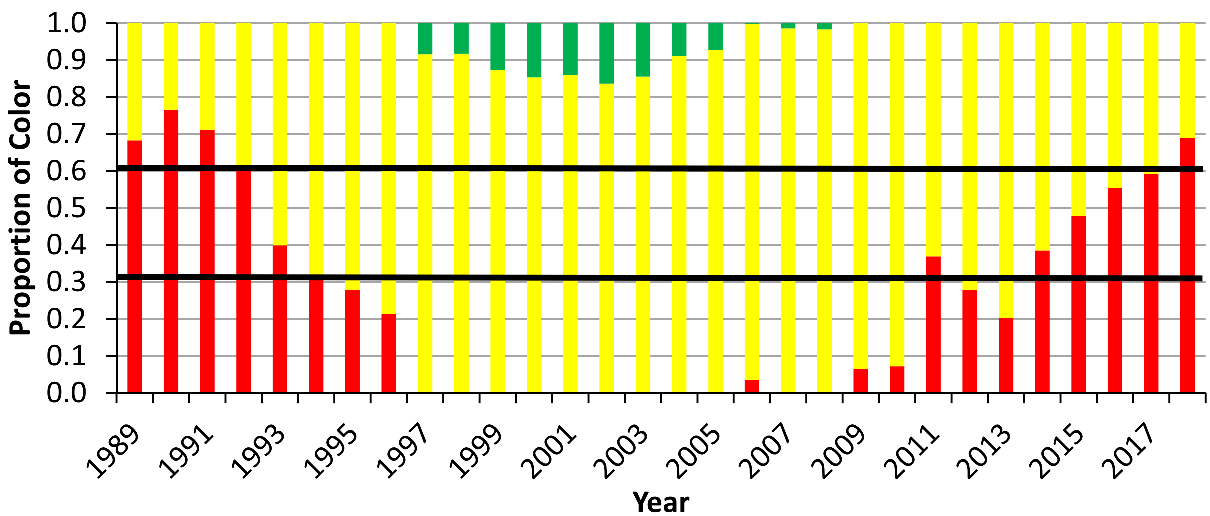


Figure 2. Draft Addendum III **Mid-Atlantic (NJ-VA) Regional** Composite TLA analysis using commercial landings and recreational harvest for Atlantic croaker with management thresholds of 30% and 60% proportion red (**reference period 2002 – 2012**).

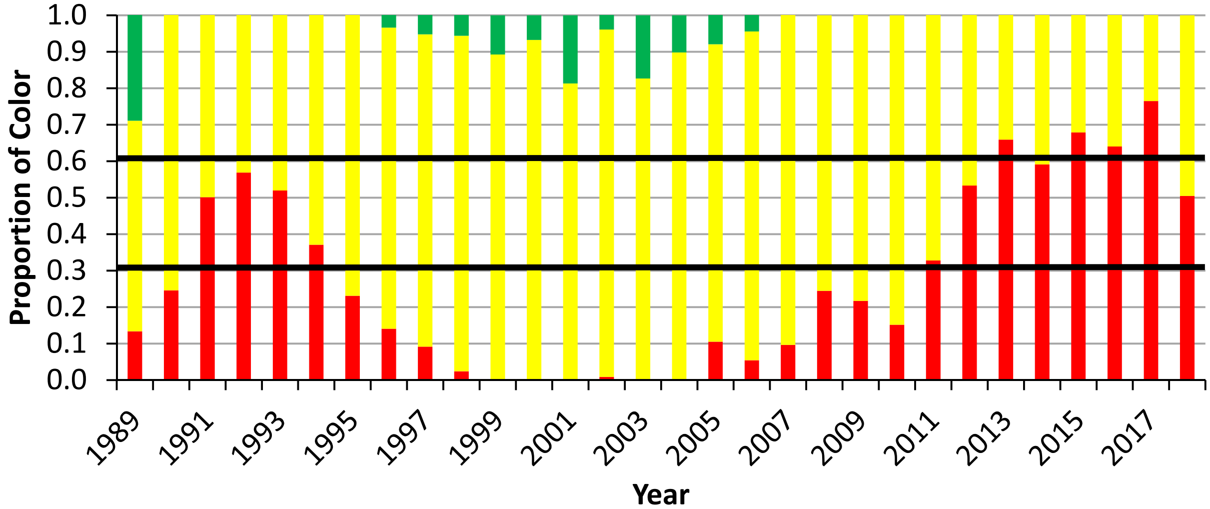


Figure 3. Draft Addendum III **South Atlantic (NC-FL) Regional** Composite TLA analysis using commercial landings and recreational harvest for Atlantic croaker with management thresholds of 30% and 60% proportion red (**reference period 2002 – 2012**).

The following figures show composite abundance characteristic TLA analyses for Atlantic croaker through 2018 using the methods of Addendum II (Figure 4) and those of Draft Addendum III (Figures 5 and 6). Changes to analyses being incorporated through Draft Addendum III are shown in bold font in the captions for Figures 5 and 6, including use of age and regional information and a different reference time period.

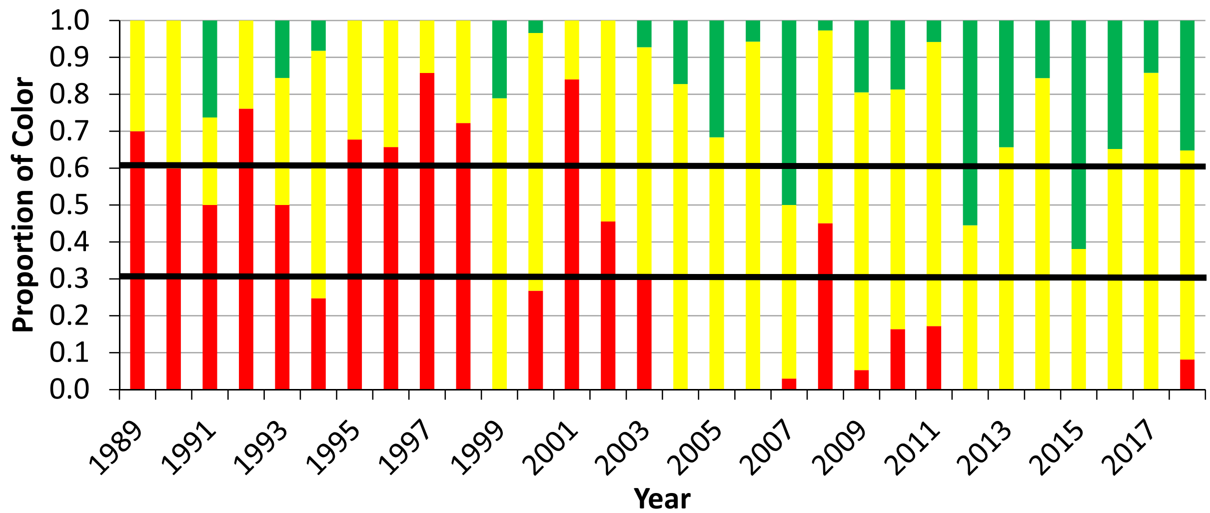


Figure 4. Addendum II Composite TLA analysis using fishery-independent survey indices (NEFSC Trawl Survey and SEAMAP) for Atlantic croaker with management thresholds of 30% and 60% proportion red (reference years 1996 – 2008).

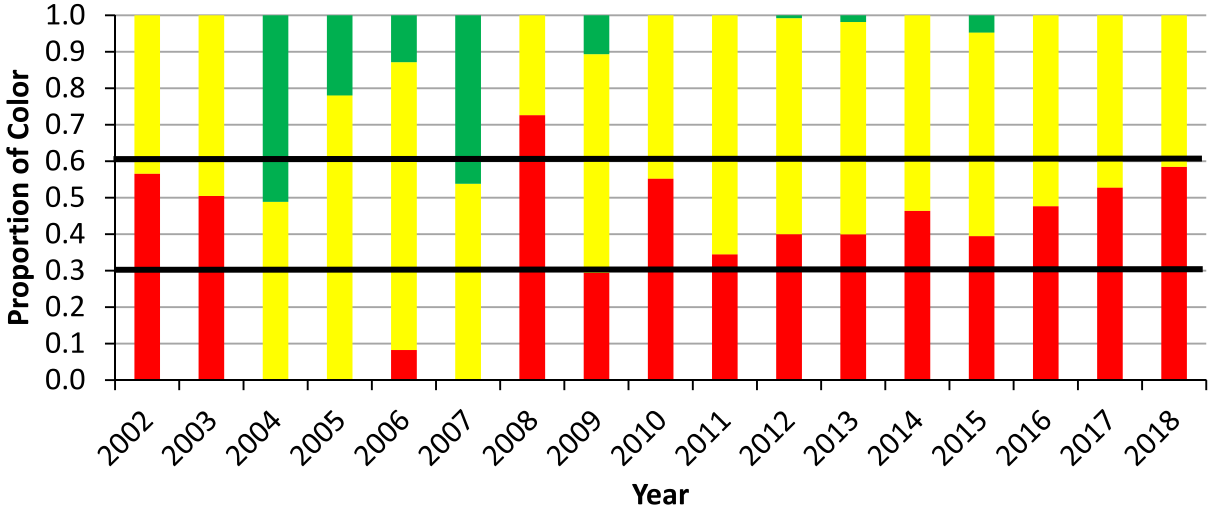


Figure 5. Draft Addendum III **Mid-Atlantic (NJ-VA) Regional** Composite TLA analysis using **age-specified** fishery-independent survey indices (NEFSC Trawl Survey and **ChesMMAP**) for Atlantic croaker with management thresholds of 30% and 60% proportion red (**reference period 2002 – 2012**).

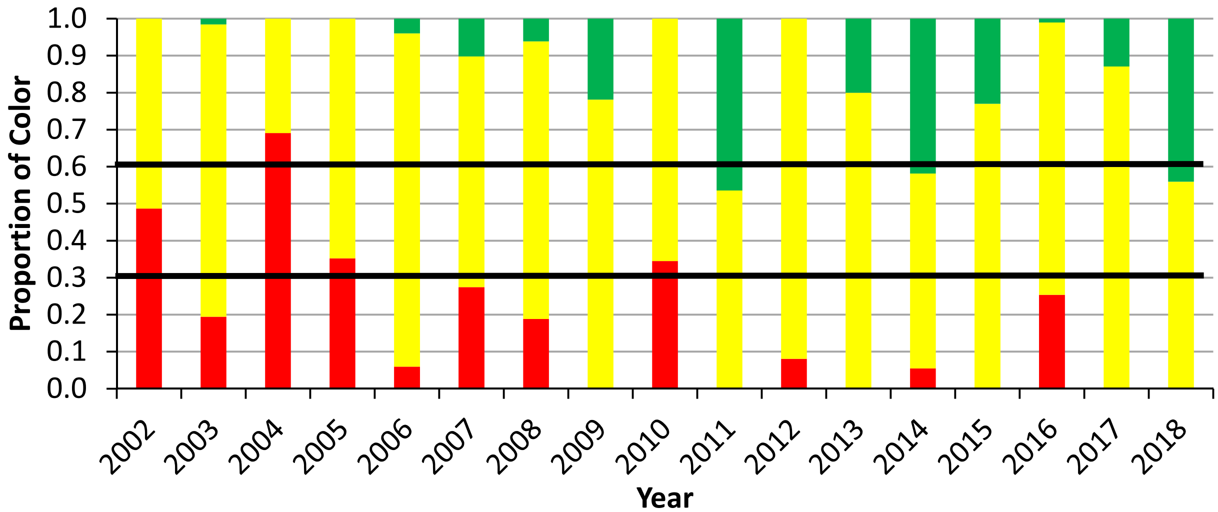


Figure 6. Draft Addendum III **South Atlantic (NC-FL) Regional** Composite TLA using **age-specified** fishery-independent survey indices (SEAMAP and **SCDNR Trammel Net Survey**) for Atlantic croaker with management thresholds of 30% and 60% proportion red (**reference period 2002 – 2012**).

3.0 PROPOSED MANAGEMENT PROGRAM

Changes to the management program would replace Section 3.0 of Addendum II to Amendment 1 to the Atlantic Croaker FMP.

The following issues consider options for the TLA management triggering mechanism (Issue 1) and required management responses for the recreational (Issue 2) and commercial (Issue 3) fisheries. Recommended updates to the TLA analyses including additional fishery-independent survey indices, use of age information, use of regional characteristics, and changing the reference time period, will be incorporated into the TLA as part of this addendum, but are not considered with alternatives in the following issues as they apply the most current scientific advice, which is allowed under Addendum II. Draft Addendum III also retains the TC's ability to alter the TLA as needed to best represent trends in Atlantic croaker harvest and abundance.

3.1 Issue 1: Management Trigger Based on Proportion Red Options

Status quo is not included in either of the following options due to the incorporation of regional characteristics, which is based on the most current scientific advice. Option A is closest to status quo, as it retains the Addendum II trigger timeframe.

Option A. If red proportions for both population characteristics (adult abundance and harvest) in a regional, with both characteristics being for the same region, or a coastwide TLA meet or exceed the proportion of a threshold for the three terminal (most recent) years, then management action would be required.

Option B. If red proportions for both population characteristics (adult abundance and harvest) in a regional, with both characteristics being for the same region, or a coastwide TLA meet or exceed the proportion of a threshold for any three of the four terminal years, then management action would be required. (TC recommendation from *Section 2.2.3*)

Thresholds for both options are listed below:

30%- this represents moderate concern to the fishery with moderate management response
60%- this represents significant concern to the fishery with elevated management response

3.2 Management Response to Triggers

If management action has not been triggered according to *Section 3.1*, there are no coastwide management requirements, in accordance with Amendment 1. States regulations restricting Atlantic croaker harvest are encouraged to be maintained.

Per the PDT recommendations and direction of the Board, TLA-triggered management response options were developed to reduce fishing impacts to not exacerbate periods of low abundance. As the TLA does not offer advice on overfished or overfishing status, resulting management responses are not designed to stop overfishing or recover an overfished stock. Such status designations should be evaluated through a stock assessment and responded to accordingly. Additionally, while projected reductions to previous harvests are incorporated into the management responses, due to the lack of a coastwide quota and uncertainty of the fishery's behavioral response to triggered management measures, it is recognized that projected harvest reductions based on past fishery performance may not necessarily be achieved through triggered management measures. Furthermore, due to large numbers of removals from this population as bycatch through the South Atlantic shrimp trawl fishery (the majority of annual total removals), it is also recognized that directed harvest reductions may not result in large increases to abundance. However, these measures would reduce the probability of directed harvest inhibiting growth of the Atlantic croaker stock and provide baseline information for any future consideration of coastwide management measures.

Recreational response alternatives include bag limits while commercial alternatives include percentage reductions through quantifiable measures such as seasons, trip limits, or size limits. In developing these different regulatory responses, the PDT considered sector differences in gears, fishing behavior, and state regulations already in place.

If management action is triggered according to *Section 3.1*, the Draft Addendum proposes the following coastwide requirements (NOTE: the public is asked to identify its preferred option for both the recreational and commercial sectors):

3.2.1 Issue 2: Recreational Management Trigger Response Options

Option A. (Status Quo) The TC would recommend the appropriate percent reduction in recreational harvest needed and state-by-state measures to achieve the harvest reduction for approval by the Board. This allows the states to meet the individual needs of their fisheries. The application of an overall harvest percentage reduction would be proportional to the magnitude of exceeding the trigger, using a combination of management tools that include size limits, bag/trip limits, seasonal closures, and gear restrictions.

Option B. If management action is triggered by meeting or exceeding the 30% red threshold, all recreational non-*de minimis* states would be required to institute a bag limit of no more than 50 Atlantic croaker per person. If management action is triggered by meeting or exceeding the 60% threshold, all states (including *de minimis*) would be required to institute a bag limit of no more than 40 Atlantic croaker per person.

Option C. If management action is triggered by meeting or exceeding the 30% red threshold, all recreational non-*de minimis* states would be required to institute a bag limit of no more than 40 Atlantic croaker per person. If management action is triggered by meeting or exceeding the 60% threshold, all states (including *de minimis*) would be required to institute a bag limit of no more than 30 Atlantic croaker per person.

Option D. If management action is triggered by meeting or exceeding the 30% red threshold, all recreational non-*de minimis* states would be required to institute a bag limit of no more than 30 Atlantic croaker per person. If management action is triggered by an exceedance of the 60% threshold, all states (including *de minimis*) would be required to institute a bag limit of no more than 20 Atlantic croaker per person.

State and coastwide harvest reductions for each of the above options were estimated, based on Marine Recreational Information Program intercept and harvest data from 2009-2018 (Table 2). For trips that exceeded the number of fish allowed by each limit, the number of fish beyond the limit were summed, converted to pounds using average weights, and divided by the total harvest to estimate the percent reductions. Coastwide reductions, depending on the option chosen and which percent red threshold is exceeded (30% or 60%), range from 1.5% (50 fish bag limit) to 17.4% (10 fish bag limit).

Table 2. Estimated state and coastwide reductions from Issue 2 option bag limits, based on Marine Recreational Information Program intercept and harvest data from 2009-2018. Shown reductions assume recreational non-*de minimis* status for all states, although Issue 2 Options A-D do not require bag limits for recreational *de minimis* states when management action is triggered by exceedance of the 30% red threshold.

	Estimated Percent Reductions in Harvest (Pounds) from 2009-18 Averages								
Bag Limit	**NJ**	**DE**	**MD**	**VA**	**NC**	**SC**	**GA**	**FL***	**Total**
50 fish	0.00%	2.76%	0.00%	2.38%	0.20%	0.00%	0.00%	0.15%	1.49%
40 fish	0.00%	3.42%	0.00%	3.35%	0.35%	0.00%	0.00%	0.49%	2.12%
30 fish	1.07%	4.13%	0.03%	4.79%	0.56%	0.00%	0.00%	1.58%	3.16%
20 fish	4.29%	7.67%	0.65%	8.47%	1.44%	0.30%	1.65%	4.55%	6.03%
10 fish	10.58%	17.39%	8.41%	22.42%	6.95%	2.53%	4.35%	14.78%	17.38%
2009-18 Average Harvest	374,559	190,683	1,320,978	4,976,468	451,391	169,920	94,944	851,963	8,430,905

*Florida only includes Atlantic coast harvest and estimated reduction.

Under any option selected, states would be encouraged to maintain any measures already in place that are more restrictive than those required by this addendum.

De minimis states are those in which enforcement actions would be expected to contribute insignificantly to a coastwide conservation plan. Per *Section 4.4.3* of Amendment 1, states may apply for this status if, for the preceding three years for which data are available, their average commercial or recreational Atlantic croaker landings (by weight) constitute less than one percent of the average coastwide commercial or recreational Atlantic croaker landings for the same period. A state that qualifies for *de minimis* based on their commercial landings would qualify for exemptions in their commercial fishery only, and a state that qualifies for *de minimis* based on their recreational landings would qualify for exemptions in their recreational fishery only.

Recreational for-hire vessels may possess live Atlantic croaker for use as bait. The maximum number of Atlantic croaker allowed to be held onboard for this use prior to beginning a trip, during a trip or after a trip is completed would be the bag limit in effect multiplied by the number of customers allowed on the vessel. During a trip, the number of Atlantic croaker in possession to be harvested could not exceed the bag limit in effect multiplied by number of anglers onboard the vessel during the trip (any additional Atlantic croaker in possession, up to the limit stated above, must be those to be used as live bait). In this context, a trip would be defined as a period of time in which fishing is conducted, beginning when the vessel leaves port and ending when the vessel returns to port. If no coastwide bag limit is in effect, then this use would not be limited by this addendum.

Recreational private vessels that possess live Atlantic croaker for use as bait would be subject to personal bag limits of anglers on the vessel, with live fish possessed counting towards the bag limits. If no coastwide bag limit is in effect, then this use would not be limited by this addendum.

3.2.2 Issue 3: Commercial Management Trigger Response Options

Option A. (Status Quo) The TC would recommend the appropriate percent reduction in commercial harvest needed and state-by-state measures to achieve the harvest reduction for approval by the Board. This allows the states to meet the individual needs of their fisheries. The application of an overall harvest percentage reduction would be proportional to the magnitude of exceeding the trigger, using a combination of management tools that include size limits, bag/trip limits, seasonal closures, and gear restrictions.

Option B. Include the following language defining commercial responses to triggers at the 30% and 60% thresholds, with selection of one of Sub-Options B1-B3.

30% Threshold *(single option proposed)*
If management action is triggered by meeting or exceeding the 30% red threshold, commercial non-*de minimis* states that do not already have a minimum size limit or possession limit would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) that reduce commercial harvest by 1% of the average state commercial harvest from the previous 10 years. States may establish differential measures by gear or area, as long as measures implemented are quantifiable and achieve the required 1% reduction for the entire state commercial harvest.

60% Threshold *(choose one of Sub-Options B1-B3)*
Sub-Option B1. If management action is triggered by meeting or exceeding the 60% red threshold, all states (including *de minimis*) would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) that reduce commercial harvest by 5% of the average state commercial harvest from the previous 10 years.

Sub-Option B2. If management action is triggered by meeting or exceeding the 60% red threshold, all states (including *de minimis*) would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) that reduce commercial harvest by 10% of the average state commercial harvest from the previous 10 years.

Sub-Option B3. If management action is triggered by meeting or exceeding the 60% red threshold, all states (including *de minimis*) would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) that reduce commercial harvest by 20% of the average state commercial harvest from the previous 10 years.

All measures established as required responses to TLA triggers would be evaluated to determine if they are both quantifiable and meet the objective reduction by the TC and approved by the Board prior to implementation.

3.2.3 Management Alternatives

If management action is triggered by meeting or exceeding the 60% red threshold and the Board determines more restrictive actions are necessary than those defined in *Sections 3.2.1* or *Section 3.2.2*, the Board may task the TC to determine an alternative reduction to the recreational or commercial fisheries. The TC would recommend the appropriate percent reduction in harvest needed and state-by-state measures to achieve the harvest reduction for approval by the Board. This allows the states to meet the individual needs of their state's fisheries. The application of an overall harvest percentage reduction may include use of a combination of management tools that include size limits, bag/trip limits, seasonal closures, and gear restrictions.

3.3 Issue 4: Evaluation of Fishery Response to Management Measures

Option A. (Status Quo) Management measures set in response to any trigger would remain in place for three years to promote consistent measures and allow for sufficient time to evaluate population response. Once management action has been taken, the thresholds would not be applied to the harvest characteristics in assessing the fishery for three years, as the fishery-dependent data may be influenced by management action.

Option B. Management measures set in response to any trigger would remain in place for at least three years to promote consistent measures and allow for sufficient time to evaluate population response. Once management action has been taken, the harvest characteristics would no longer be used to trigger management action, as the fishery-dependent data may be influenced by triggered measures. While triggered measures are in effect, a composite regional abundance characteristic, by itself, may trigger action at the next highest level of management response by the proportion red exceeding the next highest threshold in any three of the four terminal years.

After a minimum of three years, once no composite regional abundance characteristics trigger management action at either threshold, triggered measures would no longer be required, and the TC would resume using the harvest characteristics as components of the TLA that would be required to trigger management action.

If triggered measures have remained in place for a minimum of four years due to proportions of red above a threshold for either of the composite regional abundance characteristics, the TC would, as part of conducting the annual TLA, evaluate trends in abundance to recommend to the Board whether triggered measures should remain in place or more restrictive measures should be considered.

4.0 COMPLIANCE

The management framework contained in *Section 3.0* of Addendum III to Amendment 1 is effective immediately upon its approval.

5.0 LITERATURE CITED

Halliday, R.G., L.P. Fanning, and R.K. Mohn. 2001. Use of the Traffic Light Method in Fishery Management Planning. Canadian Science Advisory Secretariat, Research Document No. 108. 41 p.

6.0 APPENDIX

To aid in public interpretation of TLA figures and results, the following figures depict components of Atlantic croaker TLA characteristics in a linear format with the long-term mean (average) (LTM) of the proposed reference period (2002-2012).

Commercial and Recreational Harvest

Commercial landings show a general declining trend has occurred since the late 1990s.

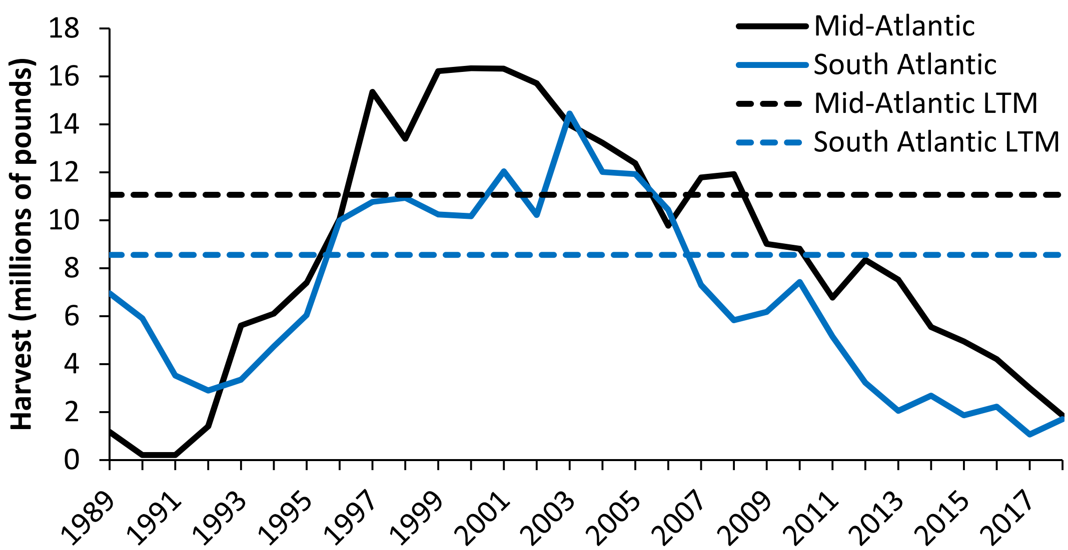


Figure A1. Commercial harvest and the LTM harvest for 2002-2012 in the Mid-Atlantic (NJ-VA) and South Atlantic (NC-FL) regions.

Mid-Atlantic recreational harvest shows an increase to a peak in the early 2000s, followed by a decline with values under its LTM since 2011. South Atlantic recreational harvest declined in the late 1980s and has remained low, varying about its LTM.

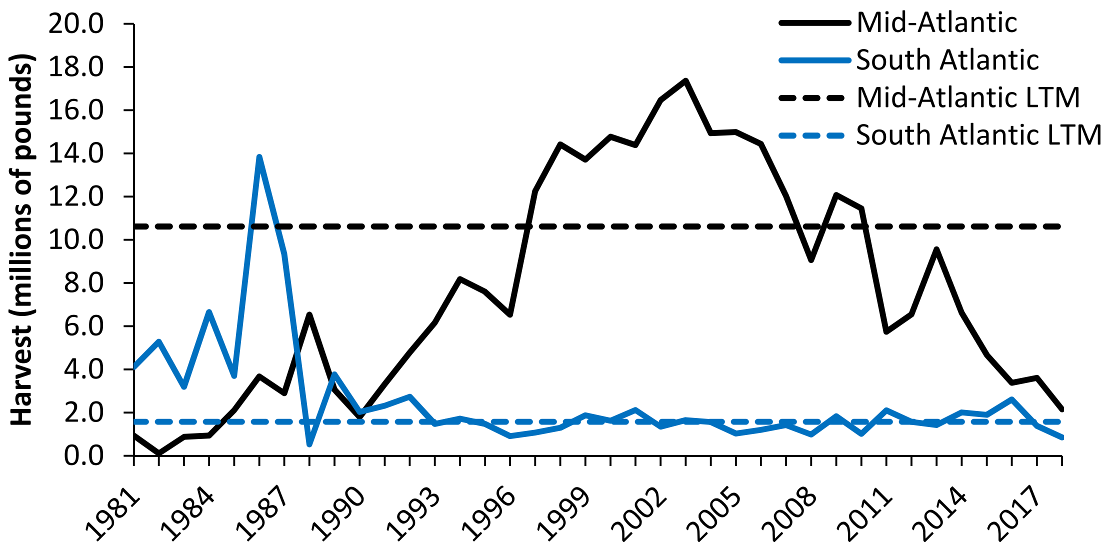


Figure A2. Recreational harvest and the LTM harvest for 2002-2012 in the Mid-Atlantic (NJ-VA) and South Atlantic (NC-FL) regions.

Abundance Indices

<u>*Mid-Atlantic*</u>

The Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey adult index has declined from its peak years (2007-2009), and general index levels have been below the LTM for the last three years.

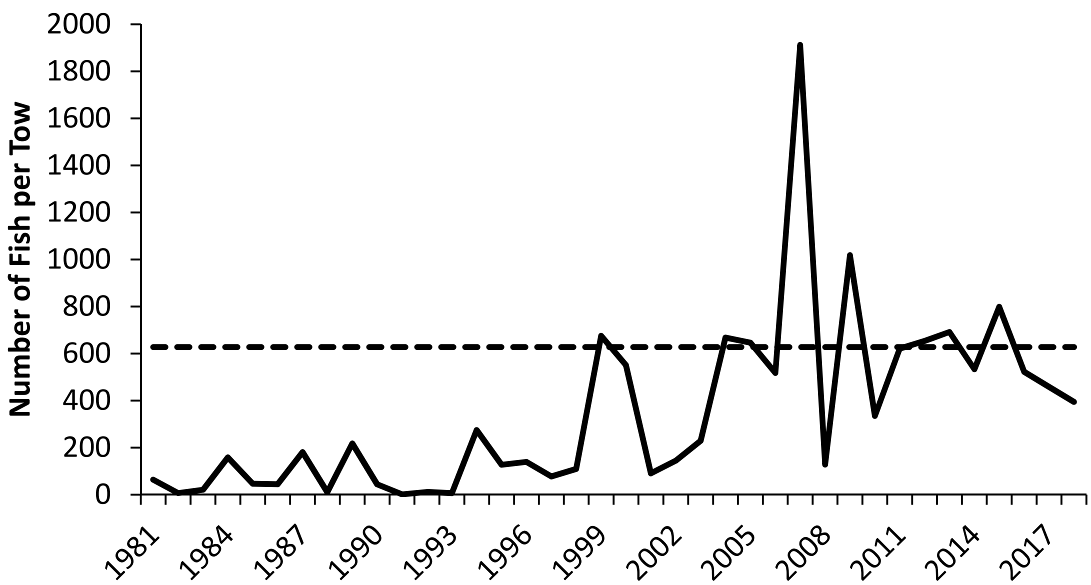


Figure A3. NEFSC adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

The Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) adult index shows a general long-term decline since the series peak in 2004.

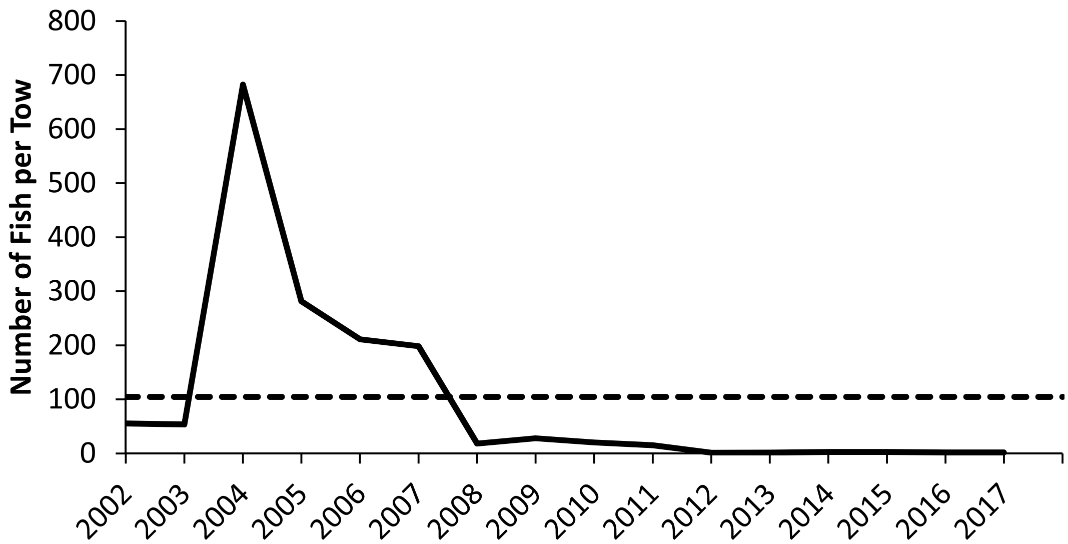


Figure A4. ChesMMAP adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

South Atlantic

The Southeast Area Monitoring and Assessment Program (SEAMAP) adult index shows a general increasing trend since the early 2000s.

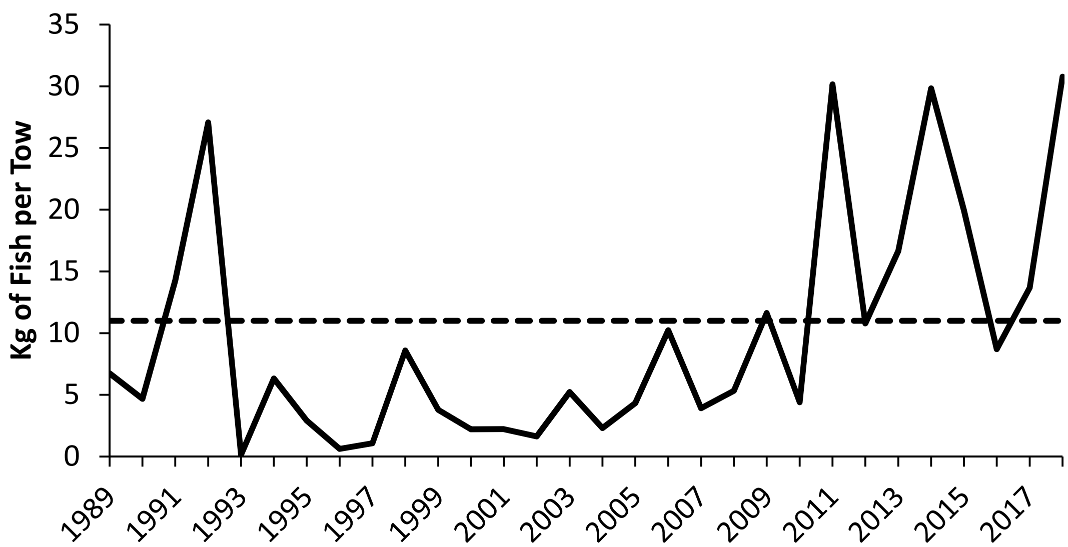


Figure A5. SEAMAP adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

The South Carolina Department of Natural Resources (SCDNR) Trammel Net Survey index shows a general declining trend since 2009 with annual values above and below the LTM.

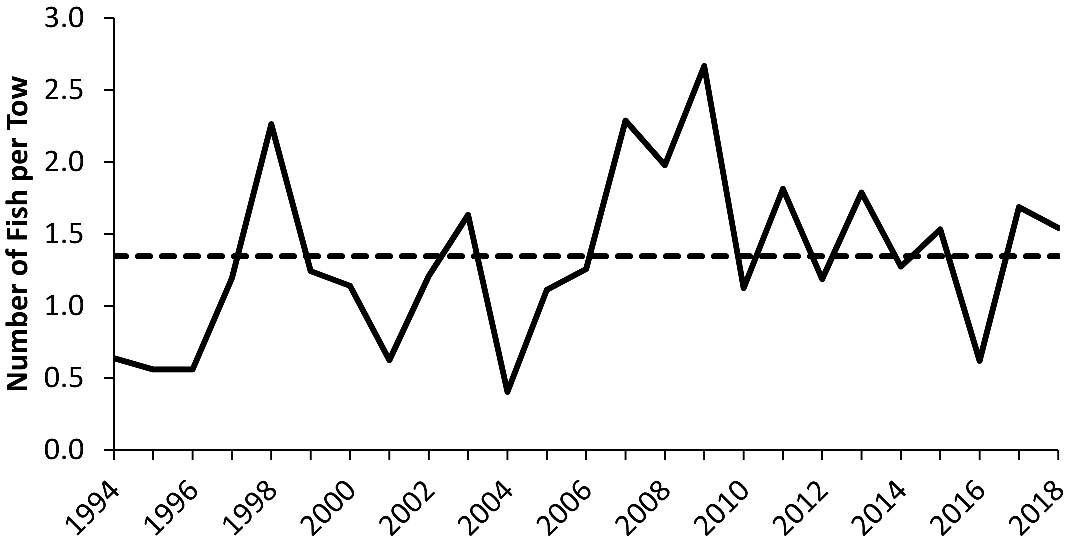


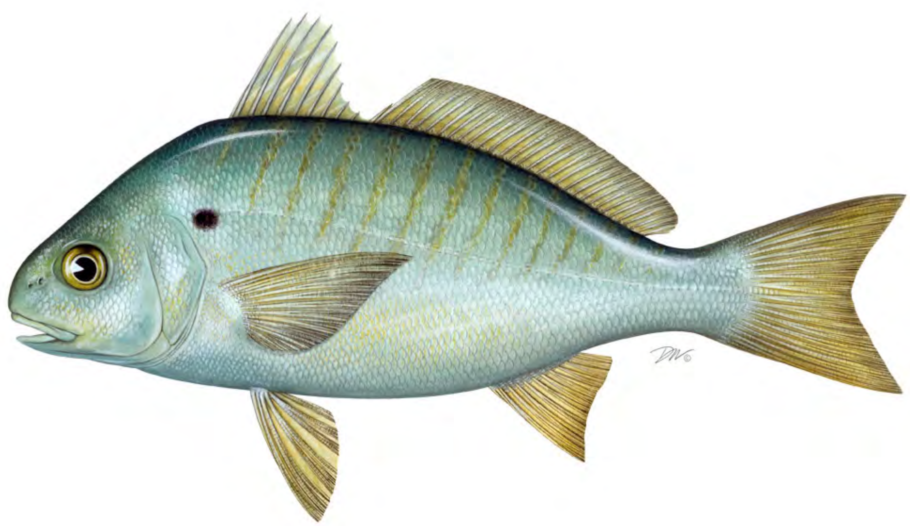
Figure A6. SCDNR adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

Draft Addendum for Public Comment

Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM III TO THE OMNIBUS AMENDMENT TO THE INTERSTATE FISHERY MANAGEMENT PLANS FOR SPANISH MACKEREL, SPOT, AND SPOTTED SEATROUT FOR PUBLIC COMMENT

Revisions to Spot Management using the Traffic Light Approach



October 2019

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Draft Addendum for Public Comment

Public Comment Process and Proposed Timeline

In May 2019, the South Atlantic State/Federal Fisheries Management Board (Board) initiated the development of an addendum to the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout to incorporate updates to the annual Traffic Light Approach and associated management for spot. This Draft Addendum presents background on the Atlantic States Marine Fisheries Commission's (Commission) management of spot, the addendum process and timeline, and a statement of the problem. This document also provides management options for public consideration and comment.

The public is encouraged to submit comments regarding this document at any time during the public comment period. The final date comments will be accepted is **January 10, 2020 at 5:00 p.m**. Comments may be submitted at state public hearings or by mail, email, or fax. If you have any questions or would like to submit comment, please use the contact information below.

Mail: Dr. Michael Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, VA 22201

Email: comments@asmfc.org
(Subject: Spot Draft Addendum III)
Phone: (703) 842-0740
Fax: (703) 842-0741

Commission's Process and Timeline

May 2019	South Atlantic Board Tasks PDT to Develop Draft Addendum III
May 2019 – October 2019	PDT Develops Draft Addendum III for Public Comment
October 2019	South Atlantic Board Reviews Draft Addendum III and Considers Its Approval for Public Comment
November 2019 – January 10, 2020	**Board Solicits Public Comment and States Conduct Public Hearings**
February 2020	Board Reviews Public Comment, Selects Management Options and Considers Final Approval of Addendum III
TBD	Provisions of Addendum III are Implemented

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission (ASMFC) is responsible for managing spot (*Leiostomus xanthurus*) in state waters (0-3 miles from shore) under the authority of the Atlantic Coastal Fisheries Cooperative Management Act, and has done so through an interstate fishery management plan (FMP) since 1987. Spot are currently managed under the Omnibus Amendment to the Spot, Spotted Seatrout, and Spanish Mackerel FMPs and Addendum II. The states of New Jersey through Florida have a declared interest in the fishery and are responsible for implementing management measures consistent with the interstate FMP as members of the South Atlantic State/Federal Fisheries Management Board (Board).

Addendum II established the Traffic Light Approach (TLA) as a precautionary management framework to evaluate fishery trends and develop management actions. The TLA was originally developed as a management tool for data-poor fisheries, and its application to spot is described in further detail in *Section 2.2.2*.

In recent years, the spot fishery has experienced significant declines in harvest, while such declines have not been evident in fishery-independent survey abundance indices used in the TLA. Furthermore, a 2017 stock assessment was not recommended for management use, due partially to conflicting signals between harvest and fishery-independent indices. These conflicting signals indicate the harvest and fishery-independent characteristics may not be representing comparable aspects or components of the stock, thus making management advice from the TLA unclear.

In response to the recent TLA and assessment results, a 2018 report from the Spot Plan Review Team (PRT) recommended five updates to the TLA. Additionally, a 2018 report from the Atlantic Croaker and Spot Plan Development Team (PDT) discussed how the management responses required by Addendum II could be updated to better reflect stock characteristics and develop more achievable management goals. Draft Addendum III addresses the recommendations of the PRT and PDT by incorporating PRT-recommended updates to the TLA analysis and proposing changes to the TLA triggers and management program.

2.0 OVERVIEW

2.1 Statement of the Problem

The TLA has been used since 2014 to monitor the spot population. The lack of a recent assessment approved for management use makes this approach the prominent source of management advice. While strong declines in harvest and reports of poor fishing have prompted concern, management action has not been triggered through the TLA because similar declines have not been observed in abundance indices. These conflicting signals suggest the current abundance indices used in the TLA may not adequately represent coastwide adult abundance and the TLA may not be sensitive enough to trigger management action when changes to the fishery occur that should trigger action. Additionally, current management lacks specificity in measures implemented if management action is triggered and attainability by requiring a percent increase in abundance be achieved through a percent reduction in harvest derived from the TLA analysis. Draft Addendum III incorporates PRT-recommended updates to improve the TLA analysis and proposes alternatives to the current management triggers and responses.

2.2 Background

Spot are a small sciaenid forage species that support commercial and recreational fisheries in the Mid- and South Atlantic regions. Spot migrate seasonally along the coast, moving northward and inshore to estuaries and bays during warmer months (spring-fall) and southward and offshore to more oceanic waters in the winter. Spot feed on planktonic organisms as post-larvae and young-of-the-year, and as juveniles and adults prey on bottom dwelling organisms such as worms and crustaceans. Spot reach maturity by approximately age two and are considered a short-lived species, rarely living beyond six years.

2.2.1 Stock Status and Assessment

While state level stock assessments for spot have been conducted over the years, a coastwide benchmark assessment has not been approved for management use. The most recent coastwide assessment, conducted in 2017, was not recommended for management use by the Peer Review Panel. Therefore, current stock status is unknown, although the Peer Review Panel did not indicate problems in the spot fishery that would require immediate management action. The Peer Review Panel did recommend continued evaluation of the fishery using the annual TLA. The Peer Review Panel also noted that estimated discards from the shrimp trawl fishery were derived using current and supported methods. These estimates had not previously been made, but they suggested that shrimp trawl discards constitute a majority of spot removals.

One of the reasons the 2017 stock assessment was not approved for management use was due to conflicting signals in harvest and abundance characteristics. Theoretically, increases in adult abundance should result in more fish available to be caught by the fishery; thus, fishing would be more efficient (greater catch per unit effort) and harvest would increase in a pattern similar to adult abundance. However, several of the most recent abundance indices have shown increases while harvest has declined to some of the lowest levels on record. One factor that has contributed to overestimates of adult abundance is an increase in the number of juveniles misclassified as adults in surveys that historically have typically caught adults.

2.2.2 Traffic Light Approach as Applied to Spot

The TLA was originally developed as a precautionary management framework for data poor fisheries whereby reference points could be developed that would allow for some level of evaluation and management of the fishery, particularly in the absence of or between stock assessments. The name comes from assigning a color (red, yellow, or green) to categorize relative levels of different indicators for either a fish population or a fishery. Examples of indicators include growth and reproduction parameters, abundance and stock biomass estimates, recreational harvest, commercial landings, or fishing mortality. Additionally, the indicators can be combined to form composite characteristics within similar categories (e.g. biological, population estimates, or combined fisheries harvest). However, each indicator must be evaluated separately to determine its appropriateness for use in management.

In general practice when applying the TLA, the green/yellow boundary is typically set at the average for a reference time period and the yellow/red boundary is set at 60% of the reference period average, which would indicate a 40% decline (Halliday et al., 2001). Index values in the intermediate zone can be represented by a mixture of either yellow/green or yellow/red depending on where they fall in the transition zone.

Proportions of green and red for an individual component (e.g. recreational harvest) are calculated based on summary statistics for a predefined reference period. Annual values are compared to the reference period average to determine whether they are higher, lower, or the same. If the value is greater than the reference period average, a linear model is used to estimate the proportion green, such that greater values have a higher proportion green. If the value is less than the average, a linear model estimates the proportion red, such that lesser values have a higher proportion red. Yellow proportions are calculated as one minus the proportion green minus the proportion red and will be 100% yellow if the value equals the reference period average. Since an increasing percentage of red reflects a decreased value (e.g. harvest or abundance) below the reference period average, the proportion red offers a way of determining if any management response is necessary.

The color proportions in a composite index are averages of the color proportions for the individual components combined to make up the composite index. For example, if there are two components (e.g. recreational and commercial harvest) combined for the composite index, the proportion red is the average of the proportion red for both components, the proportion green is the average of the proportion green for both components, and the proportion yellow is the average of the proportion yellow for both components.

As an example of how to interpret TLA figures, consider year 2018 of Figure 1 (*Section 2.2.4*) which depicts the coastwide composite harvest characteristic of the Addendum II TLA. Table 1 lists specific values considered for this characteristic and year. The reference period is 1989-2012, with average annual harvests during this time period being 5.6 million pounds and 8.6 million pounds for the commercial and recreational sectors, respectively. In 2018, commercial harvest was 878 thousand pounds. This value is less than the reference period average. Therefore, a linear regression was used to calculate the percent red based on how much less the 2018 value is than the reference period average, resulting in 69.2% red, 30.8% yellow, and 0% green. In 2018, recreational harvest was 3.1 million pounds. This value is less than the reference period average. Therefore, a linear regression was used to calculate the percent red based on how much less the 2018 value is than the reference period average, resulting in 50.5% red, 49.5% yellow, and 0% green. Averaging of sector harvest characteristic values for each color results in the final composite characteristic percentages: 59.8% red, 40.2% yellow, and 0% green.

Table 1. Commercial and recreational harvests and Traffic Light Approach (TLA) percentages for the 2018 spot harvest characteristics (commercial, recreational, and composite), using the 1989-2012 reference period.

1989-2012 Coastwide Average Commercial Harvest	5,574,170 pounds
2018 Coastwide Commercial Harvest	878,077 pounds
2018 Commercial Harvest TLA Percentages (Red, Yellow, Green)	69.2%, 30.8%, 0%
1989-2012 Coastwide Average Recreational Harvest	8,610,835 pounds
2018 Coastwide Recreational Harvest	3,068,469 pounds
2018 Recreational Harvest TLA Percentages (Red, Yellow, Green)	50.5%, 49.5%, 0%
2018 Composite Harvest TLA Percentages (Red, Yellow, Green)	59.8%, 40.2%, 0%

For spot, the TLA is used to provide management guidance in between stock assessments. It has two parts, a harvest characteristic, comprised of commercial landings and recreational harvest data, and an abundance characteristic, comprised of fishery-independent abundance indices. The PRT annually runs the TLA and includes the results in the annual FMP Review. To utilize the best data available, the PRT is able to modify the TLA as needed through annual reviews and updates.

2.2.3 Recommended Changes to the TLA and Management Responses

Following the failed assessment in 2017, the Board tasked the Spot PRT with exploring potential updates to improve the TLA. The PRT developed five recommendations, which are listed below and are being considered for implementation through this Draft Addendum.

1. Incorporation of indices from the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) and the North Carolina Division of Marine Fisheries (NCDMF) Pamlico Sound Survey, into the adult composite characteristic index, in addition to the currently used indices from the Northeast Fisheries Science Center (NEFSC) Multispecies Bottom Trawl Survey and the South Atlantic component of the Southeast Area Monitoring and Assessment Program (SEAMAP).
2. Use of revised adult abundance indices from the surveys mentioned above, in which age-length keys and length composition information are used to estimate the number of adult (age 1+) individuals caught by each survey.
3. Use of regional metrics to characterize the fisheries north and south of the Virginia-North Carolina state border. The ChesMMAP and NEFSC surveys would be used to characterize abundance north of the border, and the NCDMF Program 195 and SEAMAP surveys would be used to characterize abundance south of the border.
4. Change/establish the reference time period for all surveys to be 2002-2012.

5. Change the triggering mechanism to the following: Management action will be triggered according to the current 30% and 60% red thresholds if both the abundance and harvest thresholds are exceeded in any 2 of the 3 terminal years.

Some of these changes, such as the selection of fishery-independent surveys used for the abundance characteristic, incorporation of age and length information, and establishment of a new reference time period are already allowed under Addendum II. However, changes to the triggering mechanism are beyond the scope of Addendum II. Thus, they are proposed in this addendum. Draft Addendum III proposes the establishment of a Spot Technical Committee (TC) with the ability to alter the TLA as needed to best represent trends in spot harvest and abundance, including selection of surveys and methods to analyze and evaluate these data. The TC would also evaluate implementation of management responses triggered through the TLA.

After considering the recommended changes to the TLA, the Board tasked the Atlantic Croaker and Spot PDT with exploring potential management responses to management triggers that could result after incorporation of these updates. The PDT noted that there are currently no coastwide management requirements for spot. Additionally, because of a lack of information on environmental impacts on spot abundance or harvest and the apparent disconnect between Addendum II harvest and abundance characteristics, a reduction in harvest may not necessarily result in a proportional increase in abundance. Therefore, the PDT recommended establishment of base management measures that would reduce fishing impacts so as to not exacerbate periods of low abundance. Additionally, with the recommended updates incorporating regional TLAs, the PDT noted this approach was developed to increase survey coverage and sensitivity, but spot are still a single, coastwide stock. Therefore, any management triggers resulting from regional TLAs should incorporate some form of response throughout the management unit.

2.2.4 Population Characteristics

The following figures show composite harvest characteristic TLA analyses for spot through 2018 using the methods from Addendum II (Figure 1) and those proposed in Draft Addendum III (Figures 2 and 3). Changes to analyses being incorporated through Draft Addendum III are shown in bold font in the captions for Figures 2 and 3, including use of regional information and a different reference time period.

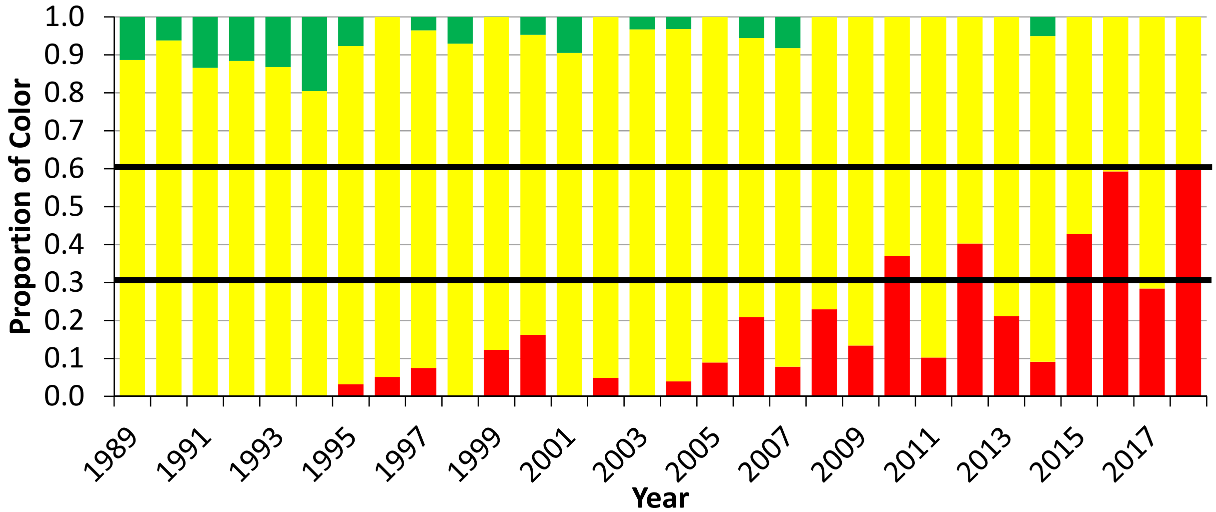


Figure 1. Addendum II Composite TLA using commercial landings and recreational harvest for spot with 30% and 60% red management thresholds (reference years 1989 – 2012).

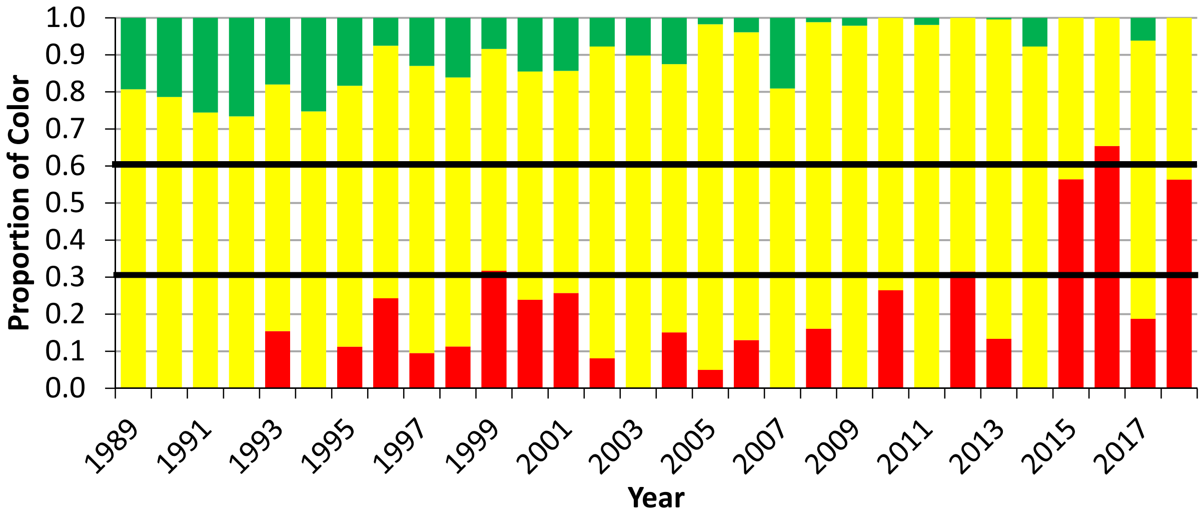


Figure 2. Draft Addendum III **Mid-Atlantic (NJ-VA) Regional** Composite TLA using commercial landings and recreational harvest for spot with 30% and 60% red management thresholds (**reference years 2002 – 2012**).

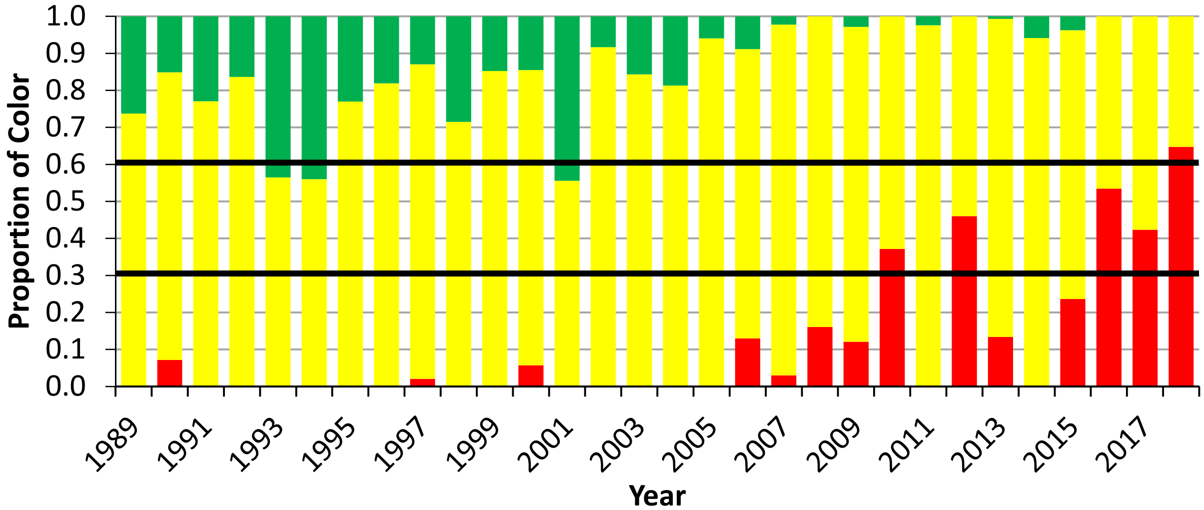


Figure 3. Draft Addendum III **South Atlantic (NC-FL) Regional** Composite TLA using commercial landings and recreational harvest for spot with 30% and 60% red management thresholds (**reference years 2002 – 2012**).

The following figures show composite abundance characteristic TLA analyses for spot through 2018 using the methods from Addendum II (Figure 4) and those proposed in Draft Addendum III (Figures 5 and 6). Changes to analyses being incorporated through Draft Addendum III are shown in bold font in the captions for Figures 5 and 6, including use of age and regional information and a different reference time period.

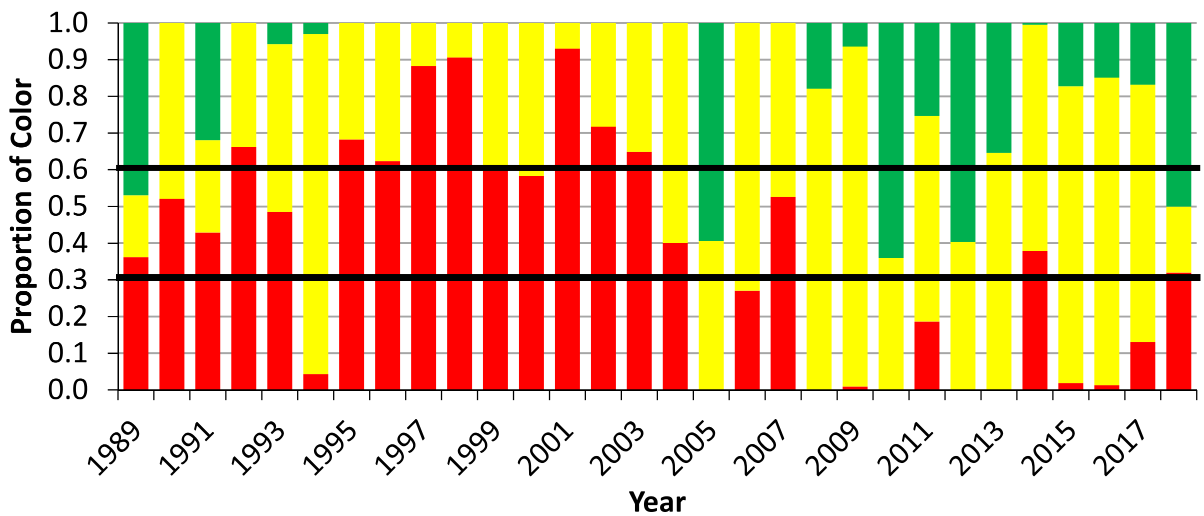


Figure 4. Addendum II Composite TLA using fishery-independent survey indices (NEFSC Trawl Survey and SEAMAP) for spot with 30% and 60% red management thresholds (reference period years 1989 – 2012).

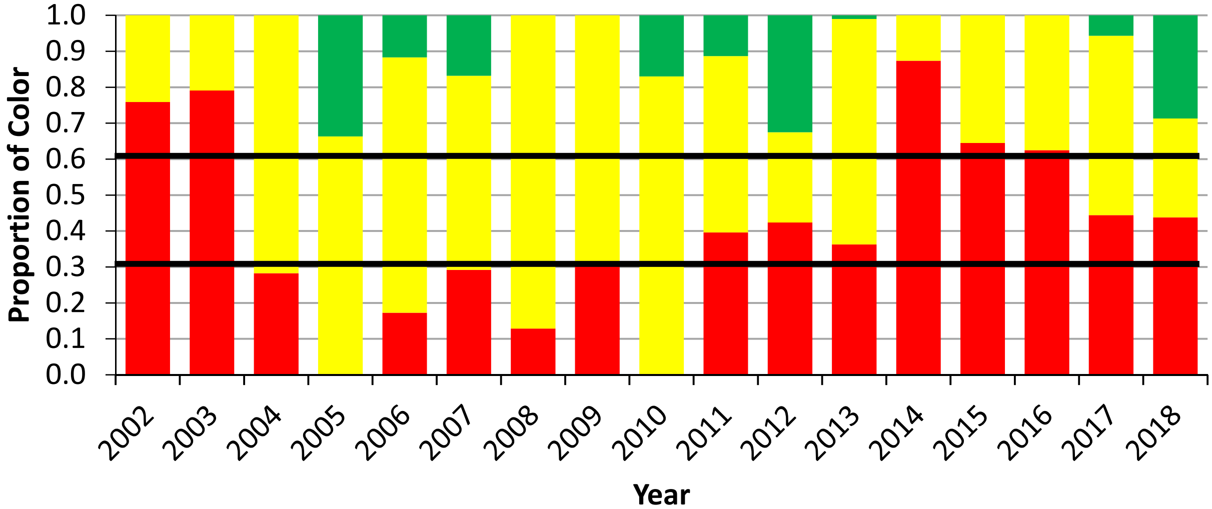


Figure 5. Draft Addendum III **Mid-Atlantic (NJ-VA) Regional** Composite TLA using **age-specified** fishery-independent survey indices (NEFSC Trawl Survey and **ChesMMAP**) for spot with 30% and 60% red management thresholds (**reference period years 2002 – 2012**).

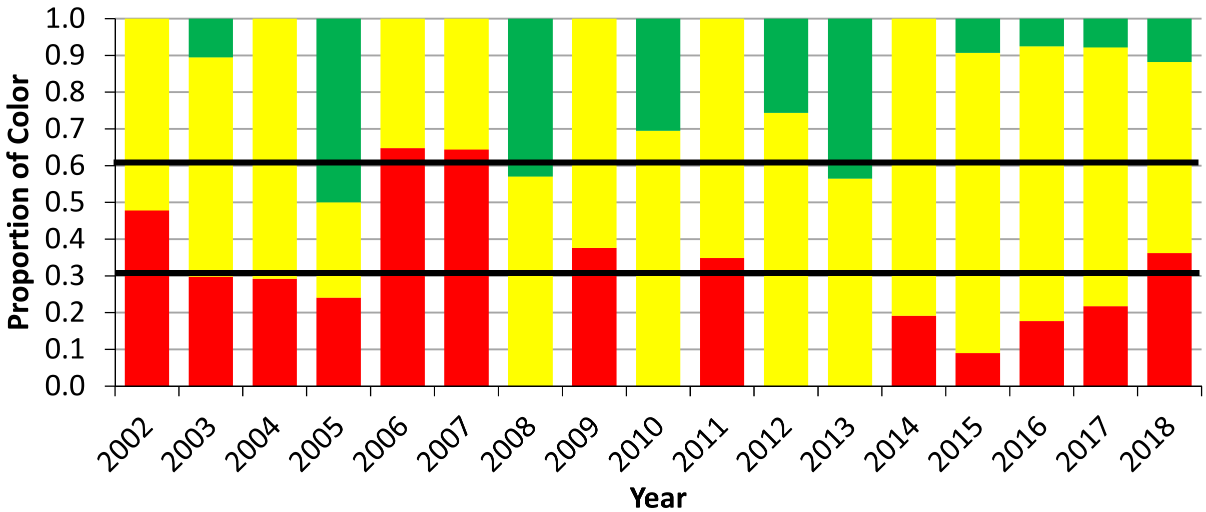


Figure 6. Draft Addendum III **South Atlantic (NC-FL) Regional** Composite TLA using **age-specified** fishery-independent survey indices (SEAMAP and **NCDMF**) for spot with 30% and 60% red management thresholds (**reference period years 2002 – 2012**).

3.0 PROPOSED MANAGEMENT PROGRAM

Changes to the management program would replace Section 3.0 of Addendum II to the Omnibus Amendment to the Interstate FMPs for Spanish Mackerel, Spot, and Spotted Seatrout.

The following issues consider options for the TLA management triggering mechanism (Issue 1) and required management responses for the recreational (Issue 2) and commercial (Issue 3) fisheries. Recommended updates to the TLA analyses including additional fishery-independent survey indices, use of age information, use of regional characteristics, and changing the reference time period, will be incorporated into the TLA as part of this addendum, but are not considered with alternatives in the following issues as they apply the most current scientific advice, which is allowed under Addendum II. Draft Addendum III also retains the TC's ability to alter the TLA as needed to best represent trends in spot harvest and abundance.

3.1 Issue 1: Management Trigger Based on Proportion Red

Staus quo is not included in either of the following options due to the incorporation of regional characteristics, which is based on the most current scientific advice. Option A is closest to status quo, as it retains the Addendum II trigger timeframe.

Option A. If red proportions for both population characteristics (adult abundance and harvest) in a specific regional or a coastwide TLA meet or exceed the proportion of a threshold for the two terminal (most recent) years, then management action would be required.

Option B. If red proportions for both population characteristics (adult abundance and harvest) in a specific regional or a coastwide TLA meet or exceed the proportion of a threshold for any two of the three terminal years, then management action would be required. (PRT recommendation from *Section 2.2.3*)

Thresholds for both options are listed below:

30% - this represents moderate concern to the fishery with moderate management response
60% - this represents significant concern to the fishery with elevated management response

3.2 Management Response to Triggers

If management action has not been triggered according to *Section 3.1*, there are no coastwide management requirements, in accordance with the Omnibus Amendment. State regulations restricting spot harvest are encouraged to be maintained.

Per the PDT recommendations and direction of the Board, TLA-triggered management response options were developed to reduce fishing impacts to not exacerbate periods of low abundance. As the TLA does not offer advice on overfished or overfishing status, resulting management responses are not designed to stop overfishing or recover an overfished stock. Such status designations should be evaluated through a stock assessment and responded to accordingly. Additionally, while projected reductions to previous harvests are incorporated into the management responses, due to the lack of a coastwide quota and uncertainty of the fishery's behavioral response to triggered management measures, it is recognized that projected harvest reductions based on past fishery performance may not necessarily be achieved through triggered management measures. Furthermore, due to large numbers of removals from this population as bycatch through the South Atlantic shrimp trawl fishery, it is also recognized that directed harvest reductions may not result in large increases to abundance. However, these measures would reduce the probability of directed harvest inhibiting growth of the spot stock and provide baseline information for any future consideration of coastwide management measures.

Recreational response alternatives include bag limits while commercial alternatives include percentage reductions through quantifiable measures such as seasons, trip limits, or size limits. In developing these different regulatory responses, the PDT considered sector differences in gears, fishing behavior, and state regulations already in place.

If management action is triggered according to *Section 3.1*, the Draft Addendum proposes the following coastwide requirements (NOTE: the public is asked to identify its preferred option for both the recreational and commercial sectors):

3.2.1 Issue 2: Recreational Management Trigger Response Options

Option A. (Status Quo) The PRT would recommend the appropriate percent reduction in recreational harvest needed and state-by-state measures to achieve the harvest reduction for approval by the Board. This allows the states to meet the individual needs of their fisheries. The application of an overall harvest percentage reduction would be proportional to the magnitude of exceeding the trigger, using a combination of management tools that include size limits, bag/trip limits, seasonal closures, and gear restrictions.

Option B. If management action is triggered by meeting or exceeding the 30% red threshold, all non-*de minimis* states would be required to institute a bag limit of no more than 50 spot per person. If management action is triggered by meeting or exceeding the 60% threshold, all states (including *de minimis*) would be required to institute a bag limit of no more than 40 spot per person.

Option C. If management action is triggered by meeting or exceeding the 30% red threshold, all non-*de minimis* states would be required to institute a bag limit of no more than 40 spot per person. If management action is triggered by meeting or exceeding the 60% threshold, all states (including *de minimis*) would be required to institute a bag limit of no more than 30 spot per person.

Option D. If management action is triggered by meeting or exceeding the 30% red threshold, all non-*de minimis* states would be required to institute a bag limit of no more than 30 spot per person. If management action is triggered by meeting or exceeding the 60% threshold, all states (including *de minimis*) would be required to institute a bag limit of no more than 20 spot per person.

State and coastwide harvest reductions for each of the above options were estimated, based on Marine Recreational Information Program intercept and harvest data from 2009-2018 (Table 2). For trips that exceeded the number of fish allowed by each limit, the number of fish beyond the limit were summed, converted to pounds using average weights, and divided by the total harvest to estimate the percent reductions. Coastwide reductions, depending on the option chosen and which percent red threshold is exceeded (30% or 60%), range from 5.4% (50 fish bag limit) to 36.6% (10 fish bag limit).

Table 2. Estimated state and coastwide reductions from Issue 2 option bag limits, based on Marine Recreational Information Program intercept and harvest data from 2009-2018. Shown reductions assume non-*de minimis* status for all states, although Issue 2 Options A-D do not require bag limits for *de minimis* states when management action is triggered by exceedance of the 30% red threshold.

	Estimated Percent Reductions in Harvest (Pounds) from 2009-18 Averages								
Bag Limit	**NJ**	**DE**	**MD**	**VA**	**NC**	**SC**	**GA**	**FL***	**Total**
50 fish	0.00%	6.81%	0.83%	9.26%	5.40%	1.39%	0.00%	0.21%	5.35%
40 fish	0.96%	10.89%	1.31%	12.69%	7.91%	6.07%	0.00%	0.41%	8.19%
30 fish	8.26%	20.71%	1.91%	19.15%	12.11%	17.17%	0.00%	0.60%	13.93%
20 fish	13.19%	30.67%	3.42%	29.73%	20.88%	29.14%	0.00%	1.22%	22.52%
10 fish	24.03%	44.77%	11.89%	42.96%	39.30%	46.60%	0.00%	8.29%	36.56%
2009-18 Average Harvest	181,274	124,704	865,618	2,760,249	1,462,935	1,093,306	8,988	344,906	6,841,980

*Florida only includes Atlantic coast harvest and estimated reduction.

Under any option selected, states would be encouraged to maintain any measures already in place that are more restrictive than those required by this addendum.

De minimis states are those in which enforcement actions would be expected to contribute insignificantly to a coastwide conservation plan. Per *Section 4.4.3* of the Omnibus Amendment, states may apply for this status if, for the preceding three years for which data are available, their average combined commercial and recreational spot landings (by weight) constitute less than one percent of the average combined coastwide commercial and recreational spot landings for the same period.

Recreational for-hire vessels may possess live spot for use as bait. The maximum number of spot allowed to be held onboard for this use prior to beginning a trip, during a trip or after a trip is completed would be the bag limit in effect multiplied by the number of customers allowed on the vessel. During a trip, the number of spot in possession to be harvested could not exceed the bag limit in effect multiplied by number of anglers onboard the vessel during the trip (any additional spot in possession, up to the limit stated above, must be those to be used as live bait). In this context, a trip would be defined as a period of time in which fishing is conducted, beginning when the vessel leaves port and ending when the vessel returns to port. If no coastwide bag limit is in effect, then this use would not be limited by this addendum.

Recreational private vessels that possess live spot for use as bait would be subject to personal bag limits of anglers on the vessel, with live fish possessed counting towards the bag limits. If no coastwide bag limit is in effect, then this use would not be limited by this addendum.

3.2.2 Issue 3: Commercial Management Trigger Response Options

Option A. (Status Quo) The PRT would recommend the appropriate percent reduction in commercial harvest needed and state-by-state measures to achieve the harvest reduction for approval by the Board. This allows the states to meet the individual needs of their fisheries. The application of an overall harvest percentage reduction would be proportional to the magnitude of exceeding the trigger, using a combination of management tools that include size limits, bag/trip limits, seasonal closures, and gear restrictions.

Option B. Include the following language defining commercial responses to triggers at the 30% and 60% thresholds, with selection of one of Sub-Options B1-B3.

30% Red Threshold *(single option proposed)*
If management action is triggered by meeting or exceeding the 30% red threshold, non-*de minimis* states that do not already have a minimum size limit or possession limit would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) to reduce commercial harvest by 1% of the average state commercial harvest from the previous 10 years. States may establish differential measures by gear or area, as long as measures implemented are quantifiable and achieve the required 1% reduction for the entire state commercial harvest.

60% Red Threshold *(choose one of Sub-Options B1-B3)*
Sub-Option B1. If management action is triggered by meeting or exceeding the 60% red threshold, all states (including *de minimis*) would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) to reduce commercial harvest by 5% of the average state commercial harvest from the previous 10 years.

Sub-Option B2. If management action is triggered by meeting or exceeding the 60% red threshold, all states (including *de minimis*) would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) to reduce commercial harvest by 10% of the average state commercial harvest from the previous 10 years.

Sub-Option B3. If management action is triggered by meeting or exceeding the 60% red threshold, all states (including *de minimis*) would be required to institute quantifiable measures (e.g. season, trip limit, or size limit) to reduce commercial harvest by 20% of the average state commercial harvest from the previous 10 years.

All measures established as required responses to TLA triggers would be evaluated to determine if they are both quantifiable and meet the objective reduction by the TC and approved by the Board prior to implementation.

3.2.3 Technical Committee

This Draft Addendum proposes the establishment of a Spot TC to provide scientific and technical advice, as defined in *Section 4.7.4* of the Omnibus Amendment. This advice would include evaluation of plans to implement management actions. All measures established as required responses to TLA triggers would be reviewed by the TC and approved by the Board prior to implementation.

3.2.4 Management Alternatives

If management action is triggered by meeting or exceeding the 60% red threshold and the Board determines more restrictive actions are necessary than those defined in *Sections 3.2.1* or *Section 3.2.2*, the Board may task the TC to determine an alternative reduction to the recreational or commercial fisheries. The TC would recommend the appropriate percent reduction in harvest needed and state-by-state measures to achieve the harvest reduction for approval by the Board. This allows the states to meet the individual needs of their state's fisheries. The application of an overall harvest percentage reduction may include use of a combination of management tools that include size limits, bag/trip limits, seasonal closures, and gear restrictions.

3.3 Issue 4: Evaluation of Fishery Response to Management Measures

Option A. (Status Quo) Management measures set in response to any trigger would remain in place for two years to promote consistent measures and allow for sufficient time to evaluate population response. Once management action has been taken, the thresholds would not be applied to the harvest characteristics in assessing the fishery for two years, as the fishery-dependent data may be influenced by management action.

Option B. Management measures set in response to any trigger would remain in place for at least two years to promote consistent measures and allow for sufficient time to evaluate population response. Once management action has been taken, the harvest characteristics would no longer be used to trigger management action, as the fishery-dependent data may be influenced by triggered measures. While triggered measures are in effect, a composite regional abundance characteristic, by itself, may trigger action at the next highest level of management response by the proportion red exceeding the next highest threshold in any two of the three terminal years.

After a minimum of two years, once no composite regional abundance characteristics trigger management action at either threshold, triggered measures would no longer be required, and the TC would resume using the harvest characteristics as components of the TLA that would be required to trigger management action.

If triggered measures have remained in place for a minimum of three years due to proportions of red above a threshold for either of the composite regional abundance characteristics, the TC would, as part of conducting the annual TLA, evaluate trends in abundance to recommend to the Board whether triggered measures should remain in place or more restrictive measures should be considered.

4.0 COMPLIANCE

The management framework contained in *Section 3.0* of Addendum III to the Omnibus Amendment is effective immediately upon Addendum III's approval.

5.0 LITERATURE CITED

Halliday, R.G., L.P. Fanning, and R.K. Mohn. 2001. Use of the Traffic Light Method in Fishery Management Planning. Canadian Science Advisory Secretariat, Research Document No. 108. 41 p.

6.0 APPENDIX

To aid in public interpretation of TLA figures and results, the following figures depict components of spot TLA characteristics in a linear format with the long-term mean (average) (LTM) of the proposed reference period (2002-2012).

Commercial and Recreational Harvest

Commercial landings show general declining trends in both regions with greater variability in the Mid-Atlantic.

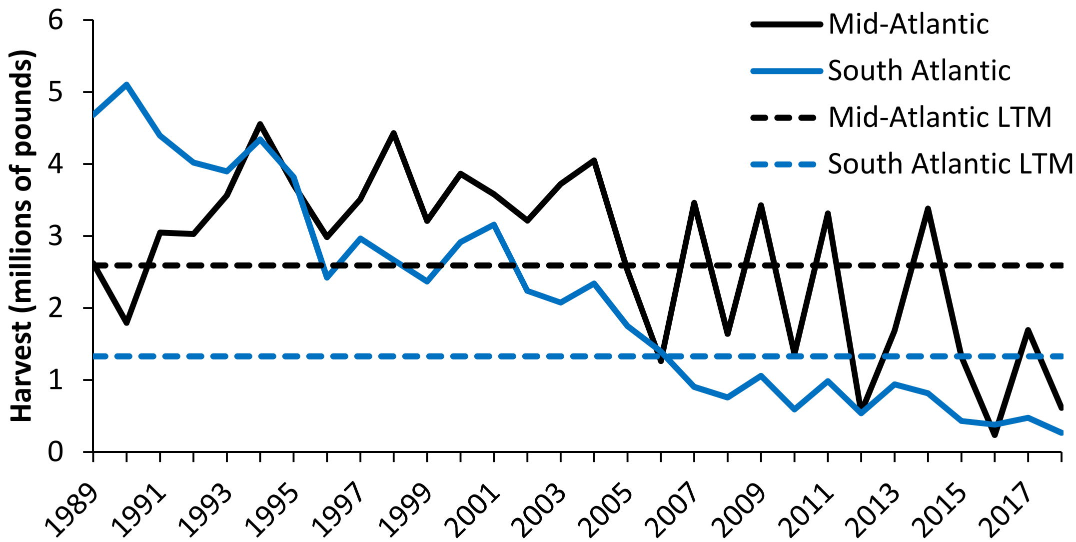


Figure A1. Commercial harvest and the LTM harvest for 2002-2012 in the Mid-Atlantic (NJ-VA) and South Atlantic (NC-FL) regions.

Recreational harvest shows a highly variable trend in the Mid-Atlantic, with most of the last ten years near or below the LTM. South Atlantic recreational harvest shows a declining trend with most of the last ten years near or below the LTM.

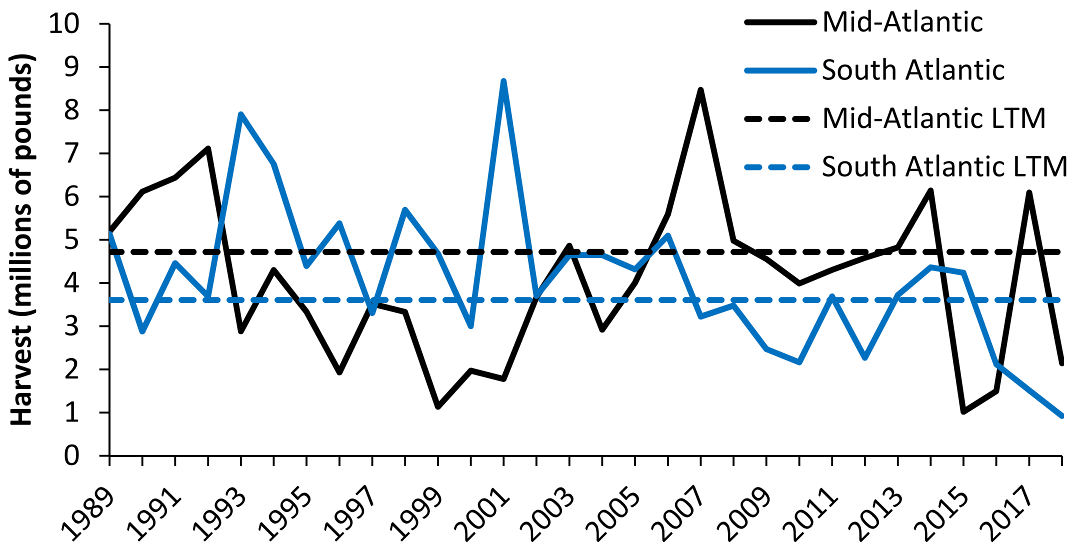


Figure A2. Recreational harvest and the LTM harvest for 2002-2012 in the Mid-Atlantic (NJ-VA) and South Atlantic (NC-FL) regions.

Abundance Indices

Mid-Atlantic

The Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey adult index showed a general increasing trend from the early 1990s to 2012, after which the index has been highly variable.

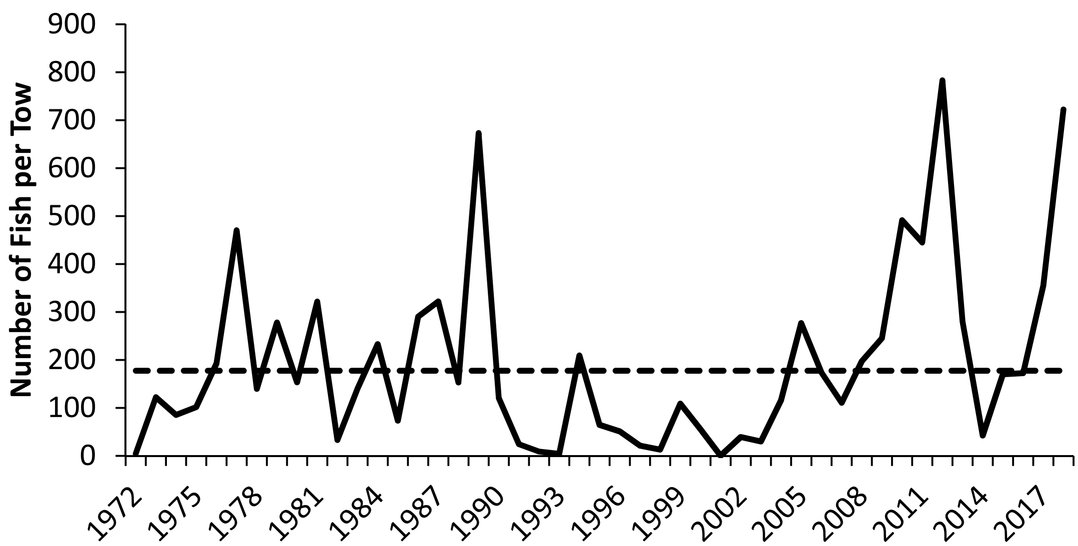


Figure A3. NEFSC adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

The Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) adult index shows a steady decline from the peak in 2005 and values below the LTM since 2008.

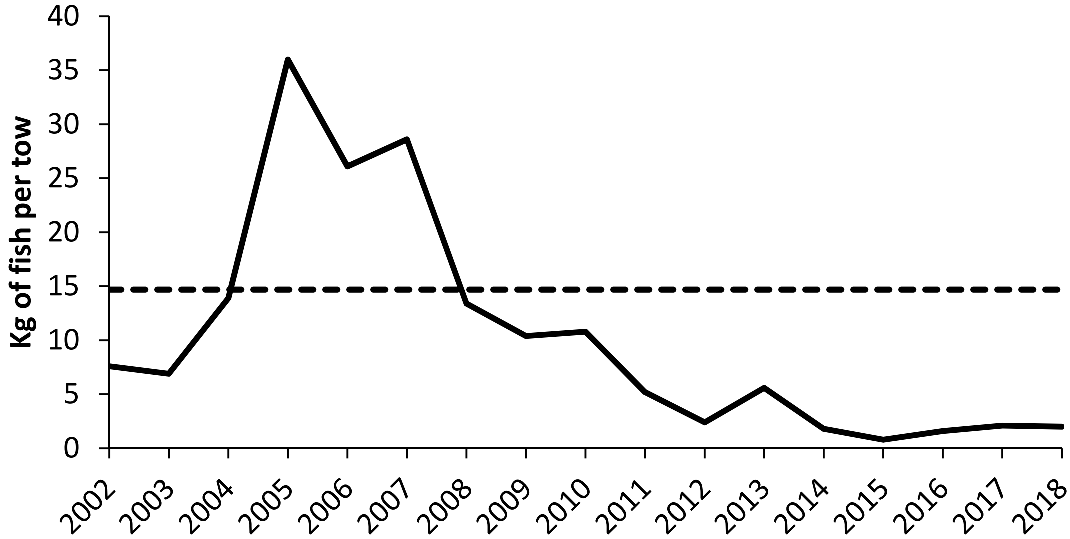


Figure A4. ChesMMAP adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

South Atlantic

The Southeast Area Monitoring and Assessment Program (SEAMAP) adult index has been variable about the LTM over, approximately, the last 25 years.

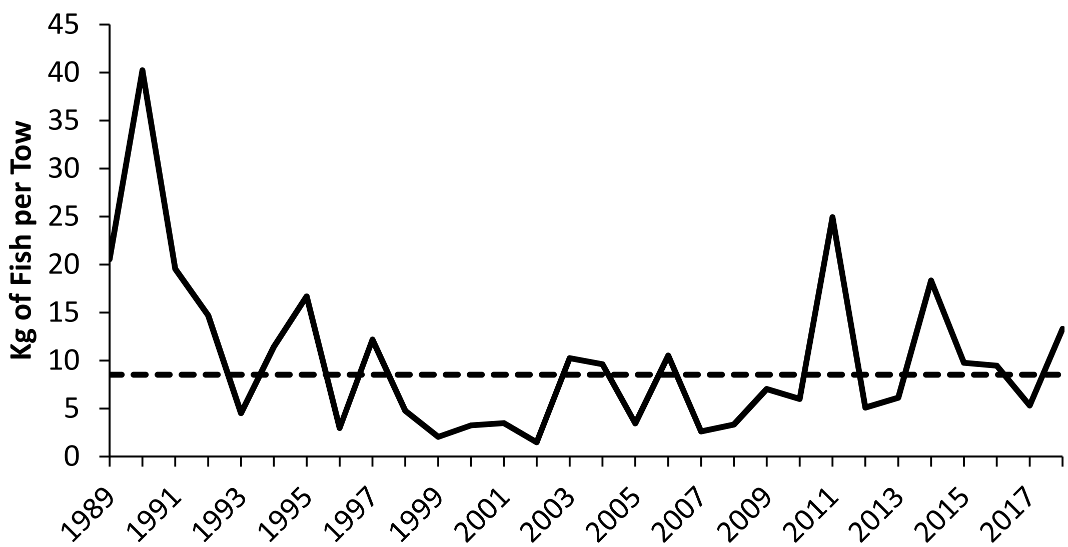


Figure A5. SEAMAP adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

The North Carolina Division of Marine Fisheries (NCDMF) Pamlico Sound Survey index has been below the LTM for most years since its peak in 2005.

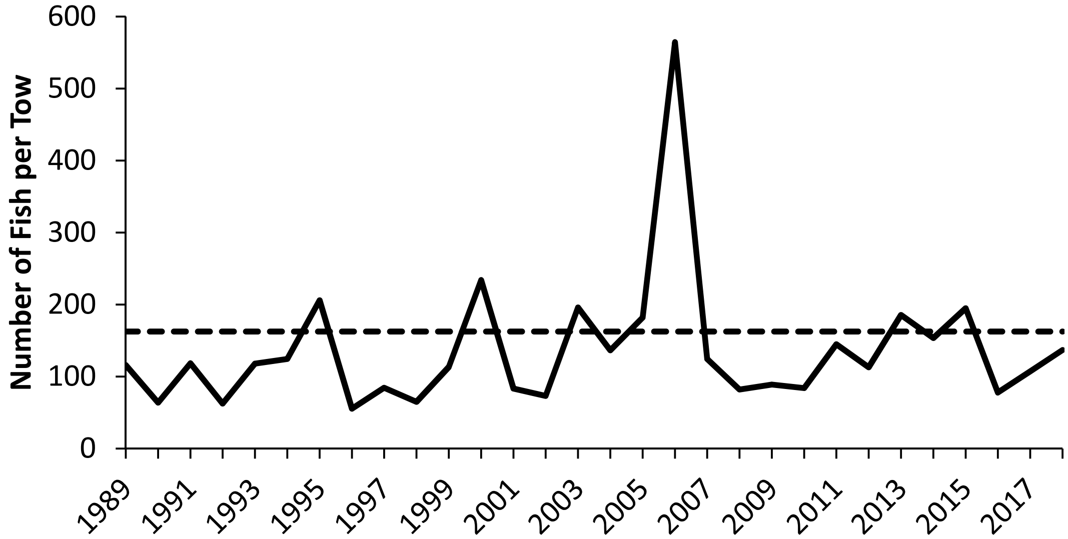


Figure A6. NCDMF adult index (solid line) and the LTM adult index for 2002-2012 (dashed line).

Dr Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A-N
Arlington, VA 22201

January 11, 2020

Dr Schmidtke,

The North Carolina Watermen United (NCWU) is writing to be sure that you are aware of the problem of how the population of cormorants may affect the Draft Addendum III for Atlantic Croaker and Spot.

Our fishermen have observed hundreds of cormorants flying in the sounds to dive unceasingly to eat small fish (Croaker, Spot, etc.) Futhermore, they fly out of the sounds to the inshore Atlantic coast to eat even more.

We understand that the North Carolina Wildlife Resources Commission is now in the process of a Study about the cormorant population; we are hoping that the Study will also include the contents of their stomachs so we can know about how many fish are eaten by their constant search for food.

We are asking that decisions be made about croaker and spot that takes the effects of nature's feeding habits into consideration.

Thank you for your attention to this matter.

Yours truly,

Perry Wood Beasley

Perry Wood Beasley
President, NCWU
252-706-0184

PWB: mm

Board of Directors

Andrew Berry	Billy Maxwell
Capt Sonny Davis	Greg Mayer
Ernie Doshier	Jamie Reibel
Ernie Foster	Britt Shackelford
Tom Harper	Duke Spencer
Glen Hopkins	Rom Whitaker

cc: Steve Murphey, Director, NCDMF
Chris Batsavage, NCDMF
Michael Regan, DEQ Secretary
John Nicholson, DEQ Deputy Secretary

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ADDENDUM

When I sent a DRAFT letter to our Board for approval, I received the reply below from Rom Whitaker, an NCWU Board Member who is an avid fisherman and duck hunter. I've included his comments in their entirety.

Melba Milak
Secretary, NCWU

This number of cormorants is not hundreds but thousands. I duck hunt almost every day during duck season in December and January out on the reef behind Hatteras and Frisco in the Pamlico Sound. Every day in the morning I see thousands of these birds leaving the sand islands in the sound and going to the ocean. Several mornings I have made rough but what I call a pretty good estimate (no way to count all) of number of cormorants flying to the ocean and it well exceeded 5 to 6 HUNDRED THOUSAND in one hour. They are not in that area every day but I do see them several times in the winter that thick. I think bird counters are going to be shocked when they count over a million from Oregon Inlet to Cape Lookout during the winter. Just watch one cormorant in the boat basin feeding for two hours and you will get an idea of how many fish they are consuming in a day. These birds are protected by the federal govt. so there is no control. This is by far the biggest problem to the spot and croaker population but no one wants to recognize it. Just blame the comercial fisherman who are really the ones going extinct.

I also want to get into the small coastal sharks and dogfish population. Most of our coastal sharks are either prohibited from catch or have very tight restrictions. What spot and croakers that are lucky enough to get big enough to avoid the Cormorants are fair game for the sharks. The real problems seem to be looked over again.

Rom Whitaker

COASTAL CONSERVATION ASSOCIATION

CONSERVATION & PROTECTION OF MARINE LIFE
6919 Portwest Drive, Suite 100 | Houston, Texas 77024
p 713.626.4234 | f 713.626.5852 | www.JoinCCA.org

January 10, 2020

Dr. Michael Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street
Suite 200A-N
Arlington, VA 22201

Dear Dr. Michael Schmidtke,

Thank you for the opportunity to comment on Draft Addenda III to the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot and Spotted Seatrout and Draft Addenda III to Amendment 1 of the Interstate Fishery Management Plan for Croaker, which are of great concern to our members. The Coastal Conservation Association is the largest marine resource conservation organization of its kind in the nation, with more than 130,000 members in state chapters on all three coasts.

We have long been concerned about the status of croaker and spot, and have been dismayed by the lack of management action to restore anything resembling historic abundance.

Spot and croaker have long been the backbone of the inshore and nearshore fishery in the southeast. Ocean fishing piers depended on the fall run of spot to make a profitable year; hordes of "spot jocks" descended on their favorite ocean piers to catch spot, which was a major boon to coastal economies. The croaker fishery was a cosmopolitan fishery that was available to anyone who could wet a line in the estuaries.

Those fisheries are essentially gone.

In North Carolina, the commercial landings of spot, croaker and weakfish have declined nearly 90 percent since 1997. The recreational harvest of spot in the South Atlantic area has fallen from 18 million fish in 2001 to 4 million fish in 2018; croaker have been under their long-term mean in the South Atlantic for much of the last 20 years.

These three species have one attribute in common - they are the dominant species caught as bycatch in the southeast shrimp trawl fishery. North Carolina allows shrimping in most inshore waters and is the last state on the Atlantic coast to allow significant shrimping effort in estuarine waters. Over the past four years, North Carolina shrimpers have landed

9 million pounds in 2015, 13 million pounds in 2016, nearly 14 million pounds in 2017 and nearly 10 million pounds of shrimp in 2018. **That means that on average they caught 11.5 million pounds of shrimp – and discarded dead about 45 million pounds of bycatch. The majority comprised of spot, croaker, menhaden and weakfish.** In fact, reducing directed harvest of spot and croaker without addressing shrimp trawl discards would accomplish little.

We are concerned that the traffic light approach (TLA) may not work to restore abundance of spot and croaker; it certainly has not worked thus far. We believe a simpler approach is better – reduce catch now, by at least 25 percent in both the commercial and recreational fisheries as well as, most importantly, shrimp trawl bycatch, in order to begin restoring abundance of these keystone species. We realize 25 percent may not be enough, but we strongly believe that reducing removals now will pay dividends in the near future and will take the pressure off so that the TLA can be better refined. Deeper targeted cuts in removals may be necessary.

Many a youngster's first trip to the coast used to be to catch a mess of spots or a bucketful of croaker. Those fisheries used to be an economic boon for coastal communities. They provided a dependable, accessible resource for the public to enjoy and we have allowed them to all but disappear. That much of this decline is attributable to those species being discarded and wasted as bycatch from shrimp trawls in sensitive estuaries is simply tragic.

It is past time the ASMFC acted to restore these important fisheries to their past abundance.

Sincerely,

Bill Bird

Bill Bird, Chairman
CCA National Government Relations Committee

cc:
Patrick C. Keliher, ASMFC Chairman
ME Dept. of Marine Resources
21 State House Station
Augusta, ME 04333-0021

Virginia Saltwater Sportfishing Association, Inc (VSSA)
PO Box 28898
Henrico, VA 23228
www.ifishva.org

Dr. Michael Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200A - N
Arlington, VA 22201

Dear Dr. Schmidtke, January 7, 2020

The Virginia Saltwater Sportfishing Association (VSSA), with over 600 members, requests the following be included as a public comment for the Croaker and Spot public hearings and FMP. VSSA conducted a poll on the croaker and spot options for 2020. The results can be found on our website at http://joinvssa.org/action-plan/spot-croaker/ and a summary is enclosed for reference.

VSSA supports Option D for both spot and croaker. Our anglers are conservation minded and prefer the conservative approach of limits of 30 spot per person or 20 per person if threshold is exceeded by 60% or more.

We do recommend provisions be made for anglers (both private and charters) who might keep spot or croaker at their dock in a bait pen. After an angler returns home, the per person limit should not apply because more than one person's limit will likely be in the bait pen.

We are not commenting on the option for commercial fisherman. We are troubled in reading the 2017 stock assessments that over 90% of the harvest comes from dead discards from the NC or South Atlantic Shrimp Trawls. We recommend the focus of your efforts be to reduce these discards as dead discards is such a waste of this resource.

VSSA appreciates the opportunity to comment on these important FMPs.

Thank you for your time.

Sincerely,

Mike Avery

Mike Avery, President

VSSA conducted a poll on the spot and croaker options for 2020. The results can be found on our website at http://joinvssa.org/action-plan/spot-croaker/

What Management Option Do You Prefer for Spot

Option D - 30 Spot Per Person (20 if exceeded by 60% or more) (62%, 109 Votes)

Option A - Status Quo - VMRC would determine bag limits if threshold is exceeded. (17%, 30 Votes)

Option B - 50 Spot Per Person (40 if exceeded by 60% or more) (13%, 23 Votes)

Option C - 40 Spot Per Person (30 if exceeded by 60% or more) (8%, 14 Votes)

Total Voters: 176

Croaker Options.

What Management Option Do You Prefer for Croaker

Option D - 30 Croaker Per Person (20 if exceeded by 60% or more) (65%, 115 Votes)

Option A - Status Quo - VMRC would determine bag limits if threshold is exceeded. (17%, 30 Votes)

Option B - 50 Croaker Per Person (40 if exceeded by 60% or more) (11%, 20 Votes)

Option C - 40 Croaker Per Person (30 if exceeded by 60% or more) (7%, 13 Votes)

Total Voters: 178

Virginia Saltwater Sportfishing Association
PO Box 28898, Henrico, VA 23228
www.ifishva.org

Atlantic States Marine Fisheries Commission Amendments to Atlantic Croaker & Spots is in need of a total remake / rewrite

Cycles of fish are well documented & follow the tide cycles & solar cycles in moons & not months thus "so called science" lack comprehension & understanding **or the "so called science" is supporting:**

U.S. Commerce & State Department agenda to make the United Stated a total seafood importing Nation! [BEGUN IN 1960'S] TODAY 92% TO 93% OF ALL CONSUMED SEAFOOD IS IMPORTED! Atlantic States Marine Fisheries Commission is proposing restrictions instead of following Articles of incorporation IV ... *stocking of the waters of such states with fish or* ***fish eggs DOES Atlantic States Marine Fisheries Commission HAVE A AQUACULTURE OR OCEAN RANCHING OBJECTIVE TO REPLENISH CROAKER & SPOTS ?***

National Coastal Condition Report from Environmental Protection Agency 1 11 address the conditions of the waters of the Atlantic States; Does Atlantic States Marine Fisheries Commission amendment addresses environmental or man made chemicals such as plastics molecules and pharmaceuticals? [JET FUEL SPILL / LEAK NEAR Cherry Point N C & U.S. Navy Air Force Marines policy of misting fuel prior to landing affecting spawning & growth of Spots & Croakers.

The proposed traffic light approach is a Southeast East Fisheries Science Center creation with no underling scientific grounds / support; WHAT OTHER COUNTRY UTILIZES THE TRAFFIC LIGHT APPROACH? {group think by Atlantic States Marine Fisheries Commission and so called science of the state employees}

Atlantic States Marine Fisheries Commission staff should review Yamaha Fisheries Journal Archives found on the internet for species filling the same ecological niche in Asia for methods of cycles for tide & solar management. **REALIZING THE JOURNALS ARE 30 TO 35 YEARS OLD. Then ask Asian fishery science what is the latest & best method of management & ENHACEMENT / OCEAN RANCHING TO SUPPLY SEAFOOD TO A NATION.**

The use of "Abundance information from the North East Science Center Biglow is not correct. Area distance from shore covered by this survey has changed. Many / most all; employees of states doing surveys with nets do not know how to correctly use the equipment. Refusal to utilize NEMP is suspect.

The problem of recreational reporting mers or what ever; has resulted in problems yet Atlantic States Marine Fisheries Commission will NOT REQUIRE SMART PHONE REPORTING! To have correct recreational reporting!

When true reporting [SMART PHONE TYPE] is mandated on recreational landings will double again THE 80% GOING TO PRIVATE DOCKS WILL THEN BE REPORTING!

Commercial Landings from North Carolina the last 10 years declined not because of abundance of fish but conditions at Oregon Inlet created by Dept. Interior working with Commerce & State. Combined with Virginia implementing restrictive trout enforcement. NC Standard Commercial Fishing Licenses declined over 50% in last 15 years. SHOW DECLINE IN COMMERCIAL LICENSES IN ALL STATES WITH CROAKER & SPOTS ! Prior to utilizing harvest as an indicator for management needs.

The Best NC Flynet Fishermen have moved to vessels with more lucrative sea scallop permits or died. **USING COMMMERCIAL LANDINGS FOR THE LAST 10 YEARS IS NOT CORRECT!!!**

LOW INCOME FISHERMEN IN THE SOUTH DO NOT PURCHASE RECREATIONAL LICENSES BECAUSE! ** regulations on other fish do not allow retention for food******
Atlantic States Marine Fisheries Commission REFUSES TO UTILIZE TOTAL LENGTH RETENTION FOR MANAGED SPECIES THUS ALLOWING THE LOW INCOME FISHERMEN FISH FOR FOOD!!!
INSTEAD Atlantic States Marine Fisheries Commission
BOARD MEMBERS PROPOSE SIZE RESTRICTIONS TARGETING THE FEMALE FISH SO THE BOARD MEMBER CAN BRAG & FILLET THEIR CATCH WHILE SUPPORTING THE IMPORTATION OF 92% TO 93% OF U.S. CONSUMED **SEAFOOD**!

INSTEAD OF DRAFT ADDENDUM 111 TO AMENDMENT 1 IMPLEMENT ARTICAL 1V of the Atlantic States Marine Fisheries Commission Compact WITH ENHANCEMENT & OCEAN RANCHING FOR SPOT & CROAKER.
GRIND THE PAPER USED IN THE DRAFT ADDENDUM TO MIX WITH THE FISH FOOD FOR THE EGGS OF SPOT & Croakers

When doing the enhancement use no fiberglass or PVC containers instead utilize cement & tetra Co ta for containment. Follow the Asian enhancement & Ocean Ranching EXPERTS NOT NORTH EAST SCIENCE .

**** nothing in the draft addendum is worth commenting on as it is all cut & Past from planned fishery reduction implemented by COMMERCE & STATE TO HAVE IMPORTATION OF SEAFOOD!

James Fletcher
UNFA
123 Apple Rd
Manns Harbor NC 27953

-

NATURE | NEWS FEATURE

Ocean conservation: A big fight over little fish

Size limits have been a part of fisheries management for decades, but some fear that they are doing more harm than good.

Brendan Borrell

30 January 2013

300 ✗

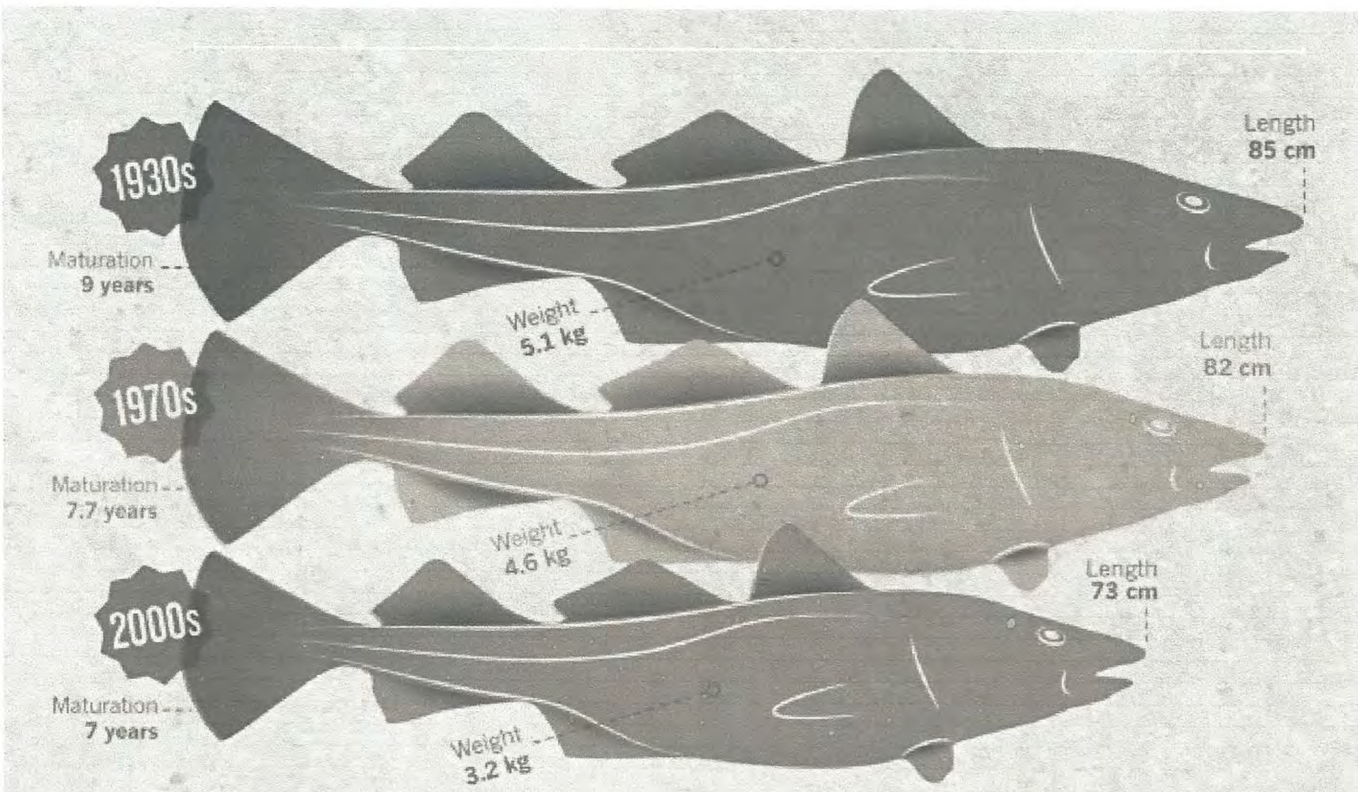

ILLUSTRATION BY WESLEY FERNANDES/NATURE; SOURCE: INT. INST. APPL. SYS. ANAL.

SHRINKING FISH: For Northeast Arctic cod, the age, size and weight of first-time spawners have fallen dramatically.

PLEASE LOOK THIS UP + READ

FLETCHER

From:	Robert Lewis
To:	Comments
Subject:	[External] draft addendums spot and atlantic croaker
Date:	Thursday, January 9, 2020 6:01:41 PM

I attended the public hearings at the VMRC offices in Hampton Va on January 7, 2020.
I was disappointed that the attendance was so low at the public hearing, it is not a representation of the number of people
that have a vested financial interest in this fishery . I have been in the Head Boat Charter business for 48 years
I am giving some background information just so you will maybe understand my perspective.
at the beginning of the meeting I asked how much weight the commission gives to public comments as far as the decision making process
well I am not sure if I got an answer. the reason I asked is because the general consensus among the charter business and the commercial
fisherman is that you listen but do not give it any consideration and taking with my fellow head boat charter friends they indicated to me they would not be attending the public hearing for that reason
I am not a scientist so I can not give you facts but I have been a full time student of the waterways and of the marine life in which I have spent the
entirety of my life and business. What I understand about science , it is supposed to be based on fact and should be subjected to peer review
,if what is printed on these two addendums were subjected to peer review outside of asmfc would they pass the test ?
I have seen a slow steady decline in the quality and quantity of croaker and spot for several years.
there is a perception among some groups that croaker and spot are not that important, they view them as bait fish and how many can I keep in my live well,
i.e Virginia saltwater sport fishing association , an example of this attitude is expressed in there newsletter announcing these addendums and meeting.
I quote (" Time To Think About The Lowly Croaker And Spot ")They have no financial interest in this fishery. They do not represent me or anyone who has a business interest
they do have a few people on their rolls by virtue of the Virginia charter boat association folding several years ago, we voted to donate our remaining treasury funds balance to them.
We are in 100% agreement on 1 issue and that is the menhaden fishery.
The addendums are sketchy at best and confusing to most, there is not a valid stock assessment and just too many question about how and when this data was collected?
How can one make decisions based on unreliable and un precise figures.

NOAA scientist say that there is a environmental issue with croakers . March 2010 issue of the journal Ecology Applications by the Ecology Society Of America
researchers forecast the future of the Atlantic Croaker.
It is from up close observation and collecting data from day to day fishing and year to year that I believe that spot and croaker are suffering from
a environmental issue of water temperature - ecosystem quality - pollution-food issues and an overabundance predation imbalance, the bottle nose dolphin
population has exploded in the past 10 years in side the Chesapeake bay, the large schools of menhaden that were once present you can no longer see on the surface and catch with a cast net
The dolphin are not feeding on the surface as they always did before , they are diving and staying down longer and they don't just move through as they did in the past
they stay in one area for days . The numbers are too great on some days to even attempt to get a close count and there seems to be multiple pods working together.
I understand that you have a job to do but you (ASMFC) should not implement regulatory tools just to satisfy concerns and really not have a handle on the core problem.
The gray trout is an example, how many years has the regulations been in place with continuing declining results , I use to fish for a wide range of fish and regulations have
shut me out of those fisheries , croaker and spot are all that most all head boats fish for now.

If the only tool you have in your tool box is a hammer i.e. regulation , then everything looks like a nail

Thank you for your time.

Robert Steve Lewis

Newport News Va

January 10, 2020

Dr. Michael Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street
Suite 200A-N
Arlington, VA 22201

Re: Draft Addenda III to the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, **Spot** and Spotted Seatrout

Dear Dr. Michael Schmidtke,

The following are my personal comments and may or may not mirror any organization's comments of which I am a member. Thank you for the opportunity to comment on Draft Addenda III to the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, **Spot** and Spotted Seatrout.

I am a recreational fisherman from Gloucester, NC. Like most recreational saltwater fishermen, I do not fish for spot because we don't have many anymore. NC used to have a vibrant recreational fishery in the fall, which is now gone. Piers would be packed with fishermen and the small boat armada was visible in many towns along the coast. I remember years ago seeing the many boats, gunnel to gunnel in Gallants Channel Beaufort, NC all fishing for spots. This fishery was one of the few that the African American community participated in here in NC.

NC is the only Atlantic state that allows shrimp trawling in their estuary*. Boats from other states come to NC because they cannot drag in their own States internal waters. Some Gulf states, like MS, AL, and LA, still allow limited shrimp trawling in their internal waters, but they only allow a 50 foot maximum headrope on their trawl nets per boat. This encourages skimmer trawls, probably a less destructive method than otter trawling. In contrast, NC allows 220 foot total headrope/boat in the Pamlico Sound. These headrope sizes were developed for use in the ocean, not in the sensitive nursery areas of the Pamlico Sound. The limitations imposed by the Gulf states has not impacted TX (no internal trawling) or LA (50 foot headrope internal), as their shrimp industry harvest is 10 and 20 times the harvest of NC, which allows almost unrestricted trawling, respectively.

Many steel hulled trawlers used in NC estuarine shrimping were constructed as ocean going vessels and many are over 100 feet in length. They drag for Summer flounder, scup, black seabass, and dredge for scallops in the ocean-where they belong. When they pull otter trawl nets in the estuary they are destroying critical bottom habitat. Moreover, these oceanic trawlers have significant draft and the impacts of their large propellers (prop wash) on shallow estuarine waters may be more damaging than otter doors. It is well documented that such bottom disturbing gear destroy benthic diversity.

If trawling were to be stopped in internal waters, NC citizens will not miss the harvest. NC shrimpers can presently provide only 5-25% of the shrimp consumed in the state (assuming that all NC harvested shrimp remains in the state). These percentages were calculated based on National per capita consumption and NC harvest. In recent years the shrimping industry has been extended their seasons by catching mature “greentail” (white) shrimp in the ocean-a larger more valuable product. This is what most other Atlantic states shrimpers have been doing for many years. Presently the overwhelming source of shrimp consumed in NC is imported from other states and other countries. The consumer has spoken.

Spot is an important forage fish for predators. Juvenile spot even more so. The killing of about a hundred million juvenile spot in shrimp trawls each year in NC must be impacting other (predator) fisheries.

We often see newspaper headlines reporting “fish kills” of several thousand. But each night of the shrimp season, 1-4 million juvenile spot, croaker, weakfish, Southern flounder are killed-yet the press remains silent.

Shrimp trawling in NC estuaries is having a devastating impact on juvenile spot (and croaker, weakfish and Southern flounder). There are three to four pounds of bycatch killed for every pound of shrimp. This is like melting the sea ice to water your lawn.

The state of NC (NC Division of Marine Fisheries) performs trawl studies (P195 for example) and has documented that the above juvenile fish species are in these undesignated secondary nursery areas. Mr. Rick Sasser has taken the Divisions data and plotted them. The juvenile fish are abundant where the trawling occurs. There are some hot spots. I wont steal Mr. Sasser's thunder, but his compilation of decades of data is quite revealing-please read his comments. It is a little embarrassing that the State of NC has had these data for decades, continues to compile it, but ignores it. ASMFC should not.

We in NC have been scratching our heads about when ASMFC is going to do something. If this is truly a single unit stock, then the other states are being hurt by shrimp trawling in NC. I urge the Commissioners from ALL states to address the shrimp trawl issue for spot, since it impacts them. ASMFC did it for menhaden in VA and can to it for spot in NC.

The inconsistencies reported in the information is troublesome. Being a scientist, I always like to err on the side of conservation when the science is unsure. I encourage ASMFC to do the same thing.

ASMFC, and NC, has managed spot for decades now, watched the decline in the population, and neither has done anything substantive to slow or stop the decline. There are no size, bag or trip limits on spot. Let me repeat this, there are no size, bag or trip limits on spot. It must be an embarrassment to those fisheries managers with a conscious.

Thank you for your service,

Chris Elkins PhD
Gloucester, NC

*FL allows shrimp trawling with a very small net in the estuary (500 square foot).

January 10, 2020

Dr. Michael Schmidtke, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street
Suite 200A-N
Arlington, VA 22201

Re: Draft Addenda III to Amendment 1 of the Interstate Fishery Management Plan for Croaker

Dear Dr. Michael Schmidtke,

The following are my personal comments and may or may not mirror any organization's comments for which I may be a member. Thank you for the opportunity to comment on Draft Addenda III to Amendment 1 of the Interstate Fishery Management Plan for Croaker.

I am a recreational fisherman from Gloucester NC. Like most saltwater recreational fishermen, I do not fish for croaker because we don't have any. Well, that's not exactly true, I see them all the time. Juvenile croaker floating on the surface-dead discards in the NC estuarine and near shore shrimp trawl industry. There is more croaker caught in shrimp trawls than by both recreational and commercial directed fisheries.

In recent years, the commercial croaker fishery has changed in NC, with fishermen going offshore in Federal waters and using gill nets. I believe that the SAFMC should co-manage this fishery since this has such a strong federal component now. This would allow the MSA to come into play and hold fisheries managers feet to the first to fix this stock. Additionally, this change in the commercial fishery, may help explain the inconsistencies between the fisheries dependent and independent data.

We in NC have been scratching our heads about when ASMFC is going to do something. If this is truly a single unit stock, then the other states are being hurt by shrimp trawling. I urge the Commissioners from ALL states to address the shrimp trawl issue for croaker, since it impacts them. You did it for menhaden in VA and you can to it for croaker in NC.

NC is the only Atlantic state that allows significant shrimp trawling in their estuary. Boats from other states come to NC in part because they cannot drag in their own states internal waters. Some Gulf states, MS, AL, and LA, still allow limited shrimp trawling in their internal waters, but they only allow 50 foot headrope total/boat. This encourages skimmer trawls, probably a less destructive method than otter trawling. In contrast, NC allows 220 foot headropes in the Pamlico Sound. These headrope sizes were developed for use in the ocean, not in the sensitive nursery areas of the Pamlico Sound.

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If trawling were to be stopped in internal waters, NC citizens will not miss the harvest. NC shrimpers can presently provide only 5-25% of the shrimp consumed in the state (assuming that all NC-harvested shrimp remains in the state). These percentages were calculated based on National per capita consumption and NC harvest. In recent years the shrimping industry has been extended their seasons by catching mature “greentail” (white) shrimp in the ocean-a larger, more valuable product. This is what most other Atlantic states shrimpers have been doing for many years. Presently the overwhelming source of shrimp consumed in NC is imported from other states and other countries. The consumer has spoken.

Croaker, especially juvenile croaker, is an important forage fish for predators. The killing of about a hundred million juvenile croakers in shrimp trawls each year in NC must be impacting other (predator) fisheries.

We often see newspaper headlines reporting “fish kills” of several thousand. But each night of the shrimp season, 1-4 million juvenile spot, croaker, weakfish, Southern flounder are killed-yet the press remains silent.

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The state of NC (NC Division of Marine Fisheries) performs trawl studies (P195 for example) and has documented that the above juvenile fish species are in these undesignated secondary nursery areas. Mr. Rick Sasser has taken the Divisions data and plotted them The juvenile fish are present where the trawling occurs. There are some hot spots. I wont steal Mr. Sasser's thunder, but his compilation of decades of data is quite revealing-please read his comments. It is a little embarrassing that the State of NC has had these data for decades, continues to compile it, but ignores it. ASMFC cannot.

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ASMFC, and NC, has managed croaker for decades now, watched the decline in the population, and neither has done anything substantive to slow or stop the decline. There are no size, bag or trip limits on croaker. It must be an embarrassment to those fisheries managers with a conscious.

Thank you for your service,

Chris Elkins PhD, Gloucester, NC

My name is Scott Vinson.

Here is why I believe that common sense fisheries management that includes (a) **Seasonal Species Specific Recreational & Commercial harvest closures that coincide with individual species spawning cycles** coupled with **(b) new bag limits on aggregate bottom species,** and **(c) specific site monitoring law enforcement and the court's willingness to prosecute** must all work hand-in-hand to improve fisheries sustainability across all species.

MY BACKGROUND

I am an avid Saltwater fisherman. I am not a scientist and so my thoughts and observations are purely anecdotal, boots-on-the-ground, front-line feedback on what I see happening on a day-to-day basis when I fish among other land-locked saltwater fisherman.

In 2019, I fished Virginia Saltwater environs 140 days. I do not own a boat 99% of my fishing days were done from piers, beach, jetties, shoreline, etc …

For the past 19 years, I have tagged fish as part of the Virginia Saltwater Gamefish Tagging program run partially through VMRC, and VIMS (William & Mary). In 2019, the program will tag 23,000+ fish … of that total figure, I contributed by tagging over 4000 fish, mainly flounder (2070) and speckled trout (1850).

Over my life in the program I have tagged 20,000+ fish. For the last few years, including 2018 (see below), I have been the 2nd most prolific tagger in the program.

Table 2. VGFTP, 2018 Tagging Awards: Winners and Runners-Up

Category	Winner	Number tagged
Overall Tags	Ed Shepherd	5688
Overall Tags Runner-up	Scott Vinson	2508
Overall Recaps	Ed Shepherd	554
Overall Recaps Runner-up	Scott Vinson	114
Black Drum Winner	Jim Robinson	17
Black Drum Runner-up	Scott Vinson	15
Flounder Winner	Ed Shepherd	782
Flounder Runner-up	Scott Vinson	624

First name	Last name	Black Drum	Black Sea Bass	Cobia	Flounder	Red Drum	Sheepshead	Spadefish	Speckled Trout	Tautog	Triggerfish	Total
ED	SHEPHERD	10	1087	3	782	1	0	3	3802	0	0	5688
SCOTT	VINSON	15	9	5	624	1	0	0	1850	4	0	2508
SHELDON	AREY	1	0	0	2	0	0	0	2234	0	0	2237

The point of this information is to show that I am someone who fishes a lot, and who interacts with a number of other fisherman who will probably be affected by any changes in management structure of these species and I am someone with the ability to provide day-to-day perspective on the everyday fisherman's experience.

2019 OBSERVATIONS vs PRIOR YEAR OBSERVATIONS

Speckled Trout … in 2019 … in recent years, especially the fall of 2019, there have been both a lot more, and larger, Speckled Trout caught / kept than any year prior that local fisherman can recall. There were also, days in the fall, where there were 20+ fisherman, fishing in land-bound spots that in year's past might only have seen 1 or 2 fisherman targeting speckled trout, so there were a lot more fisherman after trout this year.

Why were their so many quality fish in 2019? Because there was no winter freeze from Dec 2018 – Feb 2019 in the backwaters where the bigger trout tend to overwinter … and thus no fish-kill … the fish that stayed around were already larger fish, and they just continued to eat / grow over the mild winter.

If you look back at the prior winter Dec 2017 – Feb 2018 … there were 2 documented freeze periods within those few months that killed thousands of fish (only those that were seen, throughout Lynnhaven Inlet water-system, and Rudee Inlet) … and the resulting Fall of 2018 produced fish, but very small numbers of quality, keeper sized fish from the landlocked spots where I fish.

In fact, when I reviewed my data / numbers of speckled trout caught and tagged over the last fews years, it has been fairly consistent since 2016, prior to then, even though I'm fishing in the same locations year after year, I didn't catch any speckled trout. (FYI … I don't keep speckled trout, so 99% of keepers I caught each year were tagged / released).

2014	78 trout tagged	14 keeper sized trout tagged
2015	646 trout tagged	3 keeper sized trout tagged
2016	1357 trout tagged	27 keeper sized trout tagged
2017	1881 trout tagged	77 keeper sized trout tagged
2018	1850 trout tagged	55 keeper sized trout tagged
2019	1839 trout tagged	120 keeper sized trout tagged

What are the higher numbers of speckled trout eating?

In the fall of 2017 and 2019, years with warmer preceding winters, there was a shrimp population explosion that I feel was also triggered by the warmer prior winter. Prior to those 2 years, if there were shrimp in the rivers & tributaries, despite my 100s of days spent fishing the shore line / piers / jetties, I wasn't exposed to them … whereas in the fall of 2017, and this year in 2019, many fish that I caught and tagged had shrimp antennae coming out of their mouths / bellies.

But with larger, and just more, speckled trout around this year, and their habitat being coastal shallow / marshy for the most part, it stands to reason that the SPOT population would be adversely affected with larger trout being heavily dependent on fish as their food source.

And speckled trout will eat whole spot, and parts of spot, spot heads, etc … and I've watched guys who have never caught a speckled trout in their lives figure that little secret out this year, and catch / keep many larger, breeding stock fish … and if those big trout are around, they have an effect on young SPOT populations, especially if menhaden & striped mullet are not as plentiful for trout to feed on.

I anecdotally noted this fall that there was no big FALL SPOT run on the beaches, piers, jetties this year like there had been in year's past … there were plenty of SPOT fisherman waiting for them to show up, but they did not.

A resurgence of the trout population in the last few years has been at the detriment to the spot population.

Flounder … in 2019 … I caught/tagged more flounder (2070) in 2019 than any of my prior years.

I found places that held shoreline flounder and fished them religiously to tag as many flounder as I could … however, other fisherman friends of mine I spoke with who fished their tried-true spots did not catch the numbers of flounder in 2019 as they did in prior years.

At the seaside inlets where I fished, there were massive schools of Silversides / Bay-Anchovies from mid-May through July … and the flounder were just sitting under them, feeding on them.

Some days in the inlet, the water would appear to be cloudy, or muddy, but if you looked closely, you could see that it was waves upon waves of schools of Bay Anchovies, not only across the width of the inlet, but down 5 to 6 feet into the water column.

The warmer winter probably had an effect on the numbers of Bay-Anchovy and Silversides in the water … and as the number of these food fishes increased, the number of predatory fish (ie: flounder, trout) following them and feeding on them went up in my target areas.

Many flounder as I pulled them in to measure and tag would regurgitate Bay-Anchovies … one 15" flounder with a prolific appetite regurgitated 11 anchovies at my feet … this was not unique but Anchovies in this number from a single fish was unique … as this was a very significant number of food fishes (at 11), and so I took a picture.

COMMON SENSE MANAGEMENT & ENFORCEMENT

1. **Seasonal Species Specific Recreational & Commercial harvest closures that coincide with individual species spawning cycles …** while I believe that science can only roughly estimate the number of fish in the ocean, science has provided many studies, reports, observances that absolutely can dictate the spawning habits of each species that inhabits the Chesapeake Bay, and its Coastal Waterways.

   The science on each species tells us, within a fairly tight range, of the minimum size for 1st spawn for each species, and the timing for each species calendar spawning cycle.

   So in addition to managing "landings" as a percentage of estimated stock, it would seem that an even better, and longer lasting way to ensure that each species has the best opportunity for a strong future would be to let each species proliferate during it's natural spawning cycles.

   This would mean, a smart, conscientious look at closing each specific fishery just prior to & during the bulk of its spawning period, and as a side rule, regulating sizes to help ensure that female fish reach maturity and get at least 2 spawning years in their lifetime.

Now, sometimes the spawn coincides with a time frame when the species would naturally be targeted and caught in high numbers … while in other species the spawning cycle might coincide with a time when fisherman don't target a particular species, or can't target it as easily.

EXAMPLE … FLOUNDER MANAGEMENT BASED ON SPAWNING CYCLES … from information taken from these websites …

FLOUNDER … Spawning occurs in autumn and mid-winter in coastal ocean waters. Larvae eventually drift into the Bay in October to May.

The NOAA Fisheries site says …

- Summer flounder spawn in the fall and early winter when they migrate offshore.
- They spawn several times throughout the spawning season.
- Spawning peaks in October and November when water temperatures change and autumn plankton is most productive. The combination of these elements improves the chance of survival for larval summer flounder.

And the Atlantic States Marine Fisheries Commission Website says:

Summer flounder begin to spawn at age 2 or 3, at about 10 inches in length. Spawning occurs in the fall while fish are moving offshore. Spawning migration is linked to sexual maturity, with the oldest and largest fish migrating first. As in their seasonal migrations, spawning summer flounder in the northern portion of the geographic range spawn and move offshore (depths of 120 to 600 ft) earlier than those in southern parts of the range.

BASED ON THOSE FACTS, A FLOUNDER MANAGEMENT PLAN WOULD TAKE INTO CONSIDERATION …

With the minimum size to keep set above 15" for all states, that ensures 2, and maybe 3 spawning years for a female fish. And I can say that in 20-years of aggressive flounder fishing, and I do keep a few flounder every year, that I have never harvested, cleaned and eaten a flounder that did not have eggs in it … ie: every keepable flounder was a female. The difference being that the size of the ovaries vary from early spring where they are almost nothing, to late-fall, when they become robust as the spawn nears.

In regards to seasonal closure timing, if every science assessment is in agreement that flounder spawn in the late-fall, then the Flounder season might close after Labor Day weekend everywhere.

This would allow for maximum recreational commercialization of flounder (ie: vacationers, tourists fishing, charter boat fishing, tackle sales) … because closing after Labor Day weekend would only minimally effect the recreational commerce aspect, but it does allow for the fish that are preparing to spawn, to remain in the population through that annual spawning cycle … from a recreational perspective the season could then re-open in early May, which would again coincide as to not affect the recreational commerce benefits of the fishery while allowing for maximum timing for species reproduction …

Commercial Fisherman are well aware of the flounder spawning grounds off-shore near the continental shelf … and they too would have to abide by a CLOSED SEASON to allow for the spawn from September through December … their season could be opened again, after the science says that the majority of females have had the opportunity to spawn once, or more off-shore … but before the fish have begun to make their annual westward migration back into coastal waters, say in January or February …

Chesapeake Bay Program
Science. Restoration. Partnership.

Each species could be effectively managed with the same thoughtful process and would then be seasonally managed based on the science surrounding it spawning cycle.

SPOT … Spawning occurs over the continental shelf from late September through March. After spawning, adults may stay offshore. Tiny larvae enter the Bay and move to freshwater shallows and tidal creeks, where they stay and grow throughout the summer. Most young leave the Bay by Dec. Spot mature at two to three years old.

CROAKER … Spawning occurs over the continental shelf in July to February, with a peak in August to October. Beginning in August, tiny young enter the Bay and travel to low-salinity and freshwater creeks. They move to deeper parts of tidal rivers for the winter. Juveniles leave the Bay with the adults the following autumn, maturing at 2 to 3 years old.

SILVERSIDES … Atlantic silversides breed from May to July. During a new or full moon and at the highest tide, they gather in schools to lay their eggs along the sandy bottom. Eggs hatch after five to 20 days, depending on the temperature. Temperature also determines how many will be male or female. Babies that are in cooler water 32 to 46 days after hatching will more likely be female, whereas fish that are in warmer waters will likely be male.

SPECKLED TROUT .. Spawning occurs from late May to July at night in the salty waters near the Bay's mouth. Females may spawn 9 to 60 times and release as many as 3 to 20 million eggs during a single spawning season. They mature at two to four years old.

Difficult … only initially and mainly on the casual recreational fisherman, who must now begin to understand / follow / learn a system of management designed to improve the number of fish in the water to make it more likely that he can catch more in the future.

But once the timing for each species is set based on the science, it won't have to change from year to year … and saltwater fisherman, much like freshwater trout fisherman, and hunters, will know the exact OPEN SEASON dates for each species.

2. BAG LIMIT REDUCTION (or BAG LIMIT PLACEMENT) AND TIGHTER RANGE SLOT LIMITS …

Regardless of proposed management QUOTAS, it is time for BAG LIMITS on aggregate species (croaker, spot, whiting) … the main targets bottom species.

I do not target croaker/spot/whiting ever. So, in speaking only from the recreational observer point of view, the number of fisherman who keep coolers full of these fish at local fishing piers on a daily basis is a horribly wasteful action to watch. These bottom fisherman will keep hundreds of croaker, spot and whiting a day and more if they could catch them. And with no concern over the fisheries sustainability.

As mentioned earlier these species too need to be managed with their spawning cycles in mind … as an example: I see pier / beach fisherman catch and keep Whiting (ie: Sea Mullet) in the Spring … when those fish are nearly all females on the verge of bursting with eggs … and often when those fish are cleaned it appears the eggs were on the verge of being released.

Please, put a bag limit on aggregate bottom fishing fish (croaker / whiting / spot) … perhaps 20 aggregate of those species a day, and manage the season on each with a mindful eye toward their spawning habits. As for size limits it might be acceptable to say that any fish over a certain size needs to be thrown back.

3. ENFORCEMENT OF REGULATIONS

None of anything I've written though matters if it's not enforced. It's not a lack of enforcement as much as it is a lack of prosecution. Where I fish, the locals know that nothing will be done to them even if they are caught and ticketed because the overburdened court system will just throw out the fishing violation rather than prosecute it.

Research the number of citations written in each of these lower-Chesapeake bay municipalities (Hampton, Newport News, Norfolk, Portsmouth, Chesapeake, Virginia Beach, Gloucester, Poquoson and York). Look at the number of citations written versus those that are either thrown out, disregarded, or allowed to get off with only a small portion of the fine / costs paid. You'll see what I mean.

I see plenty of Marine Police, Game & Fish Police, and even local Virginia Beach police checking licenses and fish (sizes, bag limits) … so I don't think the problem lies with enforcement as much as it does with prosecution.

The 2nd problem with the law-breaking fishing community is fisherman determined to break the rules have perfected deceitful methods to take under-sized fish, and over-the-bag-limit numbers of fish. They hide fish in their cars, in their clothing, in the garbage, or amongst rocks on the jetty, or put them on hidden/fake stringers.

This year in addition to watching fisherman keep undersized fish, because of the number of large speckled trout, and puppy drum, fisherman were often catching their daily bag limit in the morning, leaving with a stringer of legal fish, and then coming back an hour later to catch a 2nd, and occasionally a 3rd bag limit in a single day … (I don't know how a conservation officer could even hope to regulate, or manage that issue, but it happens a lot).

At the places where I fish (beach, jetty, pier, etc), the LAW would only have to be enforced a couple of times before the fear of prosecution would supercede the idea of breaking the law … the Marine Police would only have to issue (and the courts prosecute) a couple of $500 fines, or vehicle impounds, when the undersized fish are hidden in fisherman's cars, in order for the word to get out that "if you break the law, and get caught, you'll wish you would have played by the rules".

The management areas of the Game & Fish enforcement community are both geographically, and physically unmanageable … but I also know that within each area, while there may be hundreds of places for a fisherman to fish, there are going to be 5 or 6 places where 75% of the fisherman congregate to fish … it should be mandatory that each officer identify those 5 or 6 spots where 75% of the fisherman within his coverage area fish, and that on EVERY SHIFT those areas are first surveilled, and then every fisherman checked.

IN SUM

The eyes in the field can see / feel what's going on out there, especially the fisherman like me who religiously fish the same areas for the same species year in and year out. On these topics I consider myself to be the "canary in a coal mine" … the first to see something out of place, or different.

I believe that I have provided fairly solid anecdotal feedback on the current state of a couple fisheries, and reasons why they are the way that they are based on recent history.

And that is all why I believe that common sense fisheries management that includes (a) **Seasonal Species Specific Recreational & Commercial harvest closures that coincide with individual species spawning cycles** coupled with **(b) new bag limits on aggregate bottom species,** and **(c) specific site monitoring law enforcement and the court's willingness to prosecute** can all work hand-in-hand to improve fisheries sustainability across all species.

Thank you for your time and consideration.

Scott D. Vinson / SDVinson@aol.com / (757) 869-8897

134 Wellington Circle, Williamsburg, VA 23185

From:	Stuart
To:	Comments
Subject:	Re: [External] spot/croaker
Date:	Thursday, December 5, 2019 5:21:52 PM

Mike,
Thanks for clearing that up, I do appreciate that.
I had sent an additional email to Chris about the same concerns also noting that I would not be able to attend because of a conflict with work.

I realize that the trawling fleet operates coastwide and that the comments that follow apply to NC waters. But, if you want adult spot and croaker abundance's you're recover, you MUST get the trawlers OUT OF PAMLICO SOUND!!
For those in the ocean, improved BRDS must be incorporated and/or transition otter trawls over to skimmer trawls.

Thanks again,

Stuart Creighton

Sent from my iPhone

> On Dec 5, 2019, at 4:19 PM, Comments <comments@asmfc.org> wrote:
>
> Hi Stuart,
>
> Thank you for submitting your comment. I'm writing to hopefully clarify a point you made concerning the shrimp trawl bycatch data.
>
> The text in the Croaker Draft Addendum describing "limited data on shrimp trawl discards and fishing mortality" was in reference to the 2010 croaker stock assessment. The 2017 assessments (for croaker and spot) included estimates of shrimp trawl bycatch mortality and noted them as the prominent source of fishing-related mortality for both croaker and spot. Although the assessments as a whole did not pass peer review, these mortality estimates were based on shrimp trawl observer data and were noted by the Peer Review Panel as a significant improvement from the previous croaker assessment (2017 was the first spot assessment, but these data were noted as a strength of that assessment as well). The shrimp trawl data were not the reasons for the assessments not passing peer review. These data continue to be collected and will be a primary focus in the next assessments for these species.
>
> Also, along with revising the Traffic Light Approaches to management based on the recommendations shown in the draft addenda, the committees that draft the annual TLA reports will, starting in 2020, begin providing discard trends (which include those of the shrimp trawl fishery) in those reports. While these data are not part of the management program to trigger management action, they can provide context to the mortalities impacting the croaker and spot populations to better inform management decisions.
>
> I hope this information addresses some of your concerns, at least on the data collection front. If you have any further questions, I'm happy to talk more about how we can improve management for these species. Don't know if you're planning to attend the NC hearing tonight, but if you are, I'll see you there.
>
> Regards,
> Mike
>
> Michael Schmidtke, PhD
> Fishery Management Plan Coordinator
> Atlantic States Marine Fisheries Commission
> 1050 N Highland St, Suite 200A-N
> Arlington, VA 22201

> Phone: 703-842-0740
> Email: mschmidtke@asmfc.org
>
>
> -----Original Message-----
> From: Stuart Creighton [mailto:stu.creighton@gmail.com]
> Sent: Tuesday, December 3, 2019 5:05 AM
> To: Comments <comments@asmfc.org>
> Subject: [External] spot/croaker
>
> To Whom This May Concern,
>
> I have been reading through your documentation for the spot and croaker fisheries and your rationale for changing the parameters as to how you will be considering management actions in each fishery.
> I see that your stock assessment did not pass peer review, and thus, will not be used for management consideration. As a result, you will attempt to make modifications to the TLA and use those as your management triggers.
> Be clear that I support THE MOST RESTRICTIVE management option in each plan as I feel that both of these stocks are in serious trouble.
>
> What troubles me most is that the ASMFC acknowledges that the single largest source of removals of spot and croaker is shrimp trawl bycatch. Yet, the data you have on said bycatch is limited.
> I find that absolutely unacceptable!! There can be no doubt that the reason you are having trouble with monitoring these stocks is because you are doing a poor job of collecting data on the largest source of the removals of these species of fish. If you don't have sufficient trawl bycatch data, GO GET IT AND DO SO IMMEDIATELY!!! Put observers on the trawlers, count and weigh the juvenile spot and croaker that are being pitched over the side.
> If that data is available from a source that you don't currently use, then get it incorporated into your modeling immediately.
>
> It is well known that two of the most abundant fish in shrimp trawl bycatch coastwide are spot and croaker. From a quick sampling of the most recent NOAA data, 80 million pounds of bycatch were reported from a harvest of 16 million pounds of shrimp. For argument's sake, assume that 75% of that bycatch is spot and croaker. That means that 60 million pounds of these fish were removed. Since these fish are juveniles, we can assume that there are several of each per pound of removal. Again, for simplicity, 5 individual spot/croaker per pound. So, in this example, 300 million juvenile fish were removed as bycatch in ONE YEAR.
> Is this estimate overly simplistic and a bit crude scientifically, certainly. But it makes my point that you are missing the boat on management of these species.
> Until you specifically address the bycatch from the shrimping industry, your stock assessments will be faulty and these two species will continue to decline.
>
> As another limited example, the coast of North Carolina experienced a spot run this fall. It was brief, and the spot were small, but it was the first one of note in a decade. The fact that this spot run occurred after Hurricane Florence had effectively shut down trawling the previous season cannot be understated. The reduction of trawling effort in and around Pamlico Sound allowed these fish to escape and grow producing an immediate increase in the number of available spot.
>
> I hope you can improve your available data with these fisheries so that you can get a more reliable stock assessment and begin to act to sufficiently protect these fish.
>
> Sincerely,
>
> Stuart Creighton
> Oriental, NC

From: Batsavage, Chris
To: Comments
Subject: [External] Croaker and Spot Draft Addenda III
Date: Friday, December 6, 2019 9:14:19 AM

Hi Mike,

Below is a comment we received earlier this week.

Thanks,

Chris

****
Chris Batsavage
Special Assistant for Councils
NC Division of Marine Fisheries
NC Department of Environmental Quality
(252) 808-8009 (Office)
(252) 241-2995 (Mobile)
(252) 726-0254 (Fax)
Chris.Batsavage@ncdenr.gov

3441 Arendell St.
P.O. Box 769
Morehead City, NC 28557

-----Original Message-----
From: Stuart Creighton [mailto:stu.creighton@gmail.com]
Sent: Tuesday, December 3, 2019 10:08 AM
To: Batsavage, Chris <chris.batsavage@ncdenr.gov>
Cc: Murphey, Steve <steve.murphey@ncdenr.gov>; David Sneed <david@ccanc.org>
Subject: [External] spot/croaker

Good morning Chris,

I would like to submit these comments for public record for your upcoming meeting this week in Wilmington regarding spot and croaker. I would much prefer to give these comments in person, but I did not hear of the meeting until this morning and there is no way I can get off work to make the meeting on Thursday.
I hope these comments will carry sufficient weight, and I hope we can develop a dialogue. Rebuilding our fish stocks in NC and coastwide is something that I am becoming increasingly passionate about, and I want to make sure my comments are appropriate and effective.

My overwhelming concern is with the data that is used in the modeling to develop stock assessments and the FMP's that result from the information available. In the summaries published that accompany the announcement of the public comment period, conflicting signals are cited with regard to both fisheries. Current studies indicate that the

biomass is increasing yet there is record low catch accompanied by low adult abundances. These supporting documents also state that there is limited availability of data from the shrimp trawl industry and that the available data is generally poor. When I see from the 2017 Croaker stock assessment that 91.6% of the total croaker removals are from trawler discards, and, while percentages are not given, but a similar statement is made with regard to the spot fishery, I can see the problem is with the model itself.
WHY is that data either so poorly treated or ignored outright? I find it incomprehensible that the ASMFC and/or NCDMF knows where an overwhelming majority of the removals are coming from, yet do not sufficiently address them in the modeling runs.

I fully believe that the ASMFC has data on shrimp trawl bycatch that is more than sufficient and more than reliable enough to make management decisions on what it would tell you if you properly included it in your model data. It is also incumbent upon North Carolina's representatives on the ASMFC to request that the data be used for management purposes. If for some reason, you genuinely do not have that data, then go get it, and do so IMMEDIATELY. Put observers on trawlers, and get what you need!!! If they don't want to cooperate, then suspend their licenses.

When I sample the information provided in the supporting documents, I see a total reported harvest (recreational and commercial) from 2018 of 11.1 million pounds of spot and croaker coastwide. NOAA data on shrimp harvest from 2018 shows that 80 million pounds of bycatch was reported from 16 million pounds of shrimp harvested by the SE trawl fleet. Let's assume that 50% of that bycatch is spot and croaker (an estimate that is likely low). That means that 40 million pounds of spot and croaker were shoveled off the decks of trawlers in 2018 alone. While a bit simplistic and scientifically crude, my example shows that trawler bycatch exceeded total harvest by a factor of almost 4! How can any model that does not include that data be valid? How can you justify NOT doing a better job of including it??

Even though the TLA has inconsistencies, there are clear trends that management actions are needed, and have been for a number of years. Since they are largely the same, I would support Recreational option D and Commercial option B3. That support is conditional, however. What REALLY needs to happen is that the ASMFC (and NCDMF) needs to finally step up and address the actual problem: excessive trawling in areas where they should not be allowed to operate.

.Thank you for your consideration in this matter. I hope we can have more conversation soon.

Sincerely,
Stuart Creighton

From: scott.williams@wellsfargoadvisors.com
To: Comments
Subject: [External] ASMFC -- Croaker Draft Addendum III
Date: Thursday, January 2, 2020 8:36:26 AM

Croaker have been on a steady decline for many years, due in large part to the shrimp trawl industry in north Carolina.
The proposed draft addendum states clearly "Atlantic croaker migrate seasonally along the coast, moving northward and inshore to estuaries and bays during warmer months (spring-fall)…" Shrimp trawl bycatch composition
has been analyzed over the last 30+ years. ASMFC has a very good understanding of the impact of current shrimp trawl industry in NC
on Spot, Croaker, Trout and Flounder. The models <u>must</u> quantify the impact of mortality of these finfish stocks from the shrimp trawl industry.
Trawling of the inshore estuaries in NC is the major cause of the continual decline of Croaker (and other species).

Please take action in reducing the mortality rate of Croaker in order for the population to return the finfish population to historic normal levels.
I support a 10 fish bag limit for recreational fishermen. I also support the strictest harvest limits on the commercial sector as well.

Scott Williams
704-989-7211

From:	kato@fastmail.com
To:	Comments
Subject:	[External] Croaker Draft Addendum III
Date:	Tuesday, December 3, 2019 10:52:04 AM

Hi,

I am requesting that the ASFMC start taking in to account the very serious effects the inshore shrimp trawling in NC has on the spot and croaker populations far beyond NC waters. This elephant in the room regarding spot and croaker management (and other finfish) has not been fully taken into account by ASFMC to date and considering shrimp trawling kills far more of these two species than hook and line does, it is mandatory that it be included in any resource management plan ASFMC develops.

Unless ASFMC includes the full effect inshore shrimp trawling has on spot and croaker mortality rates, and establishes limits to control trawling bycatch mortality, you may as well shelve this project since it would be obvious that you are ignoring the single biggest factor affecting spot and croaker populations in NC. Focusing on recreational takes and limits and not doing the same with commercial takes would basically destroy any credibility the ASFMC has. This may sound harsh but it is 100% accurate.

I appreciate your consideration.

Best regards,
Bruce

From: William Argenbright
To: Comments
Subject: [External] Croaker and Spot Addenda III
Date: Monday, December 2, 2019 10:56:51 PM

Ladies and Gentlemen,

I am very concerned about further fishery restrictions that will result from establishment of this action. Recently NC Fisheries established unrealistic and unreasonable restrictions on our flounder under the guise of protecting weak fisheries. Meanwhile, we have seen more and larger flounder caught. It turns out the regulation was not only unreasonable but unnecessary.

We now seem to be facing down the same issue with another species. I'm sure I'm not providing an education by stating the obvious; fish swim. We share fisheries up and down the east coast and our counts will depend on water temperatures, tides, and even the availability of food. The minor impact fishermen have on these numbers are truly laughable.

If the board is serious about protecting species then the board needs to reevaluate its methods. It is not the sport or recreational fisherman that needs regulated. Gill nets used by commercial fishermen do create an issue. The use of those gill nets in estuaries make matters worse. Recreational fishermen can not harvest flounder, but gill nets kill more fish that all the recreational fishermen could harvest combined.

On behalf of the fishermen who enjoy recreational fishing, feed our family's by this skill, and the tourism industry fed by our fisheries, I ask that the board abandons this newest call to restrict citizens of our natural and self renewing resources.

Respectfully,
William Argenbright

From: johncollier.ncsc
To: Comments
Subject: [External] Croaker and Spot Draft Addenda III).
Date: Monday, December 2, 2019 2:46:47 PM

Please refrain from making such laws that I can't go fish and keep a few spots and croakers. Our town has a Spot festival every year and it will not only hurt the average fisherman like myself but the economy of North Carolina. And the small towns on our coast.

Sent from John Collier's IPhone

From: Eric Bregman
To: Comments
Subject: [External] Croaker and Spot draft Addendum III
Date: Wednesday, December 4, 2019 8:03:05 PM

I don’t know what all that crap is in the draft...but recreational fisherman should not have to take a single cut in creel or size until trawlers are removed from state waters. Then we can evaluate.

From: Chris McCaffity
To: Comments
Subject: [External] Draft Addendum III to Atlantic Croaker and Spot Fishery Management Plans Public Comment
Date: Wednesday, December 11, 2019 2:59:12 PM

Draft Addendum III to Atlantic Croaker and Spot Fishery Management Plans Public Comment

Please consider options for regionally stocking larval-stage spot and croaker to create Hatchery Supported Quotas that support more harvest.

I am happy to answer any questions and/or go into greater detail.

Thank you,

Chris McCaffity

From: scott.williams@wellsfargoadvisors.com
To: Comments
Subject: [External] FW: ASMFC -- Spot Draft Addendum III
Date: Thursday, January 2, 2020 8:49:47 AM

Spot have been on a steady decline for many years, due in large part to the shrimp trawl industry in north Carolina.
The proposed draft addendum states clearly "Spot migrate seasonally along the coast, moving northward and inshore to estuaries and bays during warmer months (spring-fall) …" Shrimp trawl bycatch composition has been analyzed over the last 30+ years. The consensus of all of these studies is ~4 – 4.5lbs of bycatch of every pound of shrimp caught.
This means if they catch 18 million pounds of shrimp, the bycatch is almost 72 million pounds of spot, croaker, trout and flounder!
Studies have shown that finfish bycatch is ~7 fish per pound of bycatch. This would mean that over 500,000,000 finfish are killed each year!
Does the ASMFC statistical models incorporate the magnitude of the mortality caused from the shrimp trawl industry?
All four of these finfish are experiencing over fishing and their population have been in decline for many years
ASMFC has a very good understanding of the impact of current shrimp trawl industry in NC on Spot, Croaker, Trout and Flounder.
Your models must quantify the impact of mortality of these finfish stocks from the shrimp trawl industry.
Trawling of the inshore estuaries in NC is the major cause of the continual decline of Spot (and other species).

Please take action in reducing the mortality rate of Spot in order for the population to return the finfish population to historic normal levels.
I support a 20 fish bag limit for recreational fishermen. I also support the strictest harvest limits on the commercial sector as well.

Scott Williams
704-989-7211

From:	Stanley1
To:	Comments
Subject:	[External] If you"re going to keep cutting out the sport fishrman and the spot and the crocer"s and spot fishing you just will stop all saltwater fishing license that we have to buy and give everything to the commercial fishing and the Sportfishing ha...
Date:	Thursday, December 12, 2019 1:43:12 PM

Sent via the Samsung Galaxy S7, an AT&T 4G LTE smartphone

From:	Jean Public
To:	Comments; INFORMATION@SIERRACLUB.ORG; INFO@PETA.ORG; HUMANELINES@HSUS.ORG; INFO@EARTHJUSTICE.ORG; INFO@PEWTRUSTS.ORG; SCOOPS@HUFFPOST.COM; CONTACT@THEDODO.COM; INFO@LOHV.ORG
Subject:	[External] PUBLIC COMMENT ON CROAKERS, SPOT SPANISH MACKERAL AND HORSESHOE CRABS UNSUSTAINABILITY
Date:	Sunday, November 24, 2019 3:33:24 PM

I NOTE THE COMMERCIAL PROFITEERS WHICH RUN THIS GOVT AGENCY AND ALWAYS HAVE HUGE QUOTAS SO THA THEY CAN RAPE THE SEA ARE AS USUAL ONLY GETTING COMMENT ON THE OVERFISHING GOING ON FROM THEIR PALS.

HOWEVER THIS PLEA IS TO CUT THE OVERFISHING ON 3 SPECIES WHICH YOU ARE PRSENTLY TAKING PUBLIC COMMENT ON.

AS TO ATLANTIC CROAKER - CUT ALL QUOTAS BY 50%.

AS TO SPANISH MACKERAKL SEATROUT, CUT ALL QUOTAS BY 50%

AS TO HORSESHOE CRABS YOU NEED TO STOP ALL COMMERCIAL FISHERMEN FROM TAKING ANY HORSESHOE CRABS FOR ANY PURPOSE AT ALL ANYMORE IN ANY LOCATION. THE FACT IS THE MIGRATING BIRDS NEED EVERY CRAB THERE IS. STOP THE BLOODTHIRSTY LDL GRABBERS FROM BLEEDIND ALL THE CRABS. THEY NEED TO STOP PERMANENTLY. THIS SPECIES IS IN HIGH DANGER DUE TO THESE SELFISH, PROFIT HUNGRY BLOOD COMPANIES THAT DRAIN BLOOD FROM FEMALE HORSESHOE CRABS. THEY ARE NOT TELLING THE TRUTH ABOUT THE HARM THEY DO. THEY ARE LYING TO THE PUBLIC WE ARE SICK OF IT.
BAN ALL THESE LDL SELFISH PROFITEERS FROM TOUCHING ANY HORSESHOE CRAB IN ANY LOCATION IN AMERICA AND DO IT NOW.

YOU ARE NOT PROTECTING OUR FISH AND THEY ARE A PUBLIC TRUST. YOU ARE ALLOWING EVERY SPECIES TO BE OVERFISHED INTO EXCTINCTION.

I ALSO WANT TO BE EMAILED COPIES EVERY MONTH THAT YOU COME OUT WITH MORE ATTACKS ON FISH AND MARINE SPECIES. I DO NOT THINK YOU ARE DOING A DECENT JOB OF PROTECTING SPECIES. I THINK YOU WORK FOR COMMERCIAL PROFITERES AND NOT FOR THE GOOD OF THIS COUNTRY., THIS COMMETNB IS FOR THE PUBLIC RECORD. JEAN PUBLIEE JEAN PUBLIC1@YAHOO.COM

From:	rick sasser
To:	Comments
Subject:	[External] Spot and Croaker- FMP Public Comment
Date:	Friday, January 10, 2020 4:42:51 PM

The ASMFC's own stock assessments have identified that the SE shrimp trawl fishery as the #1 source of total mortality in both the Spot and Atlantic Croaker stocks, mortality that could be over 90% of total annual removals. The same would be found true for Weakfish if the ASMFC would honestly review that stock.

Until you address shrimp trawling in the primary and secondary nursery areas, and trawling in near-shore ocean staging areas for offshore winter migration, these fisheries will continue to decline.

You can blame declining stocks on oscillators, predation theories or a host of other fabricated reasons. It's not directed overfishing. The problem is bycatch in multiple fisheries.

The flynet fisheries north of Hatteras are dirty. It's common to have whole tows of small unmarketable croakers that are dumped back. The same problem happens with weakfish. The flynet ban South of Hatteras has not shifted North as stocks shifted North. The ban needs to move North. Better yet, ban all flynetting.

The shrimp fishery off NC is now a nine month endeavor. Landings have increased from a 40-year average of approximately 6.2-million pounds to record harvests of almost 14-million pounds. This extended effort occurs in the primary and secondary nursery areas of the Pamlico Sound and the near-shore staging areas for offshore winter migration.

Address shrimp trawling and you will fix any problem with croaker, spot and weakfish.

Rick Sasser
Goldsboro, NC

From: bkaybrewer
To: Comments
Subject: [External] Spots & Crockers addenda III
Date: Saturday, December 7, 2019 2:31:00 PM

When will the recreational fisherman get a break. This year as my husband & I fished for spots in the intercoastal waterway, we watched netters pull nets across every conceivable waterway intersection with no regard for the little guy fishing. You clamp down on the recreational fisherman too much. Next it will be mullett. Soon it will not be fun to fish !

Sent from my U.S.Cellular© Smartphone

From: Tom Monaco
To: Comments
Subject: [External] Spot Draft Addendum III
Date: Tuesday, December 10, 2019 1:01:06 PM
Attachments: tjm.vcf

Thank you for the opportunity to comment on the condition of the spot fishery. I am a recreational fisherman and have fished in the Morehead City area since the early 70s. It doesn't take a rocket scientist to recognize the state of our fish populations are dismal for almost all species including spot. Specifically we have fished for spot during the fall run in the turn basin at Morehead City from marker 1B all the way to the coast guard station and in the 70s, 80s and 90s you could catch spot anywhere in that area. The runs usually started in October and lasted weeks. In recent years the fish are concentrated in small areas and the runs are very brief. Also the size of the fish are smaller.

There is no doubt these fish are no longer plentiful and although I have no data to confirm this over fishing both commercially and recreational has dramatically reduced fish populations. Combined with inshore shrimp trawling which kills massive amounts of juvenile fish we may have reached a point of no return with many of our species. Sea mullet(king fish) populations with both spring and fall runs have been dramatically reduced; flounder fishing is almost non existent in Bogue sound in recent years. We used to be able to catch a few keeper flounder each trip out but that hasn't happened in a number of years. I visit my brother in NJ each year to catch flounder where the minimum size is 18 inches and you can actually catch them. NJ eliminated much of the over fishing specifically by restricting commercial gear.

As far as croakers are concerned I haven't seen a croaker worth keeping in terms of size in many years-all caught are generally juvenile.

I know my response is not specific to spot and may be oversimplified and is based on anecdotal observations but the bottom line I believe we are heading toward an end to productive commercial and recreational fishing for many species.

Respectfully, Tom Monaco, Pine Knoll Shores, NC

From:	Russell Wiggins
To:	Comments
Subject:	[External] Stop light:
Date:	Tuesday, December 3, 2019 8:14:49 AM

To whom it may concern :I for one oppose any restrictions on any fish! Until the department of marine fishery steps up and does there job to stop shrimping in the intercostal water , bays , creeks and within 3 miles of of land! This is what is depleating the croaker, spots and other fish . Known as by catch! I witnessed a large amount of 6” croaker & mullet being swept off boats at the docks! So how many is swept off at sea and in the bay's? Don’t tell me it’s a living thing! You don’t need 4or 5 shrimp boats to make a living! “ money” is the name of the game!! Thank you for your time.

Sent from my iPhone

From: Tony Russo
To: Comments
Subject: [External] croker
Date: Thursday, January 2, 2020 10:12:10 AM

I have never read such BS as in this report.

Atlantic States Marine Fisheries Commission

Executive Committee

February 6, 2020
8:00 – 10:00 a.m.
Arlington, Virginia

Draft Agenda

The order in which these items will be taken is subject to change;
other items may be added as necessary.

A portion of this meeting may be a closed session for Commissioners and Committee members only.

1. Welcome/Call to Order *(P. Keliher)*

2. Committee Consent
   - Approval of Agenda
   - Approval of Meeting Summary from October 2019

3. Public Comment

4. Discuss Potential Allocation of Remaining Plus-up Funds (*R. Beal*)

5. Update on Review of Advisory Panel and Public Input Process (*R. Beal*)

6. Discuss Management Board Changes to Accommodate Shifts in Species Distributions *(R. Beal)*

7. Future Annual Meetings Update *(R. Beal)*

8. Other Business/Adjourn

Please Note: Breakfast will be served as members arrive; members may arrive as early as 7:30 a.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING SUMMARY OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

EXECUTIVE COMMITTEE

Wentworth by the Sea Marriott
New Castle, NH
October 30, 2019

For Review & Action by the Executive Committee February 2020

INDEX OF MOTIONS

1. **Approval of Agenda by Consent. (Page 2)**

2. **Approval of Meeting Summary from August 6, 2019 by Consent. (Page 2)**

3. **On behalf of the AOC, move to approval of the FY19 Audit of the Atlantic States Marine Fisheries Commission. (Page 2)**

4. **Move the Policy Addressing Non-payment of State Assessments be forwarded to the full Commission for action. (Page 2)**

5. **Adjournment by Consent (Page 3)**

ATTENDANCE

Committee Members

Pat Keliher, ME
Doug Grout, NH
Dennis Abbott, NH (L Chair)
David Pierce, MA
Justin Davis, proxy for Craig Miner, CT
Jason McNamee, RI
Jim Gilmore, NY
Joe Cimino, NJ
John Clark, DE
Roy Miller, DE (GA Chair)
Andy Shiels, PA
Bill Anderson, MD
Steve Bowman, VA
Steve Murphey, NC
Mel Bell, proxy for Robert Boyles, SC
Doug Haymans, GA
Jim Estes, FL

Other Commissioners

Mike Blanton, NC (L proxy)
David Borden, RI (GA)
Raymond Kane, MA (GA)
Eric Reid, RI (L Proxy)
Ritchie White, NH (GA)
Spud Woodward, GA (GA)

Staff

Bob Beal
Pat Campfield
Laura Leach
Geoff White

Others

Chris Batsavage, NC DMF
Maureen Davidson, NY DEC
Lynn Fegley, MD DNR
Kris Kuhn, PFBC
Kim McKown, NY DEC
Nichola Meserve, MA DMF
Derek Orner, NOAA Fisheries
Cheri Patterson, NHF&GD
Alesia Read, NOAA Fisheries

CALL TO ORDER

The Executive Committee of the Atlantic States Marine Fisheries Commission convened in the Garden Ballroom of The Wentworth by the Sea in New Castle, New Hampshire October 30, 2019. The meeting was called to order at 8:05 a.m. by Chair Jim Gilmore.

APPROVAL OF AGENDA

The agenda was approved as presented.

APPROVAL OF PROCEEDINGS

The summary minutes from the August 6, 2019 meeting were approved as presented.

PUBLIC COMMENT

There was no public comment.

FY19 AUDIT

The FY19 Audit was reviewed by the Administrative Oversight Committee (AOC) and forwarded to the Executive Committee with a recommendation for approval, noting the auditors provided a clean opinion and found no issues of concern. **On behalf of the AOC, move approval of the FY19 Audit of the Atlantic States Marine Fisheries Commission.** Motion made by Mr. Keliher. The motion passed unanimously.

REMAINING PLUS-UP FUNDS ALLOCATION

Staff presented options for allocating the remaining plus-up funds and the Committee had a good discussion on potential projects. Following the discussion, the Committee agreed to support the Winter Striped Bass Tagging Cruise (~$25K) and tasked staff with further development of a list of potential projects to use the remaining ~$175K for consideration at a future meeting.

PUBLIC INPUT PROCESS

There is concern that public engagement in the Commission's process is dropping off; so the Committee discussed possible ways to remedy this. The Committee requested staff provide an analysis of current membership and participation. The Committee also requested the Management & Science Committee brainstorm on better ways to engage stakeholders and capture public input including the possible use of surveys designed by the Committee on Economics and Social Science to facilitate input.

STATE ASSESSMENTS

Staff presented a policy concerning non-payment of state appropriations. After a couple of clarifying questions, a motion to recommend the full Commission approve the policy was made and passed unanimously. The policy details the timeline for billing and balance due reminders, as well as consequences for not fully paying state assessments. **Move the Policy Addressing Non-payment of State Assessments be forwarded to the full Commission for action.** Motion made by Mr. Grout; seconded by Mr. Keliher. Motion passed unanimously.

FUTURE ANNUAL MEETINGS

Mrs. Leach provided an update on future annual meetings, noting that in 2020 we'll be in New Jersey; 2021 North Carolina; in 2022 Maryland and in 2023 we'll be in Delaware.

ADJOURN

CHAIR JIM GILMORE closed the public portion of the Executive Committee meeting at 9:05 a.m. to go into a closed session. The Executive Committee adjourned at 10:00 a.m.

Atlantic States Marine Fisheries Commission

ISFMP Policy Board

February 6, 2019
10:15 a.m.-12:15 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(P. Keliher)*	10:15 a.m.
2. Board Consent *(P. Keliher)* • Approval of Agenda • Approval of Proceedings from October 2019	10:15 a.m.
3. Public Comment	10:20 a.m.
4. Update from Executive Committee *(P. Keliher*)	10:30 a.m.
5. Review and Discuss 2019 Commissioner Survey Results *(D. Tompkins*)	10:40 a.m.
6. Discuss Strategy to Incorporate Ecosystem Management into the Interstate Fisheries Management Process (*T. Kerns, K. Drew)*	11:00 a.m.
7. Progress Update on Benchmark Stock Assessments *(J. Kipp*) • American Shad • American Lobster	11:20 a.m.
8. Review and Consider Revisions to Stock Status Definitions *(T. Kerns*)	11:30 a.m.
9. Review Noncompliance Findings, If Necessary **Action**	11:45 a.m.
10. Other Business	12:00 p.m.
11. Adjourn	12:15 p.m.

The meeting will be held at the Westin Crystal City, 1800 S. Eads Street, Arlington, Virginia; 703.486.1111

MEETING OVERVIEW

ISFMP Policy Board Meeting
Thursday February 6, 2020
10:15 a.m.-12:15 p.m.
Arlington, Virginia

Chair: Pat Keliher (ME) Assumed Chairmanship: 10/19	Vice Chair: Spud Woodward (GA)	Previous Board Meeting: October 31, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (19 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Executive Committee Report (10:30-10:40 a.m.)
Background • The Executive Committee will meet on February 5, 2020
Presentations • P. Keliher will provide an update of the committees work
Board action for consideration at this meeting • none

5. Review and Discuss 2019 Commissioner Survey Results (10:40-11:00 a.m.)
Background • Commissioners completed a survey of Commission performance in 2019 (**Briefing Materials**). The survey measures Commissioner's opinions regarding the progress and actions of the Commission in 2019.
Presentations • D. Tompkins will present the results of the 2019 Commissioner survey highlighting significant changes from the previous year.
Board discussion for consideration at this meeting • Determine if any action is required based on the survey results

6. Discuss Strategy to Incorporate Ecosystem Management into the Interstate (11:00-11:20 a.m.)
Background • The results of the Ecological Reference Points (ERPs) Assessment will be presented at the Menhaden Board meeting on February 5, 2020. The Board will review both the menhaden single species and the ERP assessment results and consider management actions in response to the assessments. • These actions could have implications for other species management Boards.
Presentations • none
Board action for consideration at this meeting • If the actions being considered by the Atlantic Menhaden Board have implications for the management of other Commission managed species, what process should be established to take action on those issues (e.g, what board(s) should have oversight).

7. Progress Update on Benchmark Stock Assessments (11:20-11:30 a.m.)
Background • The American lobster benchmark stock assessment will be peer reviewed in the summer of 2020. A reference point workshop was held in October of 2019 and the last modeling workshop will be in February of 2020. • The American shad benchmark stock assessment will be peer reviewed in early spring of 2020. The last modeling workshop was in November of 2019.
Presentations • J. Kipp will present a progress report for the American Lobster and American shad benchmark stock assessments
Board action for consideration at this meeting • None

8. Review and Consider Revisions to Stock Status Definitions (11:30-11:45 a.m.)
Background • In August the Board reviewed the annual performance of the stocks. The current stock categories were not broad enough for all of the Commission species.
Presentations • T. Kerns will present revised stock status definitions (**briefing materials**).
Board action for consideration at this meeting • Consider approval of revised stock status definitions.

8. Review Non-Compliance Findings, if Necessary Action

9. Other Business

10. Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ISFMP POLICY BOARD

Wentworth by the Sea
New Castle, New Hampshire
October 31, 2019

These minutes are draft and subject to approval by the ISFMP Policy Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

(Recording for the following transcript begins after Call to Order by Chairman James Gilmore, Approval of Agenda, Proceedings from August, 2019, and Public Comment.)

INDEX OF MOTIONS

1. **Approval of agenda** by consent (approved but not recorded in transcripts).

2. **Approval of Proceedings of August 2019** by Consent (approved but not recorded in transcripts).)

3. **On behalf of the Atlantic Menhaden Management Board, move the ISFMP Policy Board recommend to the Commission that the Commonwealth of Virginia be found out of compliance for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden. The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 mt. The implementation of this measure is necessary to achieve the goals and objectives of the FMP and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resources on a long-term basis** (Page 7). Motion by Nichola Meserve.

4. **Motion to Amend**
   Move to amend to include the unused quota provision whereby unused quota may not be transferred to the Cap to reduce an overage, the rollover provision where unlanded fish from the cap cannot be rolled over into the subsequent year; lastly if the cap is exceeded the amount over the cap will be deducted from the next year's allowable harvest (Page 14). Motion by Eric Reid; second by Doug Grout. Motion is approved by unanimous consent; upon reconsideration of the motion the amended motion fails.

5. **Motion to Reconsider**
   Move to reconsider the previous motion to amend (Page 17). Motion by David Borden; second by Tom Fote. With the passing of this motion the above amended motion fails.

   Main Motion
   Move the Interstate Fisheries Management Program Policy Board recommend to the Commission that the Commonwealth of Virginia be found out of compliance for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden. The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons. The implementation of this measure is necessary to achieve the goals and objectives of the Fishery Management Plan and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resources on a long-term basis. Motion by Nichola Meserve. Motion carried (Page 17).

6. **Move to approve the Habitat Management Series: *Aquaculture Impacts to Fish Habitat along the Atlantic Coast*** (Page 19). Motion by John Clark; second by Malcolm Rhodes. Motion carried (Page 19).

7. **Move to approve the ASMFC Stock Assessment Schedule as presented today** (Page 25). Motion by Jason McNamee; second by John Clark. Motion carried (Page 25).

8. **Move to have the Management and Science committee investigate discard mortality across all species. This review should focus on the use of circle hooks and/or other tools that would address discard mortality** (Page 26). Motion by Pat Keliher; second by Doug Grout. Motion carried (Page 26).

9. **Move to adjourn** by consent (Page 28).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Stephen Train, ME (GA)
Doug Grout, NH (AA)
Cheri Patterson, NH, Administrative proxy
Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Jim Gilmore, NY (AA)
Maureen Davidson, NY, Administrative proxy
Emerson Hasbrouck, NY (GA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak
Andy Shiels, PA, proxy for T. Schaeffer (AA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Lynn Fegley, MD, proxy for Bill Anderson (AA)
Russell Dize, MD (GA)
Phil Langley, MD, proxy for Del. Stein (LA)
Steve Bowman, VA (AA)
Steve Murphey, NC (AA)
Mel Bell, SC, proxy for R. Boyles, Jr. (AA)
Malcolm Rhodes, SC (GA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Marty Gary, PRFC
Alesia Read, NMFS
Mike Millard, USFWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Marek Topolski, Habitat Committee Chair
Kent Smith, ACFHP Coordinating Council Chair

Staff

Robert Beal
Toni Kerns
Caitlin Starks
Pat Campfield
Sarah Murray
Katie Drew

Guests

Chris Batsavage, NC DMF
Randy Blankenship, NMFS
Ellen Bolen, VA DMF
Kelly Denit, NMFS
Zach Greenberg, PEW Trusts
Aaron Kornbluth, Pew Trusts
Kris Kuhn, PA Fish & Boat
Wilson Laney, NC Coastal Federation
Carl LoBue, TNC
Mike Luisi, MD DNR
Chip Lynch, NOAA
Nichola Meserve, MA DMF
Chris Moore, CBF
Trish Murphy, APNEP
Derek Orner, NOAA
John Satterly, VSSA
Jack Travelstead, CCA
Mike Waine, ASA
Chris Wright, NMFS

These minutes are draft and subject to approval by the ISFMP Policy Board .
The Board will review the minutes during its next meeting.

The Interstate Fisheries Management Program Policy Board of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Thursday, October 31, 2019, and was called to order at 8:00 o'clock a.m. by Chairman James J. Gilmore.

(Recording begins after Welcome, Board Consent, and Public Comment.)

UPDATE FROM THE EXECUTIVE COMMITTEE

CHAIRMAN JAMES J. GILMORE: The Executive Committee met yesterday, and we had several items on the agenda. First was the Executive Oversight Committee, which is chaired by Pat Keliher, our incoming Chair. We had the two topics was the approval of the 2019 Audit and Financial Statement.

There was a conference call last week to go over that in detail. Laura reviewed it last week, and when it was gone over yesterday morning there were no issues, just noted that the process has become more difficult because of new federal rules. She has to do more work, but the audit was fine. It was approved unanimously by the Executive Committee.

The second issue was on review of the 2020 Action Plan, and again a quick review by the Committee, and it was approved by the EC. Number two is the consideration of the allocation of the Plus up funds. We still have about $200,000 not committed from the Plus up funds. We pretty much agreed that the funding for the striped bass tagging survey was an important function and that we were going to continue the funding for that.

Then we opened the floor for discussions on several ideas. There were three or four of them, Maine Lobster Reporting. There were some other suggestions from the states of New Hampshire and Massachusetts, and essentially we discussed that for a while, but they were all conceptual, so instead of going into them now, what we did was charge the states to go back and maybe flesh those out a little bit more, so that we can have both a better understanding of the projects and the cost.

We'll be discussing those at the upcoming meetings. Next item was to discuss the public input process. There was an issue brought up about the review of the AP membership, we're not having very good attendance on some of them, so we're going to be looking into how to improve the attendance on the advisory panels.

The second issue is on the public hearing process in that from our most recent, but going back further than that recent exercise with striped bass that we may not be getting the best information from our public hearings. There were several states during striped bass that did surveys, New York, Connecticut, and New Jersey, and the results from those surveys were very different from what we had heard at the public hearing in some cases. We still need to do public hearings, but we're going to start exploring different ways to expand our information and possibly use surveys as a new tool, and maybe get better information for our decision making as we move forward. I know Toni at one point had made a comment that surveys work well maybe for the larger fisheries or the more contentious species.

On smaller issues they tend sometime not even to get any responses on them. What we decided to do is to charge management and science and the Committee on Social and Economic Services to start looking into this, and coming up with suggestions on what would be the best tools, maybe a consistent one that came from the Commission would help, because the three surveys done by the three states for striped bass had common themes about them, but they were somewhat different.

It would be helpful to get maybe the same information. I was surprised at them, because when we did ours the software on these things are so easy to get the data in, and just about hit a button and you get an output report that anybody can do, even I can do it. We're going to look into that. Next item was the report on nonpayment of state assessments.

There was a new policy approved by the Executive Committee that had been working on it. There was a flow chart that describes and essentially goes through probably a year-long process if there is somebody in arrears. There are some clear steps that can be done to correct that and essentially an appeal right before someone would lose voting rights.

That was pretty well laid out. It was approved by the EC, and we're going to consider that for final discussion at the Business Session today. Then we had a closed door to discuss some procedural issues, and essentially that was the Executive Committee, so I'll take any questions if anyone has any. Ray Kane.

MR. RAYMOND W. KANE: Talking about surveys, and we heard about it at the Executive Committee meeting. Could New York and Connecticut share their surveys with the rest of the states sitting at the table, just so the states can get an idea of what they'll be trying to incorporate in their own state? I realize geographically and spatially things are different, even in a particular fishery. But you seemed to have success with it, and I know Dr. Davis said he had success with it. Would you mind sharing with the rest of the Commission, the states at the Commission table?

CHAIRMAN GILMORE: I would be happy to, Justin if you want to.

DR. JUSTIN DAVIS: Yes certainly we could share the survey and the results.

CHAIRMAN GILMORE: I don't want to slight my neighbor, but do you want New Jersey's also? Joe, would you offer yours up also?

MR. JOE CIMINO: Also happy to Mr. Chair, thank you.

CHAIRMAN GILMORE: Okay Ray, good point. We will gladly get those around and we can start talking about it.

MR. KANE: Thank you.

CHAIRMAN GILMORE: Ritchie.

MR. G. RITCHIE WHITE: On those surveys, were those vetted as license holders? Was the question asked are you presently a saltwater license holder, and then was that checked, just out of curiosity?

CHAIRMAN GILMORE: I'll talk to New York's. We actually sent them out. Oh, sorry my mistake. Go ahead, Justin.

DR. DAVIS: We used the database of our license holder e-mails to distribute the survey, but we did not verify respondents, whether they were license holders. We did ask what state they were a resident of, but that was about as far as we went in identifying folks.

CHAIRMAN GILMORE: Yes, we sent them out to all of our registered license holders, both commercial and anybody in our registry, and we did have a question in there about whether you were an out-of-state resident or not, and checked for double e-mails on them, to make sure that we were not getting 55 surveys from one person. Joe.

MR. CIMINO: Well neighbor, like you we don't have a license, but we do have a registry. We used the registry. There were questions on if you were actively fishing for that species, and also participants in the bonus programs.

CHAIRMAN GILMORE: Dennis.

MR. DENNIS ABBOTT: Three states did surveys, did the assembly of your questions, were they all similar, and what did you use for a basis for information that you wanted to get from the respondents?

DR. DAVIS: I'll confess that we blatantly copied New Jersey's survey. They put theirs out first, and I took a look at it and said hey, this is pretty good, we should do this too. We made some small adjustments after some discussions in house, but we largely based ours on New Jersey's survey.

MR. ABBOTT: Pure plagiarism.

CHAIRMAN GILMORE: Go ahead Joe; tell us your wisdom that got you to the survey.

MR. CIMINO: Yes, so interestingly, even though it helped guide some information on this Addendum, we started this well before the Addendum was written. We started this when we knew the results of the stock assessment. It suggested that the stock was in trouble, so we put out questions to New Jersey anglers on what it is that they hoped for this stock, and what it is by management wise and regulation they would like to see. That was really the basis for the survey.

CHAIRMAN GILMORE: I must admit, staff came to me and said they wanted to do a survey. I said you all put it together and come back and let me look at it, so I looked at it. I don't know who they stole from, but I'm sure it was a collaborative effort. Are there any other questions on the Executive Committee?

Okay, seeing none we will move right along.

DISCUSS THE PROCESS IMPLICATIONS FOR ECOLOGICAL REFERENCE POINT BENCHMARK ASSESSMENT

CHAIRMAN GILMORE: The next order of business is Discuss the Process Implications for Ecological Reference Point Benchmark Assessment, sorry I can't talk this morning, so Toni. Toni is still celebrating, so we're going to let Katie do it.

DR. KATIE DREW: As many of you probably heard, at the Atlantic Menhaden Board, we are moving forward with the ERP Assessment, it will be reviewed next week. Hopefully when we come before you in February, we will have a tool for you guys to use to set ecological reference points for Atlantic menhaden.

That is reference points that allow you to take into consideration menhaden's role as a forage fish, when you are setting reference points, when you are setting total allowable catch and so forth. However, the tool isn't going to give you, there is no one right answer. The amount of menhaden that you can take out of the ecosystem depends on what you want the ecosystem to look like, how much predators do you want out there. What predators do you value?

What prey species do you want to fish harder on, et cetera? We're going to provide you with a tool. We're going to provide the Atlantic Menhaden Board with a tool, where they can evaluate the tradeoffs between menhaden harvest and predator biomass. However, there are already objectives in place for all of our predator species, basically, at least the short list that we're focusing on in our intermediate complexity model, and for a lot of other predators in the ecosystem.

There are already biomass targets and F targets in these single species fishery management plans, which limits the universe of possible reference points for Atlantic menhaden, if the Atlantic Menhaden Board wants to respect those boundaries, and leave those predator boundaries alone. However, if the Atlantic Menhaden Board wants to have more say in the single-species reference points for those predators. That is not really something they can do by themselves.

It becomes a question for the larger Commission about how you want to handle the use of ecological reference points for Atlantic menhaden. Is this an issue for the Atlantic Menhaden Board only, where they respect the boundaries set by the single-species management plans, and work within those, or is this a conversation amongst multiple boards, multiple stakeholder groups, to come up with reference points that balance all of the needs for all of the species?

Obviously that conversation, the larger conversation is going to be a much longer conversation, and really is almost the beginning of reshaping how the Commission works. It's moving away from the concept of single-species boards, and moving into a realm where all of these boards meet together, and there is no single board, it's just one board that balances the needs of the ecosystem. These conversations can't happen only at a single-species board.

The Menhaden Board is going to get the choice in February or, do you want to go with sort of what the literature calls an ecosystem approach to fisheries management, where you leave the predator reference points alone, and focus on menhaden in response to those existing single-species reference points, which will be a quicker process?

It will let us get reference points on the books much more quickly and efficiently, or do you want to go down the path of what the literature calls ecosystem-based fishery management, where you manage all of these species together as a consistent, coherent ecosystem, which as I said is going to be a much longer process?

That is really where the Policy Board, as opposed to the Menhaden Board is going to come in. I don't think we need to make a decision on this now. Certainly we're not in the position to, as we don't even have the final approved stock assessment yet. But as this process goes forward, it is something for the Policy Board as well as the Menhaden Board to think about, in terms of how does the Commission want to approach ecosystem management for this species and for all of their species in general?

MS. TONI KERNS: I would just add that for those of you that are not on the Menhaden Board, which is maybe one or two folks, come to the Menhaden Board in February so that you can hear and see the presentation on the stock assessment results.

CHAIRMAN GILMORE: Questions for Katie. John Clark.

MR. JOHN CLARK: Katie, it's still a little confusing to me. This tool in other words, will look at this is the stock of menhaden we need to feed striped bass, bluefish, et cetera. Then you go back from that and go to the standard model to try to take that into account as part of the natural mortality that you need to account for when you're looking at the reference points?

DR. DREW: Somewhat, yes. It's going back and looking at the single-species model for the best available information about biomass and fishing mortality. Then we evaluate sort of the potential quota level and how that would affect other predators, and whether that fishing mortality of that quota would keep the other predators at their biomass target or their biomass threshold, depending on how they're fished in the ecosystem.

CHAIRMAN GILMORE: Lynn, did you have your hand up? Yes, go ahead.

MR. LYNN FEGLEY: Toni, this might be more for you. If I remember there is a motion tabled on the Striped Bass Board about a new amendment. I'm just curious. Since that Board is possibly going to embark on rethinking, if there is a way that we can tie that to this, maybe as in intermediate step to the full. I don't know if they relayed, but it seems like if the Striped Bass Board is going down that road there might be a connection there.

MS. KERNS: I'm not sure it would alter the rebuilding program, unless they changed their reference points. Then that may have influence on the multi-species model itself. But if the multi-species model just holds on to the reference points as they are, then I don't think it would change the path that the Striped Bass Board would be going down.

CHAIRMAN GILMORE: Go ahead, Lynn.

MS. FEGLEY: Right, and just as a follow up, I wasn't implying that. But it was my understanding that there was some talk about, you know we have the addendum now, but then an amendment to really rethink the striped bass objectives, the striped bass reference points, all of those things going forward. That is the piece that I was pointing to.

DR. DREW: To sort of follow on that. If that component changes, then that would have an impact on the menhaden reference points that go forward. Whether you want to have that conversation with the Menhaden Board as a Striped Bass Board, whether you want that to be a conversation or whether you want that to be dictated to the Menhaden Board, I think is definitely a policy question that the Board may struggle with.

CHAIRMAN GILMORE: Ritchie White.

MR. WHITE: When all this is in place, how much effort and resources will it be to run the model? In other words, what I'm thinking about trying to put these pieces together you get the new striped bass stock assessment and it is way down, and immediately plug that in. What does that do to menhaden? I mean I'm still not quite able to picture exactly how this would work, how fast it would work.

DR. DREW: It's a good question. When we were developing these models we explored a number of different models, and we did put priority on models that were of intermediate complexity, so that they captured a lot of the important dynamics of the ecosystem, but were still updateable on a timeframe for management.

I think the key thing to keep in mind is that we will need updated information from all of our predator species to get the most up-to-date information for these ecosystem tools. If we could sort of align our predator assessments with our menhaden assessment, it all worked out perfectly this time, so good job us.

But we want to make sure that we keep that schedule going forward, and that is something that the ERP Workgroup could weigh in on is what's the ideal schedule to keep predators up to date? But in the sense the tool is really meant to be kind of a long term understanding of how the ecosystem would behave in equilibrium, rather than a specific year-by-year thing.

You're focusing on a reference point, which is an equilibrium concept of how do we get to where we want to be with these reference points, and then the single-species assessment is kind of the immediate up to date are we there or are we not there yet, on a shorter time frame.

CHAIRMAN GILMAN: Bill Hyatt.

MR. WILLIAM HYATT: Just curious. How do you make the transition to ecological reference points to ecosystem management dealing with all of these predators, and only a single forage species?

DR. DREW: That's also a good question. We also do have, in our intermediate complexity we have; these models do include another alternative prey. We have Atlantic herring in there as kind of another species that occupies a similar ecological niche. That has a similar range, not completely the same as Atlantic menhaden obviously, but there is a little bit of overlap to get at some of those dynamics, especially as Atlantic herring is changing.

However, I think if we want to fully move towards managing the entire ecosystem, we are going to need to make these models more sophisticated and include more data, and of course these models do include a lump of just other prey that's out there. That gets lumped in together, so things like sand lances of bay anchovies that we don't model and don't even manage get kind of lumped in there as well.

I think we see this as the first step towards ecosystem-based fishery management that we're going to give you some information you need to manage predators and menhaden together. But if you really want to move towards full ecosystem-based management, we're going to need to continue to improve and refine this tool and our management process. But we can still take a really important first step towards considering menhaden's role as a forage fish, with this assessment and with ERPs.

CHAIRMAN GILMORE: Other questions for Katie? Okay seeing none, thanks Katie that was great. It's going to be an evolution as we move forward, so thanks a lot. Yes go ahead, Bob.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Kind of one more on the subject of February meeting. We're going to have a number of sort of big ticket items at the February meeting, the ERPs, menhaden. That's going to take a while. Striped Bass Conservation Equivalency Proposals, the cobia stock assessment.

Where I'm going with all this is we may need to have a four-day meeting in February. We usually schedule three days, we're going to look at it right when we get home. First of all we need to know if the hotel has space. Heads up, we may be reaching out to the Commissioner's saying; we need an extra day or extra half day at the February meeting. We'll keep you posted as quickly as we can.

CHAIRMAN GILMORE: I was thinking it might be the first five day meeting, but we'll see. We've had a late request for a change to the agenda, so if everyone is okay with this, our Board Chair for Menhaden is here and has some time constraints.

REVIEW NONCOMPLIANCE FINDINGS

CHAIRMAN GILMORE: If it's okay with the Board if we move up the Noncompliance Findings, so if we could move that up does anybody have an objection to that?

MS. KERNS: Before Nichola starts, I e-mailed out a memo from Nichola last night. I just wanted to see. I have some paper copies here if anybody needs a paper copy of it I can bring it over. But in your e-mail you should have a memo from Nichola, but e-mailed from me. Does anybody need a copy?

CHAIRMAN GILMORE: Okay Nichola, we're going to hand it over to you, so if you can give us your update.

MS. NICHOLA MESERVE: During its meeting on Monday, the Atlantic Menhaden Management Board reviewed the status of the reduction fishery harvest from the Chesapeake Bay in 2019, with regards to Amendment 3's cap of 51,000 metric tons. Harvest exceeded the cap on September 6, and is now roughly 65,000 metric tons.

There was a robust discussion among the Board of the necessity of Virginia's compliance with this FMP requirement and its importance to the conservation of the Chesapeake Bay ecosystem. Ultimately a noncompliance motion was passed unanimously by the Menhaden Board on Monday, and Toni is providing you with the memo that addresses the Board's action, and begins to make the case for the conservation need of the noncompliance determination.

It's important to note that the Board has taken numerous actions over the past 18 months to avoid coming to this situation, including multiple postponements to provide the Virginia Legislature more time to adopt the Bay cap, and

effectively granting a pass on adopting the cap, provided harvest did not exceed it.
The Board was unable on Monday to come up with any other avenue to responsibly respond to Virginia's inability to effectively implement and enforce the Bay cap in 2019. The motion was made with recognition given to the fact that the lowering of the cap in Amendment 3 was not entirely in response to the stock status of menhaden, which is generally accepted as robust.

The importance of the Bay capped conservation is a much for other species that depend on menhaden as forage than the menhaden stock itself. The Bay cap addresses the potential for localized depletion caused by the reduction fishery, and its implications for numerous other Commission managed species that utilize the Bay, and menhaden as forage, some of which are in sub-optimal status, including our flagship species striped bass.

The impacts of possible localized depletion extend even further to the competing uses for menhaden, including both commercial and recreational fishing activities that target the predators of menhaden. The Board stressed that the Amendment 3 cap was not arbitrarily set, but is reflective of recent fishery performance.

It caps future harvest at that level to prevent an increase amidst scientific uncertainty, as the impact of the intensive reduction fishery harvest on the Chesapeake Bay ecosystem, while ecological reference points are developed to establish scientifically sound harvest limits that consider menhaden's important role as forage. Acting with such precaution is an accepted management practice in resource conservation.

The precautionary principle establishes that in the face of uncertainty we are to take a preventative action, and moreover that the burden of proof is shifted to the proponents of the activity**. With these arguments in mind, the Atlantic Menhaden Management Board recommends the ISFMP Policy Board that the Commonwealth of Virginia be found out of compliance for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic menhaden.**

The Commonwealth of Virginia much implements an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons. The implementation of this measure is necessary to achieve the goals and objectives of the FMP, and to maintain the Chesapeake Bay marine environment, to assure the availability of the ecosystems resources on a long-term basis.

CHAIRMAN GILMORE: Hang on one second. I'm taking that as a motion from the Board. We're going to put that up, and then we're going to have some discussion on it again. I encourage the Board that some of you were on the Menhaden Board and spoke to this, but remember not everybody heard the comments from that.

Don't feel you're being redundant if you weigh in again, and we would like to get a good discussion and some input on this. We have a Pierce motion up. Where is David? Anyway the motion is up on the Board from Nichola. First off, any questions for Nichola before we open it up? Adam, do you have a question for Nichola or do you just want to make a statement?

MR. ADAM NOWALSKY: I have a question about the motion. I'm not sure if Nichola would be best served to ask, but if you would like a question I can ask a question, although I'm not sure who will best serve to answer it.

CHAIRMAN GILMORE: Go ahead, Adam.

MR. NOWALSKY: We had discussion about payback provisions. This motion specifically says that we're asking the Commonwealth to reduce to 51,000 metric tons, when the payback provision would be something less than that. What are we actually going to judge Virginia's compliance on? Should the Legislature act to change the Bay Cap in the near future before we have to forward this on to the Service?

CHAIRMAN GILMORE: Toni.

MS. KERNS: We would ask the state to put the 51,000 metric tons in place, because that is the quota, and then in any given year if that quota is exceeded just like in any given year a state exceeds their quota, we would reduce the quota and let them know that year that their quota has been reduced due to an overage, and their quota for that year is the following. In our quota memo this year we will let the state of Virginia know that the Bay Cap quota is not 51,000 metric tons, but x, based on the overage that occurred this year.

CHAIRMAN GILMORE: Go ahead, Adam.

MR. NOWALSKY: My question to Virginia then, and I understand that this has not been a VMRC issue that the VMRC has done everything within their power to address this. The axe of the Legislature is beyond their purview. We got here on the basis of Virginia had a number in place for the cap.

ASMFC had a different number, so now I'm hearing that we're going to potentially be in the same place in 2020. Virginia may have a number, if the Legislature acts, of 51,000 metric tons. The ASMFC is going to expect harvest to be constrained to a lower number, but there will not likely be anything in place in Virginia to hold anyone accountable to that lower number. Outside of just good will, what else could we possibly expect potentially in 2020?

MR. STEVEN G. BOWMAN: Thank you for the question. I believe that if the Legislation is crafted appropriately there could be verbiage put in the Legislation that addresses the quota, and any consequences that come thereto as a result of exceeding the quota. I believe in a perfect world and a perfect legislation, if it were passed, could contain language that deals with overage.

CHAIRMAN GILMORE: Other comments, questions, input? Steve Bowman.

MR. BOWMAN: I'll yield to Mr. Fote first.

CHAIRMAN GILMORE: Go ahead, Tom.

MR. THOMAS P. FOTE: As I said at the Board meeting, because a reference came up about New Jersey and people talking to me, and I said this was a different situation. When New Jersey went out of compliance we basically were not looking for any more fish, as a matter of fact we were looking to take less fish.

But we wanted to take the size we wanted and put in the season we wanted, which actually was more restrictive and we basically accomplished that we had a lower quota. I am going to make sure I write a letter, because I was part of that process, to the Secretary of Commerce and to my Representatives and Congressional staff explaining that to him, and this is a different situation.

This is a spatial conflict that goes on in Chesapeake Bay, which in good faith they had agreed to keep it on a cap and it's basically a situation for us and the Compact to deal with, and we need the support of the Secretary of Commerce. Since I was involved in the last one, I will write a personal letter besides what the state does to that effect to the Secretary of Commerce and to Sam Rauch, because I had a lot of meetings with him over this. That's what I will do after this is sent.

CHAIRMAN GILMORE: Thanks, Tom. Steve.

MR. BOWMAN: Again, on behalf of the Commonwealth of Virginia, we don't like to be in this situation. As I said before, the stigma of the Commonwealth of Virginia being found out of compliance for anything is troubling to the Commonwealth. Governor Northam, Secretary Strickler have demonstrated a desire to improve not only water quality, but the environment in general. It's been one of the hallmarks of their administration and the team.

To be found out of compliance in such an important matter is very, very disturbing. That being said, we are here, and why are we here? We're here because this Commission has the authority by law to set quotas, and they did. They set a 51,000 metric ton quota for the Commonwealth of Virginia. This Commission has been overly kind to the Commonwealth in allowing us to attempt to remedy the issue that we're confronted with today, by not once but twice postponing a noncompliance finding, as I and the administration worked with the Virginia Legislature to try to adopt the cap. That did not work. The quota has been set. As Ms. Meserve very, very eloquently and accurately described how the quota was set. It's not an arbitrary quota, it's a quota that's based on science and based on necessity to conserve and protect the species. This is a situation in which, as it was pointed out, the Commonwealth is in violation.

But the Commonwealth is in violation because primarily one entity decided to exceed the quota by virtue of their prosecution of the fishery. This exceedance was not without warning, and I would like to read very quickly a letter into the record that I wrote on September 3, 2019, to Mr. Monty Deihl of Omega Protein.

"Dear Mr. Deihl, I am concerned about the progress of Omega Protein and its harvest of menhaden from the Chesapeake Bay this year. As of August 23, data provided to the Marine Resources Commission by the National Marine Fisheries Service indicate Omega Protein has harvested 43,385 metric tons, or 85.07 percent of the 51,000 metric ton Bay Cap on reduction harvest of menhaden from the Chesapeake Bay. The 51,000 metric ton cap was adopted under Amendment 3 at the Atlantic States Marine Fishery Commission's Atlantic Menhaden Fishery Management Plan. Of immediate concern is the sudden increase in the Chesapeake Bay menhaden harvest for the reduction over the past three weeks, and 43,385 metric tons is substantially greater than any of the previous four years, especially at this stage of the fishing season.

Although the General Assembly has not adopted this 51,000 metric ton Bay Cap, Virginia is obligated to ensure this cap is not exceeded to avoid compliance issues with ASMFC. I personally told ASMFCs Menhaden Board at their winter meeting that VMRC will monitor the menhaden reduction harvest closely, and will accept any consequences necessary if the cap is exceeded.

Your company has remained below this cap since 2013, and I urge you to monitor your activities closely to avoid any exceedance of the Bay Cap in 2019. It's signed by me, and again dated September the 3rd. I put them on notice. I put them on notice based on the fact two reasons; number one it's the law, number two we as the Commonwealth had been very diligent in trying to do whatever we could to remain in compliance. It did not work.

In addition, by virtue of their desire to, according to the testimony provided by their representative, they put economics ahead of conservation and the environment. They knew by virtue of attending these meetings that science was coming that would probably give us more certainty as what the Bay Cap may be.

Instead of waiting, instead of being a good player, instead of a good actor, they chose to on their own volition, after being warned, to violate the cap. Not only to the detriment of the environment to the resource, also to the detriment of another fishery that has not come up, we haven't spoken much about it, but to the bait fishery.

The bait fishery is a very clean fishery that has stayed within the confounds of the law, done everything it's supposed to do, and not if found out of compliance the bait fishery will be negatively impacted. Those negative impacts don't just affect the Commonwealth of Virginia; it has a ripple effect to our neighbors that rely on menhaden for bait. That to me is somewhat very, very problematic. Where are we now? This Commission has vetted this situation numerous times. The law specifically states that if a state is not compliant with the established cap, it shall be found out of compliance.

Although as I said when I left the table the other day after making comments, I believe Virginia did the right thing and we were doing the right thing by asking and suggesting that you find us out of compliance. It doesn't make me feel any the better. It's not a good feeling. That being said, the time comes when we must do what's right, and the time is right to hold Virginia out of compliance in accordance with established law. Thank you."

CHAIRMAN GILMORE: Jay McNamee.

DR. JASON McNAMEE: I was here during the Menhaden Board meeting in the audience, and listening to some of the comments. One thing that kind of struck me is I think there is a feeling of confidence on the part of some that there is no science to support that cap as it was established.

I hope you'll be patient with me, but I thought I would highlight some of the reasons why I reject that assertion. I think that's a false sense of security that those folks might have. I'll start with some, and a lot of these will be duplicative with the excellent statement that Ms. Meserve made earlier. But I think this will highlight some additional things as well in detail then.

Just thinking about the stock assessment, the mechanics of it itself, and how we use stock assessments in our management process. There are some important assumptions that go into the projections, those are the pieces of the assessment that we use to set our management moving forward. It's our crystal ball; it's how we kind of predict how things will be moving forward.

We've got a situation here where the majority of this fishery gets focused in the Chesapeake. When we go into the projections from the stock assessment we make really important assumptions about the characteristics of the fishery, things like selectivity in the fleet structure that we have within the model and the projections.

If those assumptions change moving forward that impacts our ability to meet our objectives. It impacts the performance of the projections, and the objectives that the Board is trying to meet won't be achieved, because the characteristics have change. That's a really strong reason why you would want to have some stability in the Chesapeake region, why you would set a cap.

That's why it wouldn't be an arbitrary decision, but a logical and important decision to make. On another point, there was a lot of work done a few years ago investigating a localized depletion in the Bay. There were no definitive causative links that came out of that with regard to the concept of localized depletion specifically.

But, there is ample evidence that there are extremely important linkages between menhaden and the other species in the ecosystem in the Bay. Just to highlight a few of those, there are studies on the natural mortality of striped bass, based on some of the tagging work that is done. It shows that natural mortality seems to be correlated with the size of the population of menhaden, the natural mortality of striped bass, sorry. That is what I'm talking about specifically. Striped bass natural mortality seems to be affected by changes in menhaden biomass. There is literature on that.

There has been lots of work done on the health of striped bass, again, strong correlations between the size of the menhaden population and the health of striped bass in Chesapeake Bay. Going up a level from striped bass, lots of data indicates that menhaden is a critically important component of the diet from many different predator species in the Bay.

It always shows up as one of the highest components in those diet studies. I'll stop there. I could go on. I'm sure you want me to, Mr. Chair, but I'll stop there. It's not that the science has said there is no issue with focusing fishing on the Chesapeake, but it's difficult to make that really strong linkage.

But I think from my perspective what the management board did when setting that cap is they looked at that weight of evidence, and took a set of precautionary measures to make sure these things weren't going to impact the ecosystem of the Bay. In my view the cap was set by the Board, not in an arbitrary way, but as a method to mitigate the risk to that ecosystem, not just menhaden, not just striped bass, but the entire ecosystem.

In my view it is perfectly logical to set that cap based on an average of fishing. I think the Board; they don't have to think about just science, they have lots of other things to think about. When you do something like that you don't have any specific numbers that you can throw at it, no specific math to do.

But you looked at the evidence, you thought about the fishery, you thought about the ecosystem, and you made a decision to set that cap to keep things stable for the fishery, and to make sure that there was enough forage in that ecosystem to keep it going in the way that it had. Thank you for letting me ramble on there for a few minutes. It does not appear to me to be an arbitrary decision, and that cap I think is an important conservation effort in the Chesapeake.

CHAIRMAN GILMORE: Great comments and I couldn't agree more. I mean fisheries science has never been an exact science, and we go back in time. I've been at this for close to 40 years, and we have to make decisions on management based upon the information we have. We've done very good with much less information than we've had on this fishery, so it is great points. Ritchie White.

MR. WHITE: First I would like to commend the Commonwealth and Steve for the actions they've taken. It's clearly a model for this Commission for a state or Commonwealth to do the right thing and step up. I think we don't see that type of action as commonly today as we used to. I think this is excellent for us to witness this and be part of it.

Question is, I'm already hearing from constituents that want to sound in on this. Can the Commission let us know when and who comments should go to? Should it go to the Secretary of Commerce right away? Should it go to National Marine Fisheries Service? What would be the best avenue for the public to comment, and they're already wanting to comment that a foreign company is overharvesting a U.S. resource. I'm hearing that that is what a lot of the public plans to bring forward. I assume we'll be getting the copy of the letter, and we can then forward it to our constituents, so if we know where that will go. New Hampshire also plans to contact our delegation and be encouraging them to weigh in on it.

CHAIRMAN GILMORE: Bob, can you just quickly go over the timing and the process for the letter and the follow up?

EXECUTIVE DIRECTOR BEAL: Sure, I'll go over the process timing and then speak to Ritchie's original question. The way it would work. Should a motion go forward from the Full Commission would be that I have 10 business days to write a letter for submission to the

Secretary of Commerce, so that would be starting tomorrow would be day one.

There is Veterans Day in there, so we do get an extra bonus day to do some writing. But it would be ultimately the letter would be due November 15, and we would submit that in time for that deadline. Then what happens after that is the Secretary has 30 days to make a decision whether he agrees or disagrees with the assertion in the letter.

Then if the Secretary does agree a moratorium is appropriate, the Secretary has a six-month implementation window that he can exercise. If one month from November 15, when he receives our letter, the Secretary could say well, rather than the moratorium being effective immediately, he could decide to push it back to February or April, for whatever justification working with General Assembly or whatever it may be.

There are multiple steps in the process, and there is some flexibility on when a moratorium would be affected, should the Secretary chose to go that route. To answer Ritchie's question. The Atlantic Coastal Act really doesn't include a public comment provision in this. The state in question, in this case Commonwealth of Virginia would be provided an opportunity to meet with the Secretary of Commerce or his staff to talk about the issue.

We could work with friends at NOAA Fisheries and see what the best avenue for public to provide comment would be. Again as you asked, should it go to NOAA Fisheries, should it go directly to the Secretary, should it come to us and we package that up and send it along? There are a lot of different ways to do it, and I think we can talk to the representatives from NOAA Fisheries, and get a better process for that.

CHAIRMAN GILMORE: Are you good, Ritch? Adam, do you have your hand up?

MR. NOWALSKY: Is it fair to assume that the Virginia Legislature basically would have zero chance to act on this prior to the Secretary rendering a decision, or is there any possibility that the Legislature could act prior to a decision by the Secretary?

CHAIRMAN GILMORE: Steve.

MR. BOWMAN: Considering the window that is involved and the timing that's involved. As this would work out, the Virginia General Assembly goes into session around the 17th of January for a 60 day session this year, so the six month window that's allowed would fall right within the timeframe of the Virginia General Assembly thereabout.

CHAIRMAN GILMORE: Go ahead, Adam.

MR. NOWALSKY: But the 30 days that the Secretary would respond from when our letter gets to them, I believe would end prior to that date that you're offering, 1/17.

MR. BOWMAN: That is correct.

CHAIRMAN GILMORE: I'm sorry Alicia; I missed your hand before. Did you have a comment to that point of the previous question?

MS. ALICIA REID: I was just going to point out that we will publish a Notice of Referral where comments can be submitted, so you'll see that and your constituents can comment through that mechanism.

CHAIRMAN GILMORE: Thanks. Dennis.

MR. DENNIS ABBOTT: Following up on Adam's first questions. They've overharvested, they have a payback. We set a number, whatever the number is say 40,000. In next year's fishing season at some point we're going to tell by Board action that they have to lower their quota. I think that is the way I understand it.

That would go to Virginia. The Legislature will act or won't act on that number. Would that result in a further out of compliance issue? It seems like what we do is what we do, what the Secretary does is what they do. Are we going to get into another noncompliance issue, which on the one hand, I think we have to if nothing else, keep as much pressure on the Commonwealth General Assembly to get their nose out of this and do the right thing? I'm just wondering for Steve, or for the Chair here. What would be the action for the reduction or handling the overage?

CHAIRMAN GILMORE: I think the technical response is yes there would be a second noncompliance finding, but I'll defer to staff if that is incorrect. I don't know Pat will have to deal with it. I'm just kidding. Do you want to add to that Toni?

MS. KERNS: It only depends on whether or not they exceed that reduced quota or not. You would have to wait to determine that. As part of this letter we could include some of that information, if it's helpful to Steve in his process of identifying what the cap should be and what the quota would be for the next year.

We can work with Steve to put this information out there and the best way possible to make it understood of the process that we go through, recognizing that their process is a little bit different through the Legislature, and that they don't annually shift their quota through their legislative process. I'll defer to Steve.

CHAIRMAN GILMORE: To that point, Steve.

MR. BOWMAN: To that point. The Legislation in a perfect world, if I were to write it, because we don't want to revisit it again, it would as I indicated earlier, would indicate that the Commonwealth of Virginia would adopt the cap that is established by ASMFC.

Then line two would say any further conditions assigned by the Atlantic States Marine Fisheries Commission would be adhered to. I think that's the only way to really write the Legislation. I'm not Legislative Services, I'm not an attorney, but I think that is what needs to be done, so I'll leave it at that.

CHAIRMAN GILMORE: I concur. If I was in your shoes it would be the same thing. Go ahead, Toni.

MS. KERNS: I think that that would be also helpful, Steve in the fact that this section of the document also contains other provisions, in terms of if there is an overage, which we have just been talking about, as well as there is also the provision that unused quota from states and regions are not allowed to be transferred to the cap to cover an overage, as well as unlanded fish for the cap cannot be rolled over into a following year. There are also those two other provisions as part of the section, in addition to the cap itself and reducing overages.

CHAIRMAN GILMORE: Lynn Fegley.

MS. FEGLEY: I'll be brief. I just wanted to put a finer point a little bit on what Dr. McNamee said about the science end of this. Coming from the state of Maryland, which shares the waters of the Chesapeake Bay, we do have issues with disease in striped bass, and there is some scientific peer reviewed literature that is indicating that striped bass are more susceptible to mycobacteriosis when they are not well fed.

As we're trying to rebuild striped bass, and potentially squeeze more striped bass out of the Bay. I think it's very important to keep that in mind. Remembering back in 2009, when we were struggling with the localized depletion issue, and did a lot of studies. Those studies were peer reviewed by the Center of Independent Experts.

At that point Dr. Jean-Jacques Maguire pointed out that the idea of really quantifying exactly how much forage needed to be in the Bay to satisfy increasing demands of striped bass and other predators, including the fisheries, and I quote. "It will be a difficult and possibly very expensive question to resolve."

I think it's also important to note that they're not always the extensive resources that are needed to develop these concrete answers, which are very hard to find. Dr. McGuire went on to say that one way to mitigate the negative consequences of this competition between fisheries and predators was to implement some timed area restrictions and zoning of fisheries. I think all of these things were very present in the Board's mind when they made these decisions.

CHAIRMAN GILMORE: Eric Reid.

MR. ERIC REID: To Adam's original point. If it makes anybody more comfortable, maybe if it makes me more comfortable I suppose. In this particular motion, I realize it is only a motion of finding of noncompliance, and then the actual letter that is going to be sent to the state of Virginia will be more detailed, I'm assuming.

But if you took this in this motion where it says 51,000 metric tons it would be 51,000 metric tons per year, and also implement the accountability measures in a case of an overage. You can just add that little line in there, and at least that would maybe satisfy some of my other Commissioners.

As far as the action of the Menhaden Board, it's pretty simple. The state of Virginia is out of compliance. Right now they're out of compliance by about 16,000 tons. That is 33 million pounds. Omega's reasoning. I'm in the commercial fishing business, everybody knows that. But part of their reasoning was you know they've got boats sitting at the dock and they need to go fishing, and that's it.

They sent a letter and said we're just going to go fishing. I've got boats sitting at the dock too, and you know we're in the illex fishery, and we caught the illex quota in record time. When the Feds said the fishing is over, we stayed tied at the dock. We didn't write a letter saying hey, I've got 150 employees as well, and we need to go make money and we're going. We stopped.

It kind of rubs my nose in it a little bit, and I don't care for it. I applaud the actions. It's an easy decision. What happens from here may be a little bit more dicey, and we're not in a perfect world. But this is something that has to be done. There are other ways to deal with good behavior versus bad behavior in the future, and I'll be sure to keep that in my head come February.

CHAIRMAN GILMORE: We are going to need a motion from the Policy Board, so let me go to Bob.

EXECUTIVE DIRECTOR BEAL: Yes just kind of highlighting where we are. The motion that was originally up that Nichola provided from the Menhaden Board moving forward is made on the behalf of the Menhaden Board, it doesn't need a second, but if this Board wants to adjust that as Mr. Reid just suggested, to roll in the additional provisions about accountability and overages and underages.

We'll need a motion to amend that motion that was brought forward from the Menhaden Board. There is language up on the board that I think should capture all the additional details. I got it. It makes the whole thing a lot longer. For completeness it's probably what needs to be added to fully spell out 4.3.7 from the Amendment.

CHAIRMAN GILMORE: Does anybody want to adopt this language on the board as a motion? Eric Reid. Do we have a second to that motion? Doug Grout, discussion on the motion? Adam Nowalsky.

MR. NOWALSKY: We discussed noncompliance on this issue earlier last year, prior to the cap being exceeded. I thought I heard Toni suggest, and if I misheard please correct me that we would need to see how landing proceeded in 2020, to determine if Virginia was out of compliance again.

I would offer that especially with this motion in place, we wouldn't need to. That at any point during 2020, when the Menhaden Board and ultimately the Policy Board says, is Virginia doing enough, the Legislature doing enough to enact this that we could potentially take action again? I'm just looking for guidance on that, because I don't believe we need to wait for the cap to be exceeded in another year to potentially pursue another noncompliance finding.

CHAIRMAN GILMORE: Go ahead, Bob.

EXECUTIVE DIRECTOR BEAL: Thanks Adam for the question. I think since the Menhaden Board has given some leniency to Virginia over the years, since they've been under the quota the Board hasn't pursued noncompliance. That's very different than how we handle it in most management boards.

We usually say if the state doesn't have the right regulations in place they're out of compliance. I think what you're going to is back to how this Commission usually handles compliance. They must have the appropriate regulations in place. You don't wait for someone to exceed a quota, the Commission usually finds someone out of place because they don't have the appropriate quota in place.

I think that is kind of what this is doing is trying to ensure that Virginia has all the provisions in place for the accounting, as you mentioned, and you wouldn't have to wait until you see their performance. If the harvest was really low next year, maybe they don't go over the reduced quota and those sorts of things.

I think the Board could at any time evaluate whether the package of regulations in Virginia is consistent with the FMP. You're right. You don't have to wait to see the performance usually; the Board usually evaluates compliance by what regulations are in place not once they exceed a quota.

In other words we've got multiple quotas and multiple recreational size limits and other things in place, or the states are supposed to. We don't wait until say a small size limit resulted in higher recreational landings. The states are reviewed based on the size limits they have in place, not the performance of what they do have in place.

CHAIRMAN GILMORE: Steve Bowman.

MR. BOWMAN: To that point. Based on the latitude that this Commission has given the Commonwealth of Virginia, I think that is the appropriate direction to take.

CHAIRMAN GILMORE: Other discussion on the motion? Okay I think I need to read this into the record, and then we'll vote it. Move to amend to include the unused quota provision whereby unused quota may not be transferred to the Cap to reduce an overage, the rollover provision where unlanded fish from the cap cannot be rolled over into a subsequent year.

Lastly if the cap is exceeded the amount over the cap will be deducted from the next year's allowable harvest, motion by Mr. Reid and second by Mr. Grout. Let's start with is there any objection to the motion? Let's see if we can do this quickly. Okay seeing no objection to the motion it's approved by unanimous consent. This gets added now to the main motion. This is really becoming a Pierce motion.

MR. BOWMAN: Mr. Chairman, before you read it please. I would suggest strongly that you do not read any abbreviations please when you read the motion.

CHAIRMAN GILMORE: I will try. This is now a motion. Bob, for clarification, this is still a

modified motion from the Menhaden Board, or is this now a motion from the Policy Board?
EXECUTIVE DIRECTOR BEAL: Property of the Policy Board.

CHAIRMAN GILMORE: Okay great, just wanted to make sure we're clear on that**. This is a motion of the Policy Board, and let me try to buckle up here, Steve. Move the Interstate Fisheries Management Program Policy Board recommend to the Commission that the Commonwealth of Virginia be found out of compliance for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden.**

The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons. The implementation of this measure is necessary to achieve the goals and objectives of the Fisheries Management Plan and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resources on a long-term basis.

Unused quota may not be transferred to the cap to reduce an overage, the rollover provision, where unlanded fish from the cap cannot be rolled over into the subsequent year. Lastly if the cap is exceeded, the amount over the cap will be deducted from the next year's allowable harvest. Okay is there any discussion on the motion?

MS. REID: I would like to ask one of my colleagues to come up and just offer a little bit of advice before you move forward on this.

CHAIRMAN GILMORE: Go ahead, Chip.

MR. CHIP LYNCH: Hey everybody, Chip Lynch with NOAAs Office of General Counsel. I made some comments a couple of meetings ago about the novelty of analyzing a noncompliance relative to a fishery that was not overfished and overfishing wasn't occurring. I appreciate the efforts, NOAA appreciates the efforts that you all have done today to augment the record, and better explain your rationale. I particularly note Lynn's comments and Jason's comments. That is helpful. I think that will help the Secretary better understand the position of the recommendation given to him. Incidentally, I do want to just interject. When there was the last motion that passed by unanimous consent. NOAA Fisheries would have abstained from that. We're in the decision making process or we would be in a decision making process if this carried. This motion has now become a little bit more problematic for the Secretary, and I'm not talking about it being problematic on the merits.

Certainly the Secretary will review whatever is sent. He will give it an honest look, a hard look, and will consider all the facts before him. The difficulty however, is that the Secretary is not only going to be asked about make a decision on the conservation basis for the 51,000 metric ton cap, as well as this novel concept of an ecosystem, the resource in question being more of an ecosystem resource.

But now if this motion passes, the Secretary will need to figure out the conservation, not of 51,000 metric tons, but of some number beneath it which hasn't yet been determined. That is far more complicated than what was originally on the board, and that which I spoke to a couple few meetings ago.

I would urge further examination and discussion of what the actual number would be, because I think that you all have worked so hard, and you've given your rationale for 51,000. But now all of a sudden the number 51,000 isn't the number anymore. It's some number lower than that. If you could, it would be helpful to consider that.

You may want to consider the idea of a step-based approach. The idea of the original motion, moving forward with the original motion does not preclude you from finding and raising this issue of the overage issue at some later date. In any event I'll leave those comments at that. Thank you.

CHAIRMAN GILMORE: Thanks Chip. I think part of the reason for the motion right now. We're struggling between clarity, but not trying to undermine the effect of it. My suggestion, we're going to take maybe a five minute break right now to have some discussion, and then we'll come back to the Board. Take a few minutes, thanks.

(Whereupon a recess was taken)

CHAIRMAN GILMORE: Okay, I think we have a path forward, and I think there is a suggestion for a motion. Dave Borden.

MR. DAVID V. BORDEN: I think the aspect of this as I understand it; it's very problematic for legal counsel is the second portion of the motion if related to the motion to amend, because it to some extent makes presumptions about actions that may happen in the future. **I think the appropriate process we ought to follow is to pass a motion to reconsider the prior motion to amend. Put it on the table, and then separate it back out and take it out. I would move to reconsider the prior motion to amend.**

CHAIRMAN GILMORE: Thanks David, do we have a second to that motion, Tom Fote? Do we have discussion? Remember this is going to take a two-thirds majority, so we're going to have to vote this up or down based upon that. Is there a discussion on the motion? **Seeing none, let's try to do this. Let's do a show of hands. All those in favor of the motion, all those opposed to the motion, abstentions, and null votes. Okay the motion passes unanimously.** Go ahead, Bob.

EXECUTIVE DIRECTOR BEAL: Just for clarity. I think where we are, you're back to the original motion that Nichola brought forward from the Menhaden Board. The Menhaden Board motion is modified slightly to say the Policy Board recommends to the Commission. Now that modification has happened that motion is property of the Policy Board right now, and that will be the motion that you're voting on.

CHAIRMAN GILMORE: Can we put the original motion back up again then? **We're back to the original motion, and this is a motion of the Policy Board now, since it was slightly modified from the species board.** Is there a discussion on the motion? Dave Borden.

MR. BORDEN: I support the motion, but I want to make sure it's clear on the record that the staff has the authority and is directed to fold in all of the arguments that have been brought forth today by Jason and Lynn and others. That also extends to the scientific arguments that the Commission staff and others have put together in prior written correspondence.

CHAIRMAN GILMORE: Other discussion on the motion? Okay seeing none, I think we're ready to call the question. Does anybody need time for a caucus? Seeing none, we'll do this by hand. All those in favor of the motion please raise your hand, all those opposed, anyone in abstention to the motion, two abstentions, any null votes? The motion passes 16 to 0 to 2 to 0. Mel Bell.

MR. MEL BELL: I hope this is the appropriate point. I just thought perhaps it was worthwhile to put on the record that the Commission is taking this action based on the science we've talked about, solid management principals, adherence to our process, which is very important. That is what we're doing.

There has been discussion of the next step and what the Secretary will do, in terms of consideration. It might be worth pointing out that given that NOAA Fisheries advises the Secretary related to fisheries that basically this action is also very consistent with NOAA

Fisheries Strategic Plan for 2019 to 2022, in which discussing the challenges that we're facing in fisheries in this time period and in the future.

That one of the things that they've said they want to do is to integrate ecosystem considerations into stock assessments, fisheries management, and aquaculture. I would also view what we're doing, in terms of our recommendation is totally consistent with NOAA Fisheries own strategic plan for the time period involved.

CHAIRMAN GILMORE: Great, thanks Mel. Oh Eric Reid, last word.

MR. REID: I actually missed the beginning of Mr. Borden's comment, because I was talking to the incoming Chair. I would suggest that the Policy Board send a letter to the state of Virginia explaining what next year is going to look like, given the current overages. Just so we're all very clear what next year is going to look like. Right now the Bay cap would be about 35,000 tons. But I think that would be some ink that would be well worth it, because that way they can understand what the Commission's numbers, and what's going to happen to that Bay Cap given the actions of this year. If that dovetails in with David's comments that would be great.

CHAIRMAN GILMORE: I think that can be done, thanks. Any other closing comments before we move on? Great, thanks everybody for all that effort. We're back to Item Number 6 under the agenda, Committee Reports. The first one we have is the Law Enforcement.

MS. KERNS: Mark Robson has taken ill, and so we will not have an update from the Law Enforcement Committee today. Once he is feeling better we will put together a meeting summary, and I will e-mail that out to the Policy Board for your review.

CHAIRMAN GILMORE: Next we have Habitat. Go ahead, Bob.

EXECUTIVE DIRECTOR BEAL: Before the Habitat report, just I want everyone to know that this is Mark Robson's last meeting with the Commission; he has decided to fully retire. He retired from the state of Florida eight years ago, and he's been with us for the last eight years as our Coordinator for our Law Enforcement Committee.

We wish Mark and Joanie the very best when they move on to do other things. Mark will not be around; it's too bad he wasn't here today. I wanted to recognize him in front of the Policy Board, but he's decided to be a full-time retired person. We wish Mark all the best. (Applause)

COMMITTEE REPORTS

HABITAT COMMITTEE

CHAIRMAN GILMORE: Thanks Bob. Okay we're going to have the Habitat Committee Report from Marek.

MR. MAREK TOPOLSKI: The Habitat Committee met yesterday on Wednesday. We discussed the current Habitat assessments underway in the Atlantic; one by the Atlantic Coastal Fish Habitat Partnership, and one by the Federal Councils, the Northeast Regional Habitat Assessment.

We received an update on ACFHP. We worked in breakout groups on habitats of concern designations. We discussed the possibility of having an SAV monitoring protocol developed. At that point we reviewed our progress on documents, the Habitat Hotline, the acoustic impacts on fish habitat, and fish habitats of concern.

We came back together to update status. The document Aquaculture Impacts to Fish Habitat, this Committee has been working on it since approximately 2014. Based on some survey results amongst the group from the spring, we tailored the document in the summer and fall; it's gone through multiple iterations.

Now we believe it's ready for approval, with a focus on the text not the formatting and layout of the document. The document contains sections on the effects of aquaculture on habitat, which includes water quality, sediment, and populations and communities. There is a section on common practices, tidal water mariculture and land-based mariculture, siting considerations, which includes minimizing user conflicts, protecting habitats and carrying capacity. The sections continue with some conclusions. Common practices by state in a tabular form, resources for best management practices, some policy guidance links, and links to state-specific permitting, and leasing information, and the document concludes with references, questions?

CHAIRMAN GILMORE: Any questions, John Clark?

MR. CLARK: Just curious on the aquaculture report about the water quality. In Delaware we've just started permitting shellfish aquaculture in the past three years. It's been very hyped up as the water quality benefits, particularly of oysters, because of their filtering capacity. Are you finding those types of things in this report?

MR. TOPOLSKI: The report looks at water quality from both a positive and negative benefit and impact. The literature out in the public domain that we looked at generally suggests that shellfish aquaculture can have some net benefits from a habitat standpoint for fish.

MR. CLARK: I figured as much, but you haven't seen the huge benefits that have been touted for this, like you know it's going to filter all the water in a eutrophic coastal lagoon, the way it's been plugged by some of the supporters of this.

CHAIRMAN GILMORE: Other questions. Tom Fote.

MR. FOTE: Well I think it's been proven before, when we look at the results of what zebra mussels did to the Great Lakes, and how they cleaned out all the algae and everything else in the Great Lakes, so if you get a good situation. I also want to know if oysters do the same response as clam beds do that we see eelgrass around, because of what's coming out of the clams and things like that. Do you see the same thing with oyster beds?

MR. TOPOLSKI: The document does not go into that type of specifics.

CHAIRMAN GILMORE: Other comments, questions. Okay we're going to need a motion to adopt the report, if someone would like to offer one. John Clark. Do we have a second?

MR. CLARK: Do you need me to actually make a motion?

CHAIRMAN GILMORE: Yes, if you could just make a motion.

MR. CLARK: Okay, move to accept the report of the Habitat Management Series, approval of the Habitat Management Series: Aquaculture Impacts to Fish Habitat along the Atlantic Coast report.

CHAIRMAN GILMORE: Perfect, John, second by Malcolm Rhodes. Any discussion on them motion? Seeing none, any objection to the motion? Seeing none, we will adopt that by unanimous vote.

ACFHP STEERING COMMITTEE

CHAIRMAN GILMORE: Okay our next order of business is ACFHP, and Kent I believe is going to do the update on that. Come on up, Kent.

MR. KENT SMITH: Good morning, Chairman thank you very much for this opportunity to address the Policy Board today. I'm going to give you a quick report on what is being done with the Atlantic Coastal Fish Habitat Partnership. The Steering Committee met this Monday and Tuesday. We confirmed our Fiscal Year '20 project recommendations, and had an update on our conservation mapping projects. We developed a new Action Plan for the 2020-2021 timeframe. I've been with it for a while, so it's getting all confused in terms of time.

Discussed outreach and communication initiatives, we reviewed our funding initiatives for our new Business Plan, and we discussed the status of the National Fish Habitat Conservation through Partnerships Act. Relative to our 2020 NFHP U.S. Fish and Wildlife Service project proposal list that was provided, we received 13 applications. It was the second highest number of applications that we've ever received.

Seven states provided those applications. We had representation in the Mid, North and South Atlantic Regions of the partnership. We had seven passage projects, six benthic habitat projects that included tidal vegetation, seagrass and shellfish beds. We'll be recommending six of these projects to the U.S. Fish and Wildlife Service for funding, and the recommendation deadline is January 10, 2020.

Relative to our 2020-2021 Action Plan, this is a project that we do on a biennial basis, and it is based on our 2017-2021 Conservation Strategic Plan. The highlights for our Action Plan include compiling VMPs affecting our priority habitats, sharing the importance of water quality on human and fish health, developing a methodology for using our habitat assessments, and developing a fundraising strategy to increase our funding base for those projects.

We also endorse projects within ACFHP, and at the meeting we actually reviewed a project endorsement for a project in Pamlico Sound, North Carolina, known as the Swan Island Oyster Sanctuary. This is led by North Carolina Division of Marine Fisheries, and the North Carolina Coastal Federation.

It's part of a long term management and restoration strategy in the Jean Preston Oyster Sanctuary Network. The project itself in total is a 60 acre area of harvest protected, oysters containing nearly 40 acres of developed oyster habitat. The project itself will involve the deposition of limestone and granite. It is estimated to support nearly 50 million oysters in the system.

It's intended to restore oyster and finfish populations through habitat availability, seed production, and water quality improvements. For this project we have federal, state, non-governmental organization, and industry collaboration; a true partnership project. Also, during this year, we attended the NFHP American Fishery Service Film Festival, and at the 2019 American Fisheries Society meeting.

This occurred in Reno, Nevada on September 29 through October 3. There were over 80 films on fish habitat and conservation at this meeting. ACFHP helps during the festival by supporting some of those activities. Some of the films were from ACFHP regions, including some of our endorsed projects. When they're uploaded to YouTube, obviously we'll share the link with everybody so you all can see some of the work that we're doing. At the meeting we also elected a new Vice Chair, Jessica Coakley, with the Mid-Atlantic Fisheries Management Council, and the same Chair is still present, me. We would also like to thank very much the ASMFC for your continued operational support, it has been phenomenal. Along with that I would like to just have a quick shout out for all of our Washington-based crew. The Nat's did it last night, so congratulations guys!

CHAIRMAN GILMAN: Thanks Kent, so any questions or comments for Kent? Okay seeing none, thanks a lot Kent.

MANAGEMENT AND SCIENCE COMMITTEE

CHAIRMAN GILMAN: The next item is Management and Science, and I understand Pat is going to lead us on that so come on up, Pat.

MR. PATRICK A. CAMPFIELD: The Management and Science Committee met earlier this week on Tuesday. It was the first time that Committee met, I think since 2017. They haven't been meeting very frequently, and so we've made a point to try and reengage the Management and Science Committee a/k/a MSC.

Just as a reminder to the Policy Board of this Committee's purpose. We were having some existentialist questions about what they're really there for. In a nutshell it's an oversight committee providing advice to you all on issues that span coastal fishery science and fisheries management, so big picture questions, challenges that we have that impact multiple species.

This is the laundry list of their specific roles and responsibilities. I'll highlight number two, again evaluate and provide advice on cross-species or cross-cutting issues. MSC is very important on providing oversight to our peer review processes for stock assessments and new research surveys.

They also have a key role in providing guidance on multispecies and ecosystem issues. A quick reminder of where the Management and Science Committee sit in the ASMFC process. They are one of the scientific oversight committees that can be formally tasked by the Policy Board or the Executive Committee.

Oftentimes the Committee can address these tasks themselves, but they will also delegate or farm out the work to, in the past for example, the Multispecies Technical Committee, and more recently the Ecological Reference Points Workgroup, which you're all well aware of and we touched on earlier this morning.

Going back a little further, five or ten years ago they also were tasked with projects to investigate gear technology, improvements to reduce bycatch, discards. The NEAMAP Program, which is now over a decade in existence, was identified as a need by the Management and Science Committee, and they put together the design and the selection of the Survey Team for NEAMAP.

We'll also highlight that MSC works very closely with our Assessment Science Committee on reviewing stock assessment schedule and making sure we can handle our workload up and down the coast from all your Technical Committee members. Again, we wanted to remind you all as the Policy Board that you're welcome to task this Committee at any time. I touched on some of these, but past projects have included development of multispecies models centered around Atlantic menhaden. I mentioned gear technology. But perhaps the most important role that MSC has is to periodically review the Commission's research priorities, and to try to boil them down, look for themes across species, and develop proposals to address some major issues or data deficiencies that we have. I mentioned NEAMAP.

That is how that program was started. More recently they also saw a need for greater discard data from the Northeast Fisheries Observer Program, and so we were able to write a proposal and get, I think about five years of funding from ACCSP, to improve our observer coverage. The last formal task that the Policy Board gave to the Management and Science Committee was related to climate change and fisheries issues.

This was back in 2014-2015, where you all tasked MSC to evaluate potential impacts on four stocks, summer flounder, black sea bass, scup; I think winter flounder was in there as well. The Committee completed that task, largely by working with the Northeast Fisheries Science Center, and reported back to you all on it. Subsequent to that members of the MSC also contributed to a hybrid group of Commissioners and scientists to develop a fairly new document, ASMFCs Climate Science and Fisheries Management Strategies.

To bring us up to speed with this week's discussions at the Committee meeting. They jumped back into the climate and fisheries issues, receiving a presentation from the Southeast Fisheries Science Center on the development of their South Atlantic Climate Vulnerability Assessment. This will use a broad range of environmental data as well as fish monitoring data to identify which stocks in that region may be most susceptible to climate impacts.

Another presentation that the Committee received was from the U.S. Geological Survey. Historically ASMFC has received scientific support on things like the Horseshoe Crab Adaptive Resource Model development and implementation, a few other projects. But in the last couple of years there has been renewed support from USGS, largely to the credit of Tom O'Connell, formally with Maryland DNR, who now leads USGSs Science Center in the Northeast.

That is a quick list of the new projects that USGS received funding for and is helping us with. The last discussion item that MSC covered was on wind energy and fisheries. MSC discussed their possible role in gathering the science on wind development effects on fisheries resources. They expressed an interest in supporting pre and post construction monitoring and developing guidance for that before and after wind farms are installed, and how does that affect our fisheries resources?

But they did want to come back to you and seek guidance on whether we need a separate ASMFC Committee to dig into this. The MSC did not feel that they were the appropriate group. They're not working day to day on the wind and fisheries issues, but as you all are well aware, you have staff that is engaged in this and it can be fairly time consuming.

It's a question of whether we want to form a different committee of your staff to cross-pollinate, and develop lessons learned, or if we want to stay out of that and just encourage direct participation by your state personnel in the RODA or ROSA venues. That is a question to you all. I don't know if you can answer it today, but something to think about. Finally, we left off with what is on the Management Science Committee's horizon. Another presentation that they received was on management strategy evaluations by Dr. McNamee. Folks were pretty excited about this. In a nutshell, MSCs are a tool that will use simulation models to provide different management options or approaches that may inform how we improve our management. They talked about key stocks that might be ripe for an MSE; they include striped bass, menhaden, drum, and lobster. We talked about shad, but that slide is wrong, lobster.

The Committee also received a presentation from Toni on our stock status definitions relative to our annual review of the stocks. The MSC will be working on establishing clear stock status definitions to aid that annual review. Again, they will be moving forward to revisit the Commission's research priorities, hopefully develop some themes and proposals to pursue funding.

Depending on the outcomes of the ERP and menhaden assessments that go through peer review next week, MSC has had a historical role in multispecies issues and science, and so they may be able to support the ERP Workgroup and the Menhaden Board moving forward. Most recently through the Executive Committee discussion yesterday, there was a request or a task to explore new approaches to soliciting public input on the fisheries management process. Thank you, I'll take any questions.

CHAIRMAN GILMORE: Questions for Pat? John Clark.

MR. CLARK: Thank you, Pat. I just want to go back to your wind power. You were suggesting that for that to be pursued further within the ASMFC states that we would need to develop a new Committee? Because I know, I mean a lot of these wind power issues are going to be common to all states. It seems like it would be a good idea to coordinate.

MR. CAMPFIELD: I'll give a partial answer, and maybe throw it to Bob to round it out. If you recall where we left off from our August workshop with GARFO and the Commission, I think the bottom line was we were going to take a limited role in this activity that you all are engaged with folks like BOEHM and NOAA and others.

I think our sideboards were provide opportunities, ASMFC will provide opportunities to coordinate information and how things are going, may be able to provide support for personnel or staff within the states, and then I think Bob sits on the RODA or the ROSA group that is a new partnership or external partnership to communicate on these issues. That is where we left off in August, and this is MSCs question to you all, whether we stay at that point where the August recommendations settled, or if we do something more.

CHAIRMAN GILMORE: Justin.

DR. JUSTIN DAVIS: On that topic, I think I would come down on the side of this body not forming some sort of special committee or anything to get engaged on that topic. I know my experience in recent years is this offshore wind thing has snowballed and become a bigger and bigger thing. At first it was sort of bewildering, all the different workgroups and technical groups. We were getting requests to attend eight different meetings. I'm really hopeful that ROSA and RODA will sort of become kind of the catalyst for regional cooperation and work on these issues. I think going the path of individual states being engaged with that process however they can be. I think it is helpful if the Commission can periodically do something like that workshop we had in August, where we can sort of have something that updates everyone here on what's going on, but I think I would come down more on the side of what you were talking about, the Commission having sort of limited involvement and not forming another special committee or group to get involved with wind development.

CHAIRMAN GILMORE: Yes, I agree Justin. I've got Dan McKiernan and Tom. Keep it quick, because the South Atlantic Board wants to get out of here today before the weather.

MR. DANIEL McKIERNAN: Thank you, Pat. Would it be appropriate for the Management Science Committee to do an overview to give us advice on the emerging EDNA studies that are popping up? It seems to be a new tool that has some people excited. I'm wondering if that group could take that on.

MR. CAMPFIELD: Yes they can do that. We've heard about some research for stocks like river herring and others. I think that's where USGS may come in handy, they have a lot of scientific expertise in that arena, and so we can add that to the list.

CHAIRMAN GILMORE: Tom, oh you're good, okay. All right Pat thanks for that and a lot of things with offshore wind that everyone is struggling with.

ASSESSMENT SCIENCE COMMITTEE

CHAIRMAN GILMORE: Okay, we're going to go into Assessment Science and Sarah Murray is going to do an update for us, so Sarah.

MS. SARAH MURRAY: The Assessment Science Committee met in August of this year to address several agenda items, including receiving updates from the Red Drum Subcommittee, discussing stock assessment training workshops, and reviewing the ASMFC stock assessment schedule. Note that there are plans to have advanced stock assessment training in late 2019 or early 2020, as well as an introduction to stock assessments course, which will start in January 2020.

Staff will be reaching out in the near future to partners to seek nominees for the introductory course. The ASC discussed and approved the draft stock assessment schedule at their August meeting. The stock assessment schedule proposed by the Committee is available in meeting materials; however also briefly review the changes that were made since the schedule was last approved by the Board at the 2018 Annual Meeting.

Before diving into individual changes, I just wanted to note a higher level change that took place, and affected a number of the species in the northeast region. After an extensive review the Northeast Region Coordinating Council made changes to both the assessment type and frequency in the northeast in an effort to match assessment demands with assessment capacity.

The new approach includes two main types of assessments, a management track assessment, which allows for small to moderate changes and is similar to our assessment updates, and a research track assessment, which will be open to more substantial changes similar to benchmark assessments. This will affect a number of changes in the schedule. The revised stock assessment schedule now extends to 2022. As a result assessment triggers were added in 2022 for American eel, Atlantic croaker, Atlantic sturgeon, river herring and spot, based on the five-year-assessment-trigger frequency for these species. The American shad assessment is now scheduled to be completed in 2020 instead of 2019, due to delays in the assessment process. An assessment update was added for Atlantic menhaden in 2022, based on a three-year-assessment-trigger frequency.

A tentative update was also added for the Atlantic menhaden ERP assessment, to match the single-species assessment schedule. However, the schedule will depend on the results of the peer review for the single-species assessment and ERP assessment taking place next week through SEDAR.

Management track assessments were added for Atlantic herring in 2020 and 2022 per the changes to the Northeast Region's schedule. The striped bass assessment update was shifted from 2020 to 2021, in order to better align with the timing of Draft Addendum VI. The black drum assessment trigger was shifted from 2019 to 2022, based on the Technical Committee's recommendation.

Black sea bass schedule was changed as a result of the changes in the northeast, as a result an assessment in 2020 was removed and replaced with a management track assessment in 2021, and a research track assessment through SARC was also added for fall 2022. The bluefish schedule was also adjusted per the changes in the northeast region.

The five-year-assessment trigger was removed from 2020 and replaced with a management track assessment for 2021. A research track assessment through SARC was also added for fall 2022. Two assessments through SEDAR were added for coastal sharks, one in 2020 for Atlantic black tip sharks, and one in 2022 for hammerhead sharks.

Jonah crab was added to the species list, though no assessments are currently schedule for this species. The assessment updates for northern shrimp in 2019 and 2020 were removed, as we will not be conducting a full assessment update, given the moratorium. However, there will still be data updates conducted with a TLA during this time.

A benchmark assessment through SEDAR was added in 2022 for red drum. A management track assessment was added for scup in 2021 as a result of the northeast region changes. The Spanish mackerel benchmark assessment in 2020 was removed and replaced with an operational assessment through SEDAR in 2021. This change is largely due to the fact that the lead analyst is needed for other assessments.

Per the changes in the northeast region, the spiny dogfish updates in 2019 and 2020 were removed, and a research track assessment through SARC was added for spring 2022. Changes to the summer flounder schedule also made in keeping with the northeast schedule. The 2019 and 2020 updates were removed, and a management track assessment was added for 2021.

Management track assessments for winter flounder were added in 2020 and 2022, also in keeping with the northeast regions schedule. All other species assessment schedules remain the same as the schedule previously approved by the Board. With that I would be happy to take any questions you have.

CHAIRMAN GILMORE: Are there any questions for Sarah? Adam Nowalsky.

MR. NOWALSKY: For the three species that were added for SARC assessment, are there specific research topics that are known to be coming to the table for black sea bass, bluefish, and spiny dogfish that put them into that research track in the next three years, or is it just an open holding spot with an opportunity for people to bring something should they have something?

MR. CAMPFIELD: Are you referring to the activity in 2022 for sea bass and others? For sea bass there remain questions about stock structure. I think we went from a coastwide to a north/south stock split in the most recent iteration or benchmark. There continues to be research that may further inform that.

I don't want to over promise, but I think that is the focus there for black sea bass. Was the other one bluefish and spiny dogfish? I know for spiny dogfish it's a pretty basic assessment, it's a swept area estimate, and so there may be advances in how they can mine all spiny dogfish. But I would have to defer any other information. We could probably check with the Science Center and give you some more details.

MS. KERNS: Adam, I do know that at the NRCC meeting we did discuss for the spiny dogfish assessment to look at components of male only fisheries, I believe it is over time, or in the future. In addition it's called a research track, but it doesn't necessarily always have to mean that there is research added. It's just a language change in how the assessments are, what they're called through the new SAW/SARC process.

CHAIRMAN GILMORE: Other questions for Sarah? Seeing none, thanks for the report, Sarah. Essentially we need to approve the changes to the stock assessment. I don't know if we need a motion. Jason.

DR. McNAMEE: I could provide a motion if you would like, Mr. Chair. I will make a motion, since all the questions are over. I move to approve the ASMFC Stock Assessment Schedule as presented today.

CHAIRMAN GILMORE: Okay second, John Clark. Discussion on the motion, seeing none is there any opposition to the motion? Seeing none, we'll adopt that by unanimous consent. Thanks.

OTHER BUSINESS

CIRCLE HOOKS

CHAIRMAN GILMORE: Okay we're to other business. We had a couple of items, so Pat you've got one so take it away.

MR. PATRICK C. KELIHER: Over the last few days there has been a reoccurring theme in regards to the use of circle hooks. In particular we heard from Deputy Chief Blanchard from Rhode Island at the Striped Bass Board about some of the complexities in regards to enforcement. At the Law Enforcement Committee there was a lot of talk about the simplicity of enforcement with circle hooks when multiple species are covered by that. Every time circle hooks come up it is pertaining to a stock status issue, where we're trying to help a stock out, instead of thinking about it kind of up front and more proactively. With that in mind I have a motion to task the Management and Science Committee**. I would move to have the Management and Science Committee investigate discard mortality across all species. This review should focus on the use of circle hooks and/or other tools that would address discard mortality.**

CHAIRMAN GILMORE: Do we have a second to that motion, Doug Grout? Is there any discussion on the motion? Okay let's start with Dan.

MR. McKIERNAN: Pat, do you mean investigate discard mortality related to hook and line fisheries? I don't think you want them to focus on dragger and gillnet discards.

MR. KELIHER: Well, I really didn't want to try to impede any investigation that might take us into a different direction. The main focus would definitely be hook and line. That was definitely the theme over the week. But if there are other issues associated with discard mortalities that might pop up along the way, it would be nice to get comments back from the Committee on them.

CHAIRMAN GILMORE: Jason.

DR. McNAMEE: Just looking for clarification on what exactly we want them to do. I think maybe the logical thing is just kind of like a synthesis of existing literature. Is that the idea with this task?

MR. KELIHER: I think that would be a good starting point, Jason. I think beyond that species by species what are the challenges? Maybe there are some regulatory components that become challenging as well. I think kind of just brainstorming through some of the bigger issues associated with going management board by management board as well, as it pertains to circle hooks.

CHAIRMAN GILMORE: Other comments, questions? I think it's been read in already by Pat, so I think we're covered on that. **Is there any objection to the motion? Seeing none, we'll adopt that by unanimous consent.** Dennis, do you have an additional item or did you have something else you wanted to put on the previous discussion? Okay, I'll come back to you.

TAUTOG

CHAIRMAN GILMORE: First we wanted to talk with Pennsylvania on Tautog. Toni.

MS. KERNS: I guess it's just a direct question to Andy, and I believe you know what the question is. But just for the information for everybody else. The Tautog Management Board has recently started a tagging program for all commercially caught tautog, which requires all tautog to have a tag attached to them.

The state of Pennsylvania does not have a commercial fishery for tautog, is not on the Tautog Management Board, but there is a large market for tautog in the state. We wanted to have a discussion with Pennsylvania on the possibilities or options for making sure that non-tagged tautog could not be sold in the state.

CHAIRMAN GILMORE: Andy.

MR. ANDREW SHIELS: We've done something like this before. It's in our regulations. We had a regulation for importation of taug in the past. I say taug; I don't say tautaug, because I fished in New Jersey so it's taug from here on in for me. We had importation regulations for them in the past, because they come into the Philly market and the Philly market is pretty big.

We had a regulation for weakfish in the past, a size limit. This is something that we can do. I've talked to our law enforcement already about them making visits to the Philly market in particular, or into any fish markets, particularly in the Philadelphia area and looking for tagged taug. Tagged taug that sounds pretty funny.

We're going to have to do some rulemaking to do this though, so for us typically we put something out for proposed rulemaking. We do it at one Commission meeting. Our meetings are quarterly. Our next meeting will be in January, and then we put it out for public rulemaking, usually a 30 or 60 day comment period.

The soonest we could do it would be the April or early May Commission meeting. We can do this. We can put something in place, and our law enforcement has agreed to take some swings by the market and some of the other places and look for the tagged fish. Didn't know I was needed at the Taug Board meeting the other day, but glad that it was brought up here in other business.

CHAIRMAN GILMORE: Any questions on that? Jason.

DR. McNAMEE: No question, just wanted to extend thanks to Pennsylvania and to Andy. I think this would be an important thing to have in place. There would have been kind of a, I don't know if loophole is the right word, so this will be really helpful and I thank him for the effort.

CHAIRMAN GILMORE: Yes I agree, thanks Andy for the effort. Okay, Dennis you're up.

MR. ABBOTT: This week we heard a lot about losses here in the Commission. Bob Ballou is leaving, now Mark Robson, Dr. Pierce. But a lot closer to home, not only do we have a Commission loss, but here in the New Hampshire delegation we have a loss at the table. Doug Grout is retiring.

I spent the last couple years asking Doug every time we went to a meeting, when are you going to retire? Finally and reluctantly, he came clean and told us when he was going to retire. For us at the table it's a big loss. The three of us have sat here together for approximately 13 years, and Ritchie and I spent probably 12 years with our dear friend, John Nelson.

During that time the three of us I think have developed into like a three-headed monster. You know we think pretty much alike. Somewhat it's funny when everyone goes off and caucuses that the three of us sit here. We've already done our caucusing. We're of like mind so much. I think we're quite a unit.

But personally I have to give credit to Doug for his patience, for keeping me focused on the issues. He's always been willing to discuss the issues, always willing to offer his technical expertise to us at his office, here, wherever and whenever. As a little side light, I visit and visited Doug many, many, many, many times at his office, because it's only five miles from my home. At the conclusion of any meeting Doug always left his office and walked me to the door, always did that. I don't know if he was trying to get rid of me. But I appreciated that. To Doug Grout, I wish him tight lines, smooth sailing and a Bravo Zulu, and I'll turn the microphone over to Ritchie.

MR. WHITE: I would like to just add. Dennis has said most of it for sure. Gordon Colvin always talked about when things got tough you listen to the silver backs. That is what he described the Commissioners that had been there a long time and had a lot of experience. Doug is certainly a silver back. We're going to miss him at the table, both from a technical standpoint, but also from a personal standpoint, because he's a good friend.

CHAIRMAN GILMORE: Doug, any parting comments?

MR. DOUGLAS E. GROUT: Just thank you to my team and thank you to you all for the great work you've all done. I'm going to miss you.

CHAIRMAN GILMORE: I always thought you guys were the Three Musketeers, I just couldn't figure out who d'Artagnan was. Maybe that's it, maybe Doug going. Doug it's been great. Also it's been a terrific experience working with you, so good luck!

ADJOURNMENT

CHAIRMAN GILMORE: Is there any other business to come before the Policy Board? Okay seeing none, we're going to adjourn the Policy Board and we're going to go right into Business, so don't go away.

(Whereupon the meeting adjourned at 10:10 o'clock a.m. on October 31, 2019)

From:	Greg Ludlum
To:	Comments
Subject:	[External] fishing piers
Date:	Wednesday, January 8, 2020 1:06:35 PM

Hi my name is Greg Ludlum owner Seaview fishing pier North Topsail Beach
It is great concern to me what is going on with the fisheries .I no it don't matter what I got to say but as a pier owner the fisheries are doing a financial death to the piers along the coast.
We can not survive with all the actions that are put on us no flounder,1 red drum,3,blue fish,now spots people of north Carolina will not drive to the beach where they cant catch enough fish to keep
We have 25000 to 30000 people that fish at the pier each year .As we know it not being over fished.
Every year the whole coast line up to 750 feet of the pier it is lased with nets piers are complety boxed in I know they have to make a living also but where is the regulations to cut some of this or move them off shore 500 yards .And it troubles me that shrimp boats bycatch in shore is not addressed.
When you cut one cut them all I have worked on a shrimp boat I know the truth I know what a 2 hours tow does to the small fish they are raked over dead. So 1 shrimp boat kill more in a week than the pier catches in a year. But we pay the price.
So what is happing we will have to sell the pier the towns will lose money motel restaurants will suffer show me a economic study you cant because their not one .It away comes down on the recreational fisher and their family paying the price .The Pamlico sound was not shrimped this year we had more fish this year in a while also
the shrimpers had a record season you don't have to be real smart to figure that out.
SO what come next I'm sure yall will figure it out, until you move the shrimp trawlers off shore and nets nothing going to change. My customers wont drive for the few fish your purposing we need at least 75 spots per day to keep our season. I think a lot more work need to be done before more regulations. So ill close with this people that fish that cant afford a boat or charter and the handicap are
Being told we don't care if you fish.This is their only way.

Sent from Mail for Windows 10

Thanks Greg Ludlum p;

2525590733

Seaview fishing pier

Tina Berger

From:	Robert Beal
Sent:	Tuesday, January 21, 2020 2:29 PM
To:	Tina Berger
Subject:	FW: [External] Dawson black sea bass issue
Importance:	High

From: Jim Dawson [mailto:jimdawson1@verizon.net]
Sent: Wednesday, January 8, 2020 6:29 PM
To: Robert Beal <Rbeal@asmfc.org>
Subject: [External] Dawson black sea bass issue
Importance: High

Hey there Bob, just wanted to keep the contact consistent until I get a response.

I am speaking with my state about the February wave 1 black sea bass opening our state currently allows. You do understand that I understand some of the regulations that our agencies are supposed to be enforcing, yet it seems apparent that there is a double standard becoming more present with respect to the recreational fisheries. We understand that the recreational black sea bass fishery more than doubles their catch coastwide, yet absolutely nothing has been done to change that, we also understand that states offer data to keep fishing during a wave 1 opening…has anyone checked how accurate that data is? I'd like to request a data set for Virginia is sent to me for verification purposes. Virginia data is totally inaccurate from data I have heard based on what Virginia has stated and I have a tremendous amount of data to verify that. So here is what we understand:

The coastal black sea bass recreational fishery has gone over quota for how many years, also more than doubling quota last year, yet our fisheries management allows for a "status quo", also keeping in mind that in recent years these same entities gave back the Sept-Oct closure, one extra week in May ***AND*** also granted Virginia extra fishing for an entire month, rewarding that state for cheating and under-reporting actual catch. This happened with the so-called RSA, same thing, social media and Facebook posts indicate a far different catch result for the Virginia month of February 100%! If the fishermen are not met by enforcement at the dock when they return, a small number and/or no number is being reported! Virginia MUST prove that they can police this and they have not! Bob, I fished the entire time and no police were present except when I sent pictures of vessels with no permits fishing and they only fined one boat and later dropped the charges in court! Only rewards for doing wrong! I know these people, they had (3) boats fishing the entire month with MANY on board. They filled their boats!

Omega protein can use this to challenge the scrutiny of the commercial fisheries because if we allow just one side to keep going over quota with not even a single attempt to lower the effort, no enforcement of regulatory measures being rewarded when overfishing occurs, granting 5 extra weeks to fish as well as Virginia to fish during wave 1 without enforcement and also not living up to its own requirements promised in order to receive the open season, then exactly how would the judge look upon fisheries management while attempting to regulate Omega? The judge will throw the case out! Fisheries CANNOT remain status quo for black sea bass, fisheries management MUST show "intent". Fisheries management cannot justify their own existence when abuse is occurring yet they take no action. It also CANNOT be just one sided. PERIOD!

I must also remind our members that when our commercial black sea bass quota was threatened to close a few years back, Joe Cimino had to fight for our rights because our commercial black sea bass fishermen did not go over their own respective quotas, It appeared difficult and gives the appearance that the rewards Bob seem to go to those who over-fish?

Somehow we need to come up with a solution to fix these issues. First, I am requesting that an immediate emergency action necessary to close the recreational black sea bass fishery for wave 1. Several rational and legitimate reasons, first and foremost it would show the regulating members, within “oversight”, that our fisheries are NOT being one sided as well as showing “intent” to decrease fishing “effort” when our agencies understand full well that our recreational black sea bass fishery has gone over quota, especially over time. Again and again our management teams ignore one side while fully disciplining the other? Show intent, and nothing can be said, but our teams agreed to remain status quo. This was NOT good and the MRIP data was NOT accepted so exactly why should Omega be faulted? It makes absolutely no difference that our stock size is above target…that is irrelevant, what it does show is that our fisheries management teams are allowing over-fishing to occur regardless of the numbers set for any one particular year and the status quo verifies the favoritism displayed. It also verifies that our management teams did not come up with an appropriate set of bag limits to keep within the quota set for any one particular year. Again, stock levels should have been larger IF the recreational fishery did not have such large discard amounts that go along with going over quota by double the amounts! The stock should have been above 300% or greater! There MUST be a mechanism to stop ANY abuse and to close the recreational fisheries when their quota has been met, again or the double standard will be verified to such commercial fisheries as Omega.

My suggestion is to show “intent” Bob and for starters, close the wave 1 sea bass fishery because it has 100% verifiable evidence sets that abuse has occurred and that Virginia has NOT held up its end of the agreed upon sets of criteria to counter-act abuse. The data is tremendously wrong as well as Virginia has also gone over the recreational quota set for their own state for the same reasons. Too many local docks and not nearly enough law enforcement to allow for such a season. Accountability Bob, let’s prove our management teams will do something and also act when the proof is there! I am asking you to step in.

So far I have not spoken with Omega, but lets keep in mind that I used to purchase my bait from the owners over 30 years ago. I’d like to give the people such as yourself and others a chance to do the right thing and shut down the Virginia season Wave 1 sea bass fishery. Please get up with me ASAP at 757-336-6590.

Atlantic States Marine Fisheries Commission

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Patrick C. Keliher (ME), Chair *A.G. "Spud" Woodward (GA), Vice-Chair* *Robert E. Beal, Executive Director*

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

TO: ISFMP Policy Board

FROM: Toni Kerns, ISFMP Director

DATE: January 21, 2020

SUBJECT: 2019 Commissioner Survey Results

31 Commissioners or Proxies completed the 2019 ASMFC Commissioner Survey. The survey is based on the 2019-2023 Strategic Plan. This document contains an Executive Summary, charts summarizing responses for questions 1-15, a summary of the five open-ended questions, and unabridged responses to the five open-ended questions.

Executive Summary

Questions 1-15 prompted respondents to rate their answer on a scale of 1 to 10 (ten point Likert scale). Key takeaways from this portion of the survey:

1. Scores increased for all but two questions from 2018 to 2019 (but when looking at the scale most stayed about the same).
2. The largest increases were for commission progress (Q2); and commission execution and results (Q3 and Q4). The highest scores were given for Science and ISFMP products (Q15, 14); and spending the appropriate amount of resources on issues within our control (Q13).
3. The lowest scores in 2019 were cooperation between Commissioners (Q3); the Commission's ability to manage rebuilt stocks (Q9); and progress to end overfishing (Q8). Only two questions decreased their scores from 2018:

(Q7) Satisfaction with using 'the number of stocks where overfishing is no longer occurring as a metric for progress' (this has dropped each year since it was introduced to the survey in 2015).

(Q8) Satisfaction with ending overfishing.

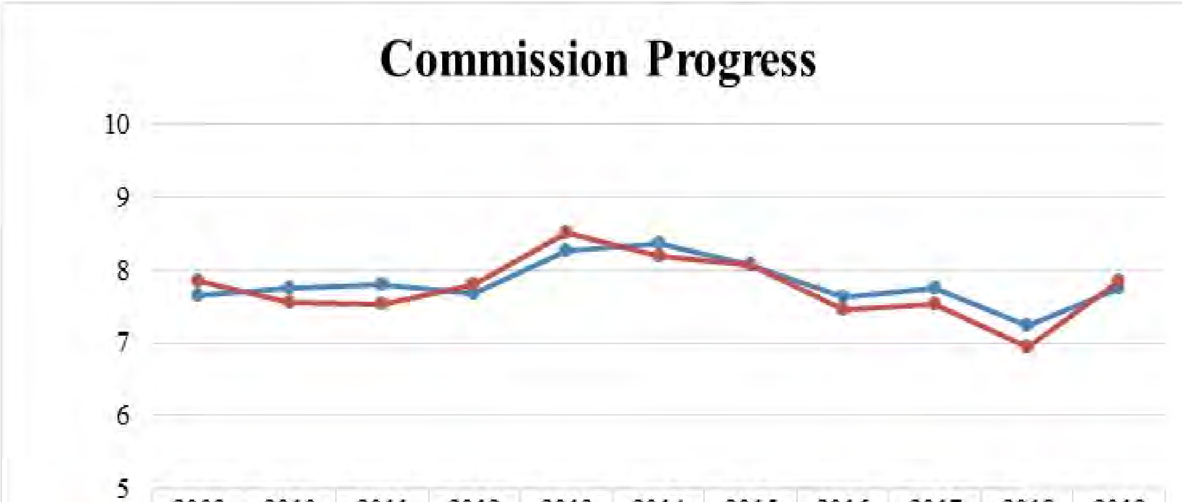
Questions 16-20 prompted respondents for open-ended responses. A few themes emerged. Throughout questions 16 (stock rebuilding obstacles), 19 (issues to focus on), and 20 (additional comments), the most frequently mentioned topic was climate change, shifting stocks and the Commission's inability to adapt management to reallocate resources.

Likert Scale Questions 1-15

Questions 1-15 prompted respondents to rate their answer on a scale of 1 to 10. The higher the average, the more positive the response. For each question, the average score by year is presented. The 2010 results were based on a response ranging from 1 through 5, so the value was doubled for comparison to future responses. Questions 7, 8, 14 and 15 were new to the 2015 survey, as the survey was simplified to increase participation.

Commission Progress

1. How comfortable are you that the Commission has a clear and achievable plan to reach the Vision (Sustainably managing Atlantic Coastal Fisheries)?
2. How confident are you that the Commission's actions reflect progress toward its Vision?

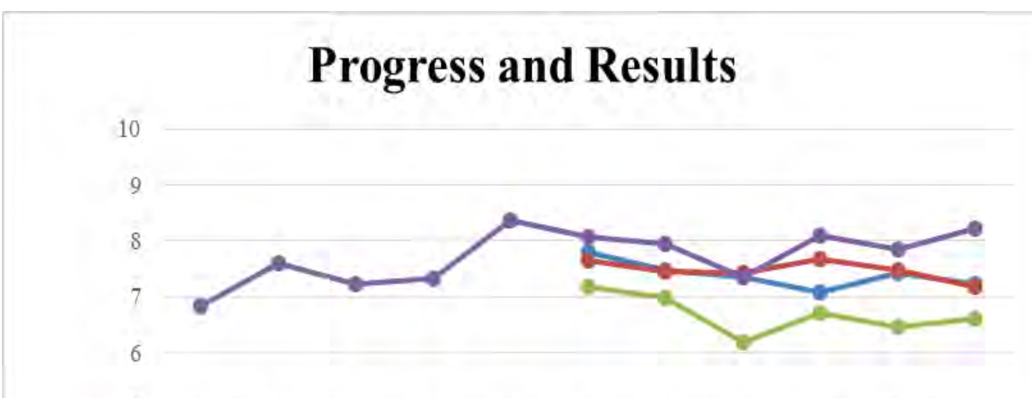


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Q1	7.64	7.75	7.8	7.67	8.27	8.37	8.08	7.62	7.76	7.23	7.74
Q2	7.84	7.55	7.52	7.79	8.52	8.2	8.08	7.46	7.53	6.94	7.84

Commission Execution and Results

3. How satisfied are you with the cooperation between Commissioners to achieve the Commission's Vision?
4. How satisfied are you that the Commission has an appropriate level of cooperation with federal partners?
5. How satisfied are you with the Commission's working relationship with our constituent partners (commercial, recreational, and environmental)?
6. How satisfied are you with the Commission's effort and success in securing adequate fiscal resources to support management and science needs? Measuring the Commission's Progress and Results
7. One of the metrics the Commission uses to measure progress is tracking the number of stocks where overfishing is no longer occurring. Is this a clear metric to measure progress?
8. How satisfied are you with the Commission's progress to end overfishing?
9. Are you satisfied with the Commission's ability to manage rebuilt stocks?
10. How satisfied are you with the Commission's efforts to engage with state legislators and members of Congress?

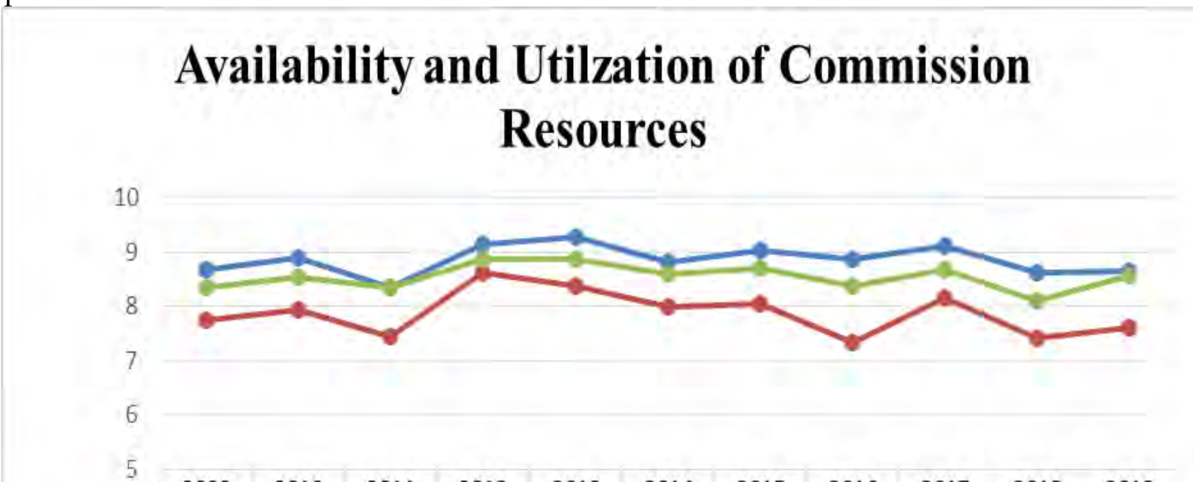
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Q3	6.78	7.15	6.90	7.88	8.20	8.00	8.00	6.88	6.65	6.45	7.19
Q4	5.42	6.70	7.21	6.21	6.96	6.83	7.11	6.46	6.79	6.97	7.71
Q5	6.64	6.85	7.00	7.71	7.92	7.46	7.57	7.00	6.94	7.03	7.35
Q6	6.84	7.20	7.28	6.75	8.04	7.37	8.00	7.50	7.94	7.97	8.39



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Q7						7.80	7.47	7.35	7.09	7.42	7.23
Q8						7.66	7.44	7.42	7.68	7.48	7.19
Q9						7.17	6.97	6.19	6.71	6.45	6.61
Q10	6.84	7.60	7.24	7.33	8.38	8.06	7.95	7.35	8.09	7.84	8.23

Measuring the Availability and Utilization of Commission Resources

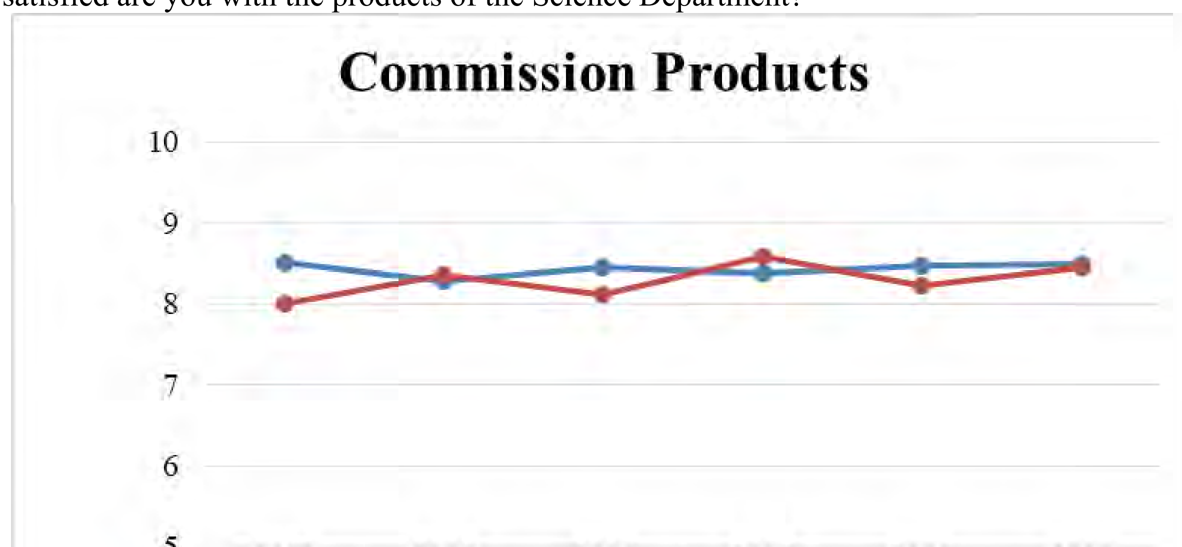
11. How satisfied are you that the Commission efficiently and effectively utilizes available fiscal and human resources?
12. How comfortable are you with the Commission's performance in reacting to new information and adapting accordingly to achieve Commission Goals?
13. The Commission has a limited scope of authority. How comfortable are you that the Commission spends the appropriate amount of resources on issues within its control?



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Q11	8.68	8.90	8.34	9.13	9.29	8.82	9.03	8.88	9.12	8.61	8.65
Q12	7.74	7.95	7.45	8.63	8.38	8.00	8.06	7.35	8.15	7.42	7.61
Q13	8.36	8.55	8.34	8.88	8.88	8.59	8.69	8.38	8.68	8.10	8.58

Commission Products

14. How satisfied are you with the products of the ISFMP Department?
15. How satisfied are you with the products of the Science Department?



	2014	2015	2016	2017	2018	2019
Q14	8.52	8.28	8.46	8.38	8.48	8.50
Q15	8.00	8.36	8.12	8.59	8.23	8.45

Discussion Questions (All responses are listed below the summary)

The most mentioned **obstacle to the Commission's success in rebuilding stocks (Q16),** according to the 2019 Survey, was climate change with an emphasis on the management of shifting stocks. Other obstacles include not taking timely management action and putting a state's/political interest before the resource.

The most **useful products produced by the Commission (Q17),** according to the 2019 Survey, include: annual FMP reviews, stock assessment summaries, website archives, and meeting summaries.

Additional products the Commission could create to make your job easier (Q18), according to the 2019 Survey, include: tables of quotas and state regulatory changes, stock assessment courses, fisheries management 101, electronic motions (voting), more public friendly web page, and summary of management options for documents out for public comment.

Issues the Commission should focus on more (Q19), according to the 2019 Survey, include: stock shifts, high level discussion on allocation, socioeconomic concerns, climate change and depleted stocks, streamlining the "Jointly" managed species, law enforcement, MRIP, and the risk policy.

'Additional Comments' (Q20) from the 2019 Survey were not conducive to summary and may be viewed in their entirety at the end of this document.

Unabridged Answers to Questions 16-20

Q16 What is the single biggest obstacle to the Commission's success in rebuilding stocks?

- Environmental conditions impacting recruitment
- Conducting stock assessments in a timely manner.
- Resources
- Climate change
- Climate change
- Takes too long to process
- Delaying Action - kicking the can until the next meeting
- The changing ocean environment is resulting in changes in the temporal and spatial distribution of several species managed by ASMFC. This confounds our ability to enact management actions that effect the desired change in fishing mortality.
- Inherent difficulties in managing the expectations and positions of competing user groups and stakeholders is always a big challenge.
- What, if anything, can the Commission do about depleted stocks?
- Habitat and Water Quality degradation/loss
- Failure to take action due to extremely slow process on jointly managed federal species.
- Socio-economic impacts
- Cooperation among states
- Favoring commercial interests and their desire to maximize harvest to the point of overharvest.
- In 2019, one of the big problems was the whipsawing of stock status due to new assessments using the new MRIP. Otherwise, the obstacle is the usual - parochial interests taking precedent over coastwide management.
- Obtaining solid science that all stakeholders can agree upon.
- Politics
- Conservation Equivalency
- Political pressure to overlook the needs of the resources in favor of state specific issues.

- We are trying to rebuild stocks by restricting catch when that does seem to be the problem IE weakfish, striped bass, summer flounder, black sea bass and winter flounder
- Over consumption by Commercial Harvest. The politics of this consumption make efforts at effective conservation more problematic.
- The unknowns of climate change and resistance of commercial and recreational fisheries.
- Putting off decision making - "kicking the can down the road"
- Climate change both affecting stock movement and recruitment.
- I think the biggest obstacles are the data we have to make management decisions on and climate change impacts on our ability to manage stocks.
- Authority

Q17 What are the most useful products the Commission produces for you?

- I find the very thorough meeting materials very useful, even years later
- Thorough meeting materials and stock assessments
- Sustainable quotas
- Technical reports
- Annual report; stock assessment summaries
- Summaries of meeting materials both before and after meetings
- Public information documents provide a useful summary of proposed actions.
- Effective meeting materials and conversations with staff willing to answer questions and explain fine points sometimes.
- Annual summary reports for each managed species. Special publications. Meeting summaries that I can use to comprise a report to our Governor.
- FMP Reviews are first rate, meeting materials are very helpful, assistance in setting up travel and lodging, written and audio recordings of board meetings, lip balm.
- Annual FMP review doc
- Website with archival of documents
- Annual report, staff presentations, well-crafted news releases and the media compilations.
- The FMP are obviously very useful in explaining the need for management action and the actions to be taken to the public, the Stock Assessments are always well done and provide a wealth of information, the FMP reviews are great and the web site has a lot of great information.
- Staff is great with keeping me timely informed and providing relevant materials.
- Clearly articulated FMP's
- Commission meetings, Joint meetings, Public hearings, Webinars
- Board specific action/ summary handouts
- The ASMFC has real problem using stock Assessments put out by NMFS based on the new recreational numbers
- The metrics regarding take and compliance with current requirements.
- Summaries of meeting materials
- Each product has its' own value
- The science training/workshops for staff are really valuable. 2019 felt pretty light by way of science training/workshops, but I know there are a couple planned for 2020 so I think that is great.

Q18 What additional products could the Commission create to make your job easier?

- Readily available tables with things like annual quotas from year to year and state regulatory changes. They are often in assessments or amendments but hard to find for every species
- More stock assessment courses to effectively keep state and federal staff trained to help with stock assessments.
- Not sure
- Very short primer on fishery management to share with stakeholders
- Create better benchmarks
- Electronic motions.
- More public-friendly web-based information on specific fisheries and issues that Commissioners would easily steer stakeholders and the public to when they have questions.
- Easy access to graphs and tables that can be copied directly into reports I compile to inform the Governor's office and fishing groups.
- More consistent formats of executive summary for stock assessments understanding that sources of stock assessments are from different sources.
- quota monitoring information for species with allocations not covered by federal quota monitoring webpage (bsb, scup, horseshoe crab)
- Current status dashboard for all managed stocks. Update monthly or as new information is available.
- Perhaps short summaries of draft Addenda/Amendments done in a bullet point format rather than dense text would be good for making the proposed management actions clear to the public.
- Acronyms and abbreviations are a necessary evil however the first use should include what the acronym stands for. More footnotes or hyperlinks will be helpful as well. Personally I would like a quick synopsis of all reports, recommendations without getting too much into the weeds followed then by the reports and data
- Meetings be held within a shuttle drive from the airport to the different meetings!
- I'm fine with all current products
- We should do separate manage plans from the council. If you are going to use the new recreational number you need to redo the quotas to reflect what was really happening according to these number
- Up to date information on the effects of climate change. We may already have that to the best of our ability but it remains very important.
- Electronic motions to speed the meeting process
- One thing that would be very useful is to restructure the way the commission management documents are created. This is not unique to the commission (this problem is also found with the regional council documents), but it is very difficult to know what the governing document is for a fishery because of the way amendments and addenda are standalone documents. A better structure would be to amend more like a regulatory package where you work from a single document and make your additions/deletions in that single document instead of creating new documents each time. I'm sure there are reasons why it is done the way it is, but investigating a new approach would be valuable. This was recently brought to my attention by a new employee as they were trying to figure out the management program for a particular commission fishery and they were having difficulty piecing it together. Talking about it with them made me question the process used, so I am forwarding along the thoughts to you.

Q19 What issue(s) should the Commission focus more attention/time on?

- I think the TCs and SASs should spend time looking at juvenile indices and looking at other environmental variable for possible trends and signals
- Maybe more contact with the regional offshore fisheries commissions
- Stock shifts
- Bench marks
- Socioeconomic considerations
- I think it is time to have a high-level discussion about allocation in the context of both interstate and federal fishery management.
- Growing issues associated with the maintenance and expansion of shellfish mariculture
- Climate change and depleted stocks. What, if anything, can we do? Also, the seeming disconnect between new MRIP estimates and back calculations of catch and effort versus observed stock abundance. Are bluefish and striped bass really overfished, or is it an artifact of changing the method of estimating recreational landings?
- Would like to see more discussion from the Law Enforcement Committee on management measures prior to board and final action by the commission. LEC rep or proxy need to attend board meetings to ensure actions are enforceable.
- Need Congress to enact legislation to force the Commission and Councils to routinely evaluate shifting species and change the state quota allocations to reflect the local abundance in each area.
- Improved fishing practices for conservation (e.g., circle hook awareness, discourage gaffing)
- In protecting the fisheries we seem to lose sight of the fishermen involved.
- MRIP. We complain about it, the public complains about it. All recreational management decisions hinge on it. There is little or no confidence in the estimates.
- Streamlining the state - federal waters management issues. The joint ASMFC - MAFMC meetings often get bogged down in minor details that often seem more like turf issues than management issues.
- Habitat, development, water quality etc. are not given as much time as some of the other topics.
- Shifting stocks and a solution to reallocation
- Redistribution of regional percentages of fully recovered and sustainable species. Less interaction by both MAFMC and NEFMC. If we are in fact a fishery governance body assigned to manage species of both Councils, we as a Commission should have final say!
- Socio-economics
- Affect of climate change and water quality in rebuilding stocks
- Developing a strong & enduring ecological perspective so that any species management proposal is coordinated within the framework of an ecological wise long range plan.
- The fact that the fish are more important than the fisheries. We do not have very many successes at recovering fish populations and as soon as we do, that fishery begins pounding at the door to let them go back to destructive practices. Be tough always.
- The commission has 26 species groups it manages. Certain species, whether for economic or ecological reasons, should receive higher priority than others.
- Coping with the future direction of fishery management. How to get away from the past and focus on the now and the future.
- We should spend 2020 working to finalize the risk and uncertainty policy (I bet you can guess who is writing this now:) and the next things we should begin to work on are developing an MSE for a commission species or two and developing a control rule for stocks that are not responding to management (a technique that will put us somewhere in the middle of giving up, and continuing to restrict for no good reason).

Q20 Additional comments?

- The staff of ASMFC does an excellent job in a very difficult and dynamic environment. Kudos to them!
- Outstanding staff support make this system function well. Thank you!
- It may be time for refreshers on stock assessment terminology. Can new techniques like Baysian probability theory be explained to non-technical people? Some new members may also benefit from a refresher on parliamentary procedure. Finally, there is a real need for further coordination/differentiation of roles between ASMFC, the Councils, and the Feds. There seems to be increased emphasis on joint meetings with the MAFMC and NEFMC, yet little attention is paid to the burden this additional travel puts on the volunteers from ASMFC who try to attend these joint meetings. Council attendees are paid to attend these meetings as opposed to Commission LGAs. I'm not suggesting Commission LGAs should be paid, but request recognition of this reality when it comes to scheduling and representation from the Commission. The Commission seems to be increasingly dependent on federal Magnuson provisions to govern all stocks managed jointly with the Councils. Some Commission members feel their hands are tied as a result, as we abdicate our authority to the feds and Councils. I'm not sure if anything can or should be done about it.
- Co-managed stocks often have two masters; MSA and the Coastal Act which have different mandates for overfished/overfishing.
- Overfishing as a measure of success is difficult because it is a binary measure (i.e. OF is either occurring or not). Overfishing may be the result of high abundance and some depleted stocks may be overfished with little to no fishing pressure.
- NMFS sometimes seems to be a true partner while at other times treat the commission as a stakeholder.
- I believe that we could accomplish more if every state could the big picture instead of just a snapshot in their own state.
- There needs to be a better balance between recreational, commercial, and environmental representatives to the Commission. Commercial interests dominate the Commission, boards and voting. There are also several Commissioners who are listed as representing one user group (Rec) but vote in line with a different user group (Comm). Commissioner profiles should be updated annually.
- Boards and Committee meetings need to be improved to reduce the comment monopolization that a few Commissioners engage in. certain members get too many bites at the apple and dominate the conversation or talk down others.
- Provide more onsite lunches to cut costs and keep the meetings running on time.
- Reduce travel costs and hotel fees by selecting less expensive meeting venues including the annual meeting.
- It is difficult to square up not having enough funds for certain studies, MRIP or observer coverage while at the same time meeting in posh resorts and downtown Manhattan. "
- Many of the management problems that we saw in 2019 and will continue to see in 2020 and beyond were caused by the new assessments using the new MRIP data. NOAA Fisheries passive response to these huge changes they knew were coming has been extremely disappointing. Rather than getting out ahead of these problems, their inaction has left ASMFC and MAFMC to have to improvise to maintain common sense management of some stocks. They knew this mess was coming, yet did nothing to prepare to manage it.
- Staff and partners are great.
- Occasional press releases geared towards the general public updating issues and advising what the Commission is doing to address those issues might be nice. All press releases now are targeted principally to industry and are bloated with science data such that average ""joe"" or ""jane"" is not going to be interested or take the time to read."
- Am very encouraged by the leadership, staff and technical committee. Keep up your good work.
- Commission staff does an excellent job trying to educate the commissioners on the topics at hand.
- I always appreciate hearing from recreational anglers and would appreciate a venue where such anglers could be given a greater opportunity to express views and recommendations.
- I feel supported by the staff and the process so far. Keep it up and thanks!

- Was a good year at the Commission
- I think the Commission process is a great one, but I am becoming increasingly frustrated by some of the more contentious items where we end up with a straight north south "partisan" voting situation. The more objective systems we can put in place (e.g. risk and uncertainty policy, MSE) the better off we will be. I think anything that can require us to state our objectives and goals up front, and then base our decisions on those objectives and goals, the better off our process will be. Additionally, trying to figure out ways to objectively incorporate economic and social science information in the context of the greater good (something akin to net benefit to the nation idea) will also help get us out of this box. Despite my frustration, I remain optimistic.

Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: **ISFMP Policy Board**

FROM: **Toni Kerns, ISFMP Director**

DATE: **January 17, 2020**

The Commission annually evaluates how well each species is performing relative to the management actions of the individual species board. This evaluation categorizes the stocks into 5 categories: (1) rebuilt/sustainable; (2) recovering/rebuilding; (3) concern; (4) depleted; and (5) unknown. These categories are not broad enough to categorize all Commission managed species. They did not included an overfished or overfishing category, leaving a gap for those species that are overfished and or overfishing and in a decline.

Below are recommended changes to the stock categories and their definitions. These changes have been reviewed by the MSC. The yellow highlight indicates a new category.

Concern	Those stock developing emerging issues, e.g., increased effort, declining landings, or impacts due to environmental conditions
Depleted	Reflects low levels of abundance though it is unclear whether fishing mortality is the primary cause for reduced stock size
Overfished	Occurs when stock biomass falls below the threshold established by the FMP, impacting the stock's reproductive capacity to replace fish removed through harvest, and that decline is driven primarily by fishing mortality.
Overfishing	Removing fish from a population at a rate that exceeds the threshold established in the FMP, impacting the stock's reproductive capacity to replace fish removed through harvest.
Recovering/Rebuilding	Stocks exhibit stable or increasing trends. Stock biomass is between the threshold and the target level established by the FMP.
Rebuilt/Sustainable	Stock biomass is equal to or above the biomass level established by the FMP to ensure population sustainability. When between benchmark assessments, a stock can still be considered rebuilt/sustainable if it drops below the target but remains above the threshold.
Unknown	There is no accepted stock assessment model to estimate the stock status.

M20-07

Atlantic States Marine Fisheries Commission

Business Session

February 6, 2020
12:15 – 12:30 p.m.
Arlington, VA

Draft Agenda

The order in which these items will be taken is subject to change;
other items may be added as necessary.

1. Welcome/Introductions (*P. Keliher*) 12:15 p.m.

2. Committee Consent 12:15 p.m.
   - Approval of Agenda
   - Approval of Proceedings from October 2019

3. Public Comment 12:20 p.m.

4. Consider Noncompliance Findings (If necessary) **Final Action** 12:25 p.m.

5. Other Business/Adjourn 12:30 p.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

BUSINESS SESSION

Wentworth by the Sea
New Castle, New Hampshire
October 29, 2019
October 31, 2019

These minutes are draft and subject to approval.
The Board will review the minutes during its next meeting.

Draft Proceedings of the Business Session
October 2019

TABLE OF CONTENTS

These minutes are draft and subject to approval.
The Board will review the minutes during its next meeting.

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of Proceedings from August 2019** by consent (Page 1)

3. **Move to accept the Action Plan as amended today** (Page 8). Motion by Pat Keliher; second by John Clark. Motion carried (Page 8).

4. **On behalf of the Nominating Committee, I nominate Pat Keliher as the Chair of the Atlantic States Marine Fisheries Commission effective at the end of the Annual Meeting** (Page 10). Motion by Doug Grout. Motion carried (Page 10).

5. **On behalf of the Nominating Committee, I nominate Spud Woodward as the Vice-Chair of the Atlantic States Marine Fisheries Commission effective at the end of the Annual Meeting** (Page 10). Motion by Doug Grout. Motion carried (Page 10).

6. **On behalf of the Interstate Fishery Management Program Policy Board, move that the Atlantic States Marine Fisheries Commission find the Commonwealth of Virginia out of compliance for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden. The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons. The implementation of this measure is necessary to achieve the goals and objectives of the Fishery Management Plan and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resources on a long-term basis** (Page 13). Motion by Jim Gilmore. Motion carried (Page 14).

7. **Move to amend the Commission's Rules and Regulations to implement the policy on non-payment of state appropriations** (Page 13). Motion by Steve Train; second by Justin Davis. Motion carried (Page 13).

8. **Move to adjourn** by consent (Page 15).

ATTENDANCE: October 29, 2019

Board Members

Pat Keliher, ME (AA)
Doug Grout, NH (AA)
Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Jim Gilmore, NY (AA)
Maureen Davidson, NY, Administrative proxy
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak
Andy Shiels, PA, proxy for T. Schaeffer (AA)
Loren Lustig, PA (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Bill Anderson, MD (AA)
Steve Bowman, VA (AA)
Pat Geer, VA, Administrative proxy
Steve Murphey, NC (AA)
Mel Bell, SC, proxy for R. Boyles, Jr. (AA)
Malcolm Rhodes, SC (GA)
Sen. Ronnie Cromer, SC (LA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Rep. Thad Altman, FL (LA)
Marty Gary, PRFC

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Robert Beal
Toni Kerns
Laura Leach
Kristen Anstead
Maya Drzewicki
Tina Berger
Geoff White

ATTENDANCE: October 31, 2019

Board Members

Pat Keliher, ME (AA)
Stephen Train, ME (GA)
Doug Grout, NH (AA)
Cheri Patterson, NH, Administrative proxy
Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Jim Gilmore, NY (AA)
Maureen Davidson, NY, Administrative proxy
Emerson Hasbrouck, NY (GA)
Joe Cimino, NJ (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak
Andy Shiels, PA, proxy for T. Schaeffer (AA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Lynn Fegley, MD, proxy for Bill Anderson (AA)
Russell Dize, MD (GA)
Phil Langley, MD, proxy for Del. Stein (LA)
Pat Geer, VA, proxy for S. Bowman (AA)
Steve Murphey, NC (AA)
Mel Bell, SC, proxy for R. Boyles, Jr. (AA)
Malcolm Rhodes, SC (GA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Marty Gary, PRFC
Alesia Read, NMFS
Mike Millard, USFWS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Robert Beal
Toni Kerns
Laura Leach
Pat Campfield
Tina Berger
Geoff White

The Business Session of the Atlantic States Marine Fisheries Commission convened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Tuesday, October 29, 2019, and was called to order at 4:15 o'clock p.m. by Chairman James J. Gilmore.

CALL TO ORDER

CHAIRMAN JAMES J. GILMORE: Welcome to the Business Session. My name is Jim Gilmore, I'm Chairman of the Commission for at least another five minutes. We'll be going through a few things for the Business Session today.

APPROVAL OF AGENDA

CHAIRMAN GILMORE: First off, we need approval of the agenda. It was in your meeting packet. Are there any changes to the agenda, seeing none?

APPROVAL OF PROCEEDINGS

CHAIRMAN GILMORE: We need approval for the proceedings from the August, 2019.

Has everybody reviewed them and are there any changes to the proceedings? Okay seeing none we will adopt those by unanimous consent. Public comment on any items not on the agenda, seeing none we'll move right along.

REVIEW AND CONSIDER APPROVAL OF THE 2020 ACTION PLAN

CHAIRMAN GILMORE: We're going to go into Item 4, and we're going to review and consider approval of the 2020 Action Plan, and Bob is going to take us through that so Bob it's all yours.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Just before we get into this, the Action Plan if you guys will remember changed formats quite a bit last year, based on some input from the leadership of the Commission. We pared it down quite a bit. There used to be 50 plus pages, we cut it in half. It really focuses on new activities and highlights for the next year.

It's a lot shorter, and what we'll do right now is ask Toni to, actually each of us staff members to go through out sections quickly. Just hit the highlights of the highlights, and you guys can ask any questions. But keep in mind, generally if you want to add a significant task to the Action Plan we probably need to take something off.

The way it is written right now we're pretty well maxed out on dollars, and on staff time. You know any significant changes we'll need to start talking about swaps in and out. With that I'll ask Toni to go ahead and go first through Section 1, which is the species management actions and stock assessment work.

MS. TONI KERNS: I'm going to go through, start with the high priority species, and try to hit most of the things that are in the bold. I may skip over one or two things. Some of the things that are in the high priority species that are not in bold are still important things, but we've been carrying on those tasks over the course of the last year, so we did not bold them. We will start with Atlantic herring, and one of the questions that we first off have are whether or not Atlantic herring should be in the medium/low priority or in the high priority. We'll be working with the Northeast Fisheries Science Center to complete a management tracked stock assessment for peer review.

In August we'll have the Board review that and then potentially review and adjust 2021 specifications if necessary. We'll also work with the Council if necessary to extend spawning into Area 3. The Council has initiated a framework to do that. In addition, yesterday the Herring Board initiated an addendum to look at how they allocate the quota allocations, as well as how they manage the Area 1A Days Out section of that fishery.

For Atlantic menhaden we'll work to resolve the implementation of the Chesapeake Bay Cap, and the Technical Committee and the Board will review the recommendations from the aerial survey project, and then the Board will need to determine the next steps. For Atlantic striped bass, we'll implement Addendum VI, including any conservation equivalency proposals if those are brought forward, as well as consider management response to rebuild the biomass and address long term fishery issues, meaning the potential initiation of an amendment.

For black sea bass and this would also most likely include summer flounder and scup. We'll work with the Mid-Atlantic Council and NOAA Fisheries on an addendum or an amendment on reforming the recreational management and commercial/recreational allocation, taking into account calibrated recreational estimates.

It's likely that this activity could extend beyond 2020. Bluefish will continue with the amendment to address allocation, as well as a rebuilding program, which was added recently. The stock is overfished, thank you, Dustin. For horseshoe crab, today the Board began a revision to the adaptive resource management framework to utilize the modeling approaches from the most recent benchmark assessment.

For summer flounder, we'll develop with the Mid-Atlantic Council, and this will be for scup as well as black sea bass, an amendment that looks at sector allocations, taking into account all the recalibrated estimates, as well as participate in a workshop with the Council on their Research Steering Committee to examine the possibility of reestablishing an RSA program.

For tautaug we'll initiate the development of a stock assessment for completion in 2021. American eel we'll work on the development of the next benchmark stock assessment methodologies, including working with USGS and Canada on that issue. Moving down, coastal sharks we'll be monitoring the 2019 shortfin mako stock assessment update that is being completed through ICCAT, as well as work with SEDAR to complete the blacktip stock assessment for peer review in November.

Then the Board would review this in February of 2021. Northern shrimp will conduct a stock assessment update. For red drum we'll work with the Assessment Science Committee to develop a road map for the next benchmark stock assessment. Spanish mackerel, we will work with the South Atlantic Council. This has not necessarily been initiated, but we anticipate it will be. At the upcoming South Atlantic Board meeting to initiate management action to ensure that we have complementary regulations in both state and federal waters. We'll also work with SEDAR for a benchmark stock assessment that would be peer reviewed in 2021. For winter flounder we will work with the Northeast Fisheries Science Center to prepare a management tracked stock assessment for peer review. That would be reviewed by the Board in October.

On cross-cutting issues, we'll work to raise awareness of regulatory changes affecting data collection for things like American lobster, American eel and tautaug, as well as work with the states and NOAA Fisheries on changes to the Take Reduction Plan for the North Atlantic Right Whales. I will take any questions.

CHAIRMAN GILMORE: Dave Borden.

MR. DAVID V. BORDEN: Toni, what is the difference under black sea bass or summer flounder? Do you use sector allocations instead of commercial/recreational allocations? What's the difference?

MS. KERNS: It is commercial/recreational allocations. We're just calling it a sector. I can change the language to say commercial/recreational allocations.

MR. BORDEN: Okay so they mean the same thing then.

MS. KERNS: Yes.

MR. BORDEN: I just want to make sure. I raised this at the Mid-Atlantic meeting that could possibly include like a commercial/recreational and charter allocation.

MS. KERNS: That is correct. I will note for summer flounder, scup, and black sea bass there are a lot of large items that are on the list. It is highly likely due to staffing issues, and the needs to try to get different things done quickly to address certain needs that we may with the Mid-Atlantic Council need to determine how to prioritize each of these issues. We'll continue to have those conversations with the Mid-Atlantic particularly at the upcoming joint meeting in December.

CHAIRMAN GILMORE: Justin Davis.

DR. JUSTIN DAVIS: Under black sea bass, the second bullet, Consider Management Action to Adjust Commercial Allocation. At the recent joint meeting the Board voted to initiate an addendum, so is this meant to reflect that? I just didn't know if the wording there should be changed.

MS. KERNS: Yes, the first bullet, correct?

DR. DAVIS: I guess I was thinking it was two separate management actions. There is the amendment to deal with recreational/commercial sector allocation, and then there is the other document, the addendum, to address state-by-state commercial allocation.

MS. KERNS: We'll add a second sentence.

CHAIRMAN GILMORE: Dan McKiernan.

MR. DANIEL McKIERNAN: Toni, the slide that had cross-cutting issues about the unanticipated impacts of data collection. Could you elaborate on those? Yes the first bullet, raise awareness of regulatory changes.

MS. KERNS: Yes. For example, what we went through lobster on Monday just making sure that we are in particular collecting data in the same format, for some things with lobster. For tautaug recognizing that we are implementing the tagging program, and making sure that everybody is aware of that and what potential future data collection needs may be, as that tagging program gets moving out of the gate. For eel, as we talked about earlier today, the importance of collecting the data and getting it into ACCSP on time, in order to monitor that fishery as best as possible.

CHAIRMAN GILMORE: Eric Reid.

MR. ERIC REID: At the last joint meeting the motion for black sea bass was to start an addendum, with the consent of the Policy Board or the Business Session. If we approve this is that consent implicit, or do we have to have a discussion about that?

MS. KERNS: This would be that consent.

MR. REID: This would be that consent. How long do you really thing that is going to take in time and resources?

MS. KERNS: I think it depends on the direction that the Board goes. Caitlin is going to work on drafting a document, and we're going to work with the Mid-Atlantic Council. We had said that we would not make any decisions on that document without a joint meeting. It is our intent to bring forward that document at the February meeting.

We need to see if the Mid-Atlantic Council can come to our February meeting, so we can approve that document for public comment. If the Board wants additional options added to the document then it will take longer, but if we are on that track then it could be finalized as early as May, or it may take a little longer, depending on how much wordsmithing and option changing the Board has.

CHAIRMAN GILMORE: Yes, go ahead Eric.

MR. REID: Are you saying that final action could be in May?

MS. KERNS: That would be fastest.

MR. REID: I don't see it that way. If you're talking about reallocation it's going to be an issue with tremendous economic impact, one way or the other, depending on which end of the see-saw you're on. I would think that is going to be something that is going to take years. I don't know if the Commission is willing to commit to such a broad topic at this time, given the workload that it's going to be. I would much rather see a more specific action or language come out of the joint meeting, before we got too carried away with whether we want to get wrapped up for three, four, five years doing it.

MS. KERNS: You're speaking just on the commercial allocation not the commercial/recreational allocation?

MR. REID: On both. I mean it's very hard for me to justify spending a lot of time on reallocating fisheries when you have a limited access fishery, which has no ability due to management to increase their catch to get more quota, and an open access fishery that can increase their catch as we all know exponentially. It doesn't add up to me. I don't think it's fair, and I don't think we should spend the time or the money doing it.

CHAIRMAN GILMORE: Well that lit everybody up, all right Doug Grout.

MR DOUGLAS E. GROUT: I noticed under Atlantic herring you're suggesting moving that to a medium/low priority. Could I hear a little bit more rationale behind why you are proposing that?

MS. KERNS: It is a question to the Board. It was just a question of whether it should be in high or low priority. Typically a lot of times when we have the issues that are in high priority they have management actions associated with them. We did just add a management action, so it could stay there. We were just working on the assessment. We knew that the New England Council was going to be working on the framework for the offshore spawning, and so it was to the prerogative of the Board.

MR. GROUT: Okay I would suggest, especially since we added a management action that it probably should remain in a high priority.

CHAIRMAN GILMORE: That makes sense, Doug. Tom Fote.

MR. THOMAS P. FOTE: I'm sorry I just walked in on the tail end of Eric's conversation there. I think that should be one of our highest priorities. After seeing the new MRIP numbers, I'm looking at the recreational community, and I always thought it took a real hit when we set up the quotas.

Basically we're looking now to adjust those quotas to reflect what the actual fisheries were, and especially what happened with the MRIP numbers showing that now we're overfishing, and the recreational is way over its quota on this, and ridiculous things like scup. It's important that we do this and the community is looking for you to do this as fast as possible, and we need to dedicate the time, effort, and money to do this and accomplish this task, because the longer it takes the more credibility you lose with the recreational public out there.

I know Eric maybe thinks it's a waste of money, but we've been fighting for this for years, and setting around this table trying to get the right numbers. If these are the right numbers, we were underestimated all these years. We need to correct that inequities that were caused back in the '90s, and go through it again.

CHAIRMAN GILMORE: I don't disagree. It may be daunting in the long period. We've got to start sometime. Justin Davis, other questions. Adam Nowalsky.

MR. ADAM NOWALSKY: Under summer flounder there is this item about the workshop with the Research Steering Committee. I was just wondering why we would put it here, specifically under one species, as opposed to it may be showing up under research, as this would be across a number of species.

I'll just add I appreciate it being here, as Chair of the Research Steering Committee, because I do think it's important so I'm glad it's here on the plan, because we will need the support putting on my Council member hat of the Commission in doing so. But again, it's going to be across a number of species would be the intent of that and perhaps might consider moving it down to Section 2 under research.

MS. KERNS: We put it here just because it was the species that it most often comes up under. As I said before, it applies obviously to black sea bass and scup. You could say it applies to dogfish and bluefish as well. I could add it to each of the species, or in parentheses afterwards I can just say this also applies to the following species.

MR. NOWALSKY: Or down to cross-cutting. Again, I am appreciative that it's on here. My only request is that it not be interpreted to only apply to summer flounder. That is my only reason for bringing it up.

CHAIRMAN GILMORE: Other questions for Toni? Okay I think we're moving on to science, Bob. Pat.

MR. PATRICK A. CAMPFIELD: Goal two of the 2020 Action Plan covers all of the fisheries research and stock assessment activity, as well as research surveys and other monitoring activities. To hit the highlights, under the Science Committees we are asking the Management and Science Committee to do a couple of things in 2020. The first is to revisit our ASMFC research priorities, and to dig through those and look for common themes and develop proposals to seek funding to address research priorities and get better data for our stock assessments.

The second is to have the MSC weigh in on our annual status of the stocks review, and provide some guidance on how to interpret and use that information. Moving down to data collection, the SEAMAP program in the South Atlantic will be developing their next five-year plan for 2021 to 2025, including exploring a new system for coordinated survey data management. Under NEAMAP in the northeast, each year they have a workshop across the various fishery independent trawl surveys to compare methods, compare notes.

In 2020 we propose conducting a trawl survey calibration workshop, in order to better integrate the data between surveys. Moving down, we have highlighted a priority related to the ecosystem modeling and ecosystem reference points to increase data collection to support those ecosystem-based assessments in management, either through new or existing programs like SEAMAP to get diet information from those survey catches. Under fisheries research, this is where we have our fish aging activity, there is a call for an Atlantic menhaden aging workshop, to ensure that all the states or university labs that are gathering and processing menhaden aging samples, to make sure that they're doing it in a consistent fashion, again so those data can plus into our stock assessment.

Under ecosystem-based management and changing ocean conditions, standardize the timeline of Commission assessments to support timely updates to ERP and Atlantic menhaden stock assessments. That is sort of a pending activity. The menhaden single species and ERP assessments will go through a SEDAR peer review next week. We'll bring those results to you in February.

We have also highlighted evaluating the effects of changing ocean conditions on stock productivity and distribution, again that is an activity that your Management and Science Committee has engaged in in the past. They are meeting this week, actually still meeting downstairs, and so they are digging back in to address those types of questions.

Finally, under Competing Ocean Uses for the Commission to participate in ROSA, or the Responsible Offshore Science Alliance, to provide a forum for the states to discuss interactions between fisheries resources and offshore energy development. Those are the highlights, Mr. Chairman, I'll take any questions.

CHAIRMAN GILMORE: Questions for Pat. Okay seeing none, we're going to move into Goal 3, oh go ahead, Geoff.

MR. GEOFF WHITE: Goal 3 discusses dependable and timely statistics for Atlantic coast fisheries through the activities of the ACCSP. We updated the language on a continuing basis, to reflect a couple of new updates. But primarily under Program Management the focus is on process enhancement and integrating with the ASMFC Communications Plan.

Under fisheries dependent data collection items are talking about extending the SAFIS database capabilities, and adding some highlights within the redesign on specific tasks that are going to focus on participant structure and trip reporting that are components of that redesign that will be occurring in 2020, and of course maintain support of our federal and state agency partners to implement their mandatory electronic trip reporting regulations.

Under recreational surveys, there is the extension and implementation of state conduct of MRIP for-hire telephone survey from Maine to Georgia, expanding the electronic data collection tools for both the Access Point Angler Intercept Survey and For-Hire Telephone Survey, developing methodologies to more fully incorporate the logbooks into the catch statistics, and of course update our Atlantic Recreational Implementation Plan that is something that comes back around every three to five years.

Under Data Distribution and Use, there are some changes to the data warehouse queries and structures, to include more data fields that are being collected by the partners and SAFIS. Adding the addition of biological data feeds and improving our communication with partners, and some processes to streamline the data integrity. Under data infrastructure and security that really speaks for itself, making sure we have the items in place to support larger data volumes, and meet with greater security constructs.

CHAIRMAN GILMORE: Any questions for Geoff? Adam Nowalsky.

MR. NOWALSKY: Under the recreational surveys that are here, and I had some discussions with various people, including from S and T, and Silver Spring in the past about improving access by the public to the surveys. Is that something that can be considered moving forward? I understand it's probably not something that would be done next year.

But specifically right now there is a certain level that you can query for a state by wave, but there has been discussions in the past about taking that a step further, being able to see something perhaps on a county-by-county basis or perhaps down to an intercept level that people could query or look up. I was just wondering if that information had gotten back to you, if there were any thoughts about that moving forward, laying the groundwork for it, and what it might take moving forward on future action plans.

MR. WHITE: In terms of what an ACCSP task can be for next year. We can certainly talk with MRIP about what access might or might not be available through their tools. The way the survey is structured the intercept-by-intercept information is publically available on their website through the download tools.

It's a matter of finding out a little bit more of what it is that you're asking for, in terms of preprogrammed access, what analysis, and how that could be done. We can certainly talk further about it, but I'm not quite sure of a particular action plan item to add at this point.

CHAIRMAN GILMORE: Other questions for Geoff. Seeing none, we're going to go forward. Toni.

MS. KERNS: Under Goal 4 we don't have any new activities. The Law Enforcement Committee will continue to work with the management boards to seek increased and improved compliance with FMPs. The Law Enforcement Committee is continuing on with work on things like lobster offshore enforcement, which is mentioned in Goal 1. But I don't really have anything new, if there are any questions.

CHAIRMAN GILMORE: Are there any questions on that? Okay Goal 5, Toni.

MS. KERNS: Goal 5 is looking at the habitat goals and Atlantic Coast Fish Habitat Partnership falls under this goal. The artificial reef programs will work through a comprehensive update to state profiles in updating the Profile of Atlantic Artificial Reef Development Source Document. The Habitat Committee will work on an acoustics document for the Habitat Management Series.

Under the Atlantic Coast Fish Habitat Partnership they will be promoting the Southeast Fish Habitat and the Northeast Fish Habitat Mapping Projects that were recently completed, as well as develop a fundraising strategy to solicit donations from the private sector to put money towards targeted on the ground restoration projects.

CHAIRMAN GILMORE: Questions on that? Okay seeing none, we'll move to Item 6. Tina is going to do that. Tina.

MS. TINA L. BERGER: Under Stakeholder and Public Support, the first item is to identify three to four high profile issues, and seek to proactively address stakeholder criticisms and concerns through various outreach tools. The next is promoting high profile species and stock assessment results through various outreach initiatives, with our focus species for 2020; lobster, cobia, herring, Atlantic menhaden, and ERPs, shad, Spanish mackerel, and winter flounder.

Under Facilitate Stakeholder Participation, we have evaluate the effectiveness of current advisory panel process, and consider possible changes to enhance engagement and provide management boards with useful stakeholder input, as well as explore additional tools to gather public comment and proposed management actions. Under Media Relations and Networking, increase interdepartmental coordination on outreach activities through the development of a strategic communications plan, and that's it for outreach.

CHAIRMAN GILMORE: Are there any questions for Tina? Okay seeing none we'll move on to Goal 7 and Bob is going to lead that one. Bob.

EXECUTIVE DIRECTOR BEAL: Goal 7 is our legislative activities at the Commission, mostly the ones that Deke and I engage in, and a number of you engage in, reaching out to Capitol Hill and the Commission's priorities and wants and desires. Most of this is ongoing activity; it's just continued engagement with a series of offices on Capitol Hill as well as the professional staff for a number of the Committees on the House and Senate side.

We did update the list of pending legislation and emerging issues that we'll be working on, and we've had questions about recently, so there is a pretty long list there including forage fish and state-by-state allocations, and monuments and energy initiatives, and a number of other things. We'll be working to keep offices informed on what's going on at ASMFC relative to those issues, and bring back any information that they provide to this Commission.

Then moving down, you know we always convey the funding priorities for ASMFC to appropriation staff, as well as individual offices, so we'll continue to do that. This just reflects the priorities and the regional council and fishery commission line is one of the most important lines that we always look out for, and that provides the primary funding to ASMFC as well as out to the states to implement the provisions of the Atlantic Coastal Act.

The final new bullet is a new initiative, primarily out of the Gulf, but involving ASMFC and the Pacific states. It is to potentially change or increase Wallop-Breaux funding to the Commission. But we need to make sure as that moves forward there is no, if it's a zero sum game, where does that money come from? We want to make sure there are no negative impacts to the states if we're able to get more money to the Commission. Those are the highlights of the legislative activity, and just as a bit of an advertisement, Deke and I are always willing to go up to Capitol Hill with anyone. If you want to go up there we can set meetings up. You know when we are in Crystal City we'll run you over to D.C. anytime you want. That is Goal 7.

CHAIRMAN GILMORE: Tom Fote.

MR. FOTE: At the Mid-Atlantic Council we got into a discussion about the funding of MRIP and the money that was necessary. Dr. John Boreman when we basically talked about what he said in 2007 before Congress about the funding of MRIP to get really decent numbers, what you needed to do was 50 million dollars, not the 11 million dollars we've still been spending 11 to 13. The following week I was at MAFAC and I brought that up to Paul.

I can't think of his last name but maybe Bob knows, who actually handles the budget for the National Marine Fisheries Service, and we talked about these 50 million dollars. I was hoping that the Commission could also basically say that we need to really fund the MRIP numbers to where the scientists have said we always need to be, and the money that's necessary to do it properly.

We spend a lot of money gathering commercial statistics, but we really don't spend it. The MRIP numbers are probably better than they were before, but they don't compare to how we get numbers for the commercial fishery. Until we basically start spending the money, we're going to be sitting around this table arguing whether the numbers are valid, whether they really reflect what's going on.

I don't know if 50 million dollars will do it, but maybe we can get maybe 20 million dollars, and actually start doing a better job and basically increase it over the years. Hopefully the Commission will basically do that when they're lobbying on the hill.

EXECUTIVE DIRECTOR BEAL: Thanks Tom, I think the name you're looking for was Paul Doremus, and when Deke and I go to the Hill, you know I often comment how important funding recreational data collection is. We do convey that message, but we'll add it to the list here, just so it is spelled out directly, and we'll keep working on that.

CHAIRMAN GILMORE: Bill Hyatt.

MR. WILLIAM HYATT: Just a suggestion to add the Recovering America's Wildlife to that list of pending legislation emerging issues. I know it's something that you have been forwarding information to us on, and it is something that could be important, so just add it to the list.

CHAIRAMN GILMORE: John Clark.

MR. JOHN CLARK: Bob, could you elaborate a little more about the federal aid funding here. I know the reauthorization for federal aid right now, the Fish and Wildlife Service is looking to take a bigger bite out of the pot for administrative purposes, and I'm just wondering what part of the federal aid funds this would be coming out of.

CHAIRMAN GILMORE: That's a good question. That's why we're keeping an eye on this. The bottom line is ASMFC; our office receives about $200,000.00 per year from Wallop-Breaux. That has been fixed since 1987, I believe. We're looking to work with the other Commissions to possibly increase that. But again, if there is an opportunity to increase that it can't be at the expense of any programs or anything that funds your state programs, the money that goes directly to the state.

You know if it is a zero sum game, which I think it is, the pool of money, the Wallop-Breaux fund has increased over time. There might be some additional funds available. We'll just have to see how this goes and then it's not far enough long to show where that money would come from, so we're going to monitor it and see if it's a good idea or bad idea, I guess is the best way to phrase it.

CHAIRMAN GILMORE: Are there any other questions for Bob? Okay, Goal 8, Laura.

MS. LAURA C. LEACH: Goal 8 is ensuring fiscal stability and efficient administration of the Commission. It's ongoing in a daily routine that we do every day. We will do a couple of things new next year; the first one is develop a revised statement of work for the IJ Cooperative Agreement to respond to the new federal grant reporting requirements.

The second on is researching options for staff performance review, changing the form that we use or changing the format, any number of changes there, and then conducting a workshop on parliamentary procedures and meetings management for Commissioners. That concludes my report.

CHAIRMAN GILMORE: Questions for Laura. Okay seeing none, we're going to need a motion to adopt this, unless there is any other discussion on the document, or anything that wasn't brought up. Okay we have a motion by Pat Keliher, seconded by John Clark, any discussion on the motion? Seeing none, is there any objection to the motion? Seeing none, we'll adopt that by unanimous consent. I would like to thank the staff for doing a great job on the Strategic Plan, and great presentations. Yes, go ahead, Bob.

EXECUTIVE DIRECTOR BEAL: Just one quick comment on the Action Plan. The Action Plan or review of the Action Plan is also on the Executive Committee agenda for tomorrow morning, but it's really just to look at or start diving into some of the issues that are included in the document; public engagement, advisory panel process, those sorts of things, needing some development in a plan for how we're going to move forward next year.

The Executive Committee is going to talk about that in the morning. I don't anticipate any significant changes to the Action Plan itself, just sort of starting the details on how we're going to work through some of these issues. It's not a second review; it's just sort of a deeper dive into a couple of the issues.

CHAIRMAN GILMORE: Our next action item is elections of the officers, so I'm going to relinquish the chair and turn it over to Bob, and go back to my caucus. Bob, it's all yours.

EXECUTIVE DIRECTOR BEAL: Thank you, Mr. Chairman. It's the last time I say that I think. Before I call on Doug to do the report from the Nominating Committee, Jim, don't go too far away just yet, please. I want to thank you. Can you open that? Jim, on behalf of the staff and all the Commissioners, we want to thank you for two great years of service. We've got a crystal clock for you.

Always when working with Jim, every Friday at one o'clock, we've got a standing call, and I get to get the play-by-play details of that week's the artificial reef trials and tribulations in New York, which always don't go that well. It's been a lot of fun working with Jim, he's a great boss to have for me, and he's been a huge support of this Commission, works really hard, put in a lot of hours, kind of behind the scenes between these meetings to help this process work as smoothly as it does. On behalf of all of us, Jim, thank you for two years. (Applause)

CHAIRMAN GILMORE: Thank you very much and I'm humbled and now it's over to Bob, thanks.

NOMINATING COMMITTEE REPORT

EXECUTIVE DIRECTOR BEAL: All right now I'll turn it right back over to Doug then, and he can do the hard work here. Doug, give the Nominating Committee Report, please.

MR. GROUT: Well, are you going to describe at some point the process for the vote at all, or do you want me to? Go ahead. We'll just start off with that and then I'll be glad to provide the nominee.

EXECUTIVE DIRECTOR BEAL: The Commission voting process is that for every other year when we elect the Chair and the Vice-Chair, we go through a balloting process. It sometimes seems a little bit cumbersome, but it's not. It's to allow for write in votes, or for other people to be nominated from the floor. It was agreed that that is the most open and fair process. Once Doug provides the Nominating Committee's nomination for Chair, we'll pass out the ballots for Chair.

Deke has the ballots ready to go, and then we'll count those votes, and then we'll move onto Vice-Chair, and we'll go through the same process of a ballot, and votes for the Vice-Chair. One vote per state, please, so caucus and hopefully you guys all agree. I don't know where Pat's been the last couple hours. We'll see who he's been talking to, so we'll see. With that Doug, are you ready to go up for the Nominating Committee Report?

ELECTION OF COMMISSION CHAIR

MR. GROUT: I am ready. We queried all the Commissioners looking for suggestions for Chair and Vice-Chair. All of the responses seem to focus around a couple of what we believe to be great candidates. The first one for Chair, I think there is going to be a formal motion for this. **Then on behalf of the Nominating Committee I nominate Pat Keliher as Chair of the Atlantic States Marine Fisheries Commission, effective at the end of the Annual Meeting.**

EXECUTIVE DIRECTOR BEAL: Since this is a Committee motion it does not need a second. With that we'll pass out the ballots, and we'll conduct the vote. Good luck, we'll give you all the time you need over there.

MR. GROUT: I have a report that we have approved Pat Keliher as Chairman for the next two years by unanimous consent. (Applause)

EXECUTIVE DIRECTOR BEAL: Congratulations, Pat.

MR. GROUT: Congratulations, Pat.

EXECUTIVE DIRECTOR BEAL: Would you like to say anything?

MR. GROUT: Next on our agenda.

MR. KELIHER: Evidently not. I was just going to remind everybody that I've talked to about becoming Chair that as I promised, a lobster in every pot will come true tonight, on behalf of the state of New Hampshire.

ELECTION OF VICE-CHAIR

EXECUTIVE DIRECTOR BEAL: That is fast work. Doug, can you give the nomination for the Vice-Chair, please?

MR. GROUT: Yes, the Nominating Committee would like to bring forward Spud Woodward; on behalf of the Nominating Committee I nominate Spud Woodward as Vice-Chair of the Atlantic States Marine Fisheries Commission, effective at the end of the Annual Meeting.

EXECUTIVE DIRECTOR BEAL: Is the accounting firm of Grout & Grout ready to report the results?

MR. GROUT: Yes I am, and I'm pleased to say that Spud Woodward has been elected Vice-Chair by unanimous consent. (Applause)

MR. DENNIS ABBOTT: Bob.

EXECUTIVE DIRECTOR BEAL: Yes, Mr. Abbott.

MR. ABBOTT: I would just like to comment on the election we just held. Having been here for over 20 years, I can recall close to 20 years ago Pat Keliher was here lobbying for CCA, so now he's the Chair, which I think is significant, and I congratulate him. Secondly, I would like to comment that 20 years ago the legislators and the governor's appointees did not have a seat at the table.

Here we are 20 years later and proudly we elect Spud Woodward as our Vice-Chair, and I think that is a significant step in Atlantic States Marine Fisheries Commission, and I congratulate Spud, I congratulate Pat. I'm sure they'll be a wonderful slate of officers. Thank you.

EXECUTIVE DIRECTOR BEAL: Are there any other comments? Spud, would you like to say anything as the incoming Vice-Chair?

MR. A. G. "SPUD" WOODWARD: Well, I made sure that I got here as early as I could on Sunday, because I spent four hours across the border in Maine with a voice coach, teaching me how to understand what Pat was going to say whenever he had conversations with me. I'm certainly willing to reciprocate, I've got some good voice coaches down in Georgia that can do likewise for him, to make sure that when I speak he understands what I say, and when he speaks, I do likewise.

EXECUTIVE DIRECTOR BEAL: Yes, I think my hardest job for the next two years is going to be translator between both you guys, but I'll give it a go. Tom, yes please.

MR. FOTE: I hate to correct Dennis, but I will. When I first got to the Commission the only place we were allowed to vote was nominating for the Chair and Vice-Chair, because it was a caucus vote at the Business Meeting, so we actually were able to vote. The second year I was a Commissioner in 1991, we decided to have some fun.

It was the only time we had seven ballots and they were all tied, because we were trying to get a governor's appointee elected, actually a legislative appointee elected. We compromised and got a governor's appointee, and that was the first one that was Mickey Neuberger. The second one over the years was Bonnie Brown, Dr. Bonnie Brown from Virginia.

But she won the election without any controversy at all. There were no ballots; it was just a single ballot. Of course then she basically didn't get reappointed, so I decided never to nominate another governor's appointee or legislator, so we said it was the kiss of death, so it's nice to see Spud get it, thank you.

RECESS

EXECUTIVE DIRECTOR BEAL: Thank you, Tom, anything else to come before the Business Session today? I'm going to fill some time while Laura gets the answer to a question that we have. Seeing no other hands, the Business

Session will recess until Thursday at 10:00 a.m. Thank you all.

(Whereupon the meeting adjourned at 5:15 o'clock p.m. on October 29, 2019)

THURSDAY, OCTOBER 31, 2019 SESSION

CALL TO ORDER

The Business Session of the Atlantic States Marine Fisheries Commission reconvened in the Wentworth Ballroom of the Wentworth by the Sea Hotel, New Castle, New Hampshire; Thursday, October 31, 2019, and was called to order at 10:10 o'clock a.m. by Chairman James J. Gilmore.

CONSIDER CHANGES TO THE RULES AND REGULATIONS TO ADOPT THE POLICY TO ADDRESS NONPAYMENT OF STATE APPROPRIATIONS

CHAIRMAN JAMES J. GILMORE: We're just going to take up the first item, and the first item is to Consider Changes to the Rules and Regulations to Adopt the Policy to Address Nonpayment of State Appropriations, and Bob is going to lead that one.

EXECUTIVE DIRECTOR ROBERT E. BEAL: I'll try to go through this relatively quickly. The last couple pages of the briefing material for the Business Session are a Draft Policy on Nonpayment of State Appropriations. In the past the Commission has only had very few instances where states have not paid their dues on time, and gotten pretty far into arrears.

We had one recently, and all states are currently paid up. Everything is in good shape, so this policy is kind of theoretical. The good news is it doesn't apply to anyone right away, so it's always easier to approve these policies when they don't have to immediately impact a state. We asked our attorney to look back at all of our guiding documents at the Commission, the Charter and the Compact and everything else.

There really are no provisions in any of those documents right now to address states that are behind on their paying of the dues to the Commission. The Executive Committee has chatted about this a couple times, and this policy reflects kind of the current thinking of the Executive Committee. As you mentioned, Mr. Chairman, they approved this document, or recommended that this document be approved at their meeting earlier this week.

With that I'll quickly go through what is included here. Really what it is is a series of notifications to the state that is late on a payment, with ultimately the end could be that if the state is significantly in arrears they would actually lose their ability to vote at ASMFC. They would be allowed to come to meetings, participate in the boards, but when it came to votes that state would not be able to cast any vote at the Management Board, Policy Board, or Business Session level.

With that the graphic on the last page I think is probably the most important part. I can quickly go through that. April 1 of each year we already send out our bills to the states that let the states know what their annual dues are. That payment that is billed on April 1 isn't actually due until June 30th of the subsequent year, so you get about a 16 month notice that you have a bill due at the Commission.

You have quite a while to respond to that bill and pay the bill. First notice will be April 1, six months later on October 1, the Commission would remind any state that has not paid their dues that they have dues due on upcoming June 30. We have another reminder January 1, nine months from the original bill date, to say essentially the same thing that you have a bill or your dues are due to the Commission on June 30.

That moves us along to June 30 of Year 2, essentially from the bill date. That is when the payments are due. If any state does not submit payments on time on the following day, July 1, the Executive Director would notify in writing the Governor and the three Commissioners from that state of an overdue payment. At the August summer meeting a state would be able to come forward to the Executive Committee and make an appeal to say hey, we've had special conditions in our state.

This is why our bill is late, or this is why we've only paid part of our bill, or whatever it may be. That state can start that appeal at the Executive Committee. If the Executive Committee concurs with that state the Executive Committee could recommend to the Full Commission that some leniency be granted to that state, and the state could be given more time to submit payment to the Commission. If no leniency is given and the bill is not paid by October 1, which is 18 months after the original billing date that is when the loss of voting privileges would occur. What would happen if the Commission approves this policy is we would amend the rules and regulations to reflect this change.

Again, the important part to note here is that it seldom happens. It's a rare occasion where a state gets into arrears, which is thank you all for paying on time and very quickly. Most folks are way ahead with their dues payments. Mr. Chairman that is a quick summary of the Draft Policy, I'm happy to answer any questions.

CHAIRMAN GILMORE: Questions for Bob? Seeing none, we need a motion for this right, Bob? Do we just put up the motion from the Executive Committee or do we just put up a separate one and adopt it?

EXECUTIVE DIRECTOR BEAL: I think a motion that says move to modify the Commission's Rules and Regulations to implement the policy on nonpayment of state appropriations would probably be good.

CHAIRMAN GILMORE: Who would like to make that motion? Steve Train. Second to the motion, Justin Davis, is there any discussion on the motion? Seeing none, any objection to the motion that we haven't put up yet? Trust us, staff will get it right. They never fail. We'll move along and we'll put it up, and if there is anything wrong we'll fix it. **Okay, I'll read it into the record. Move to amend the Commission's Rules and Regulations to implement the policy on nonpayment of state appropriations, motion by Mr. Train, second by Dr. Davis.**

I'll do it again, any discussion on the motion, any objection to the motion? Seeing none, we will adopt it by unanimous consent.

CONSIDER NONCOMPLIANCE FINDINGS

CHAIRMAN GILMORE: Okay next order of business is noncompliance findings. I think we just recycle the motion from the Policy Board. We'll put that back up. Okay, I'm going to read this into the record. Doug, do you have any good jokes before you leave?

Okay, on behalf of the Interstate Fishery Management Program Policy Board, move that the Atlantic States Marine Fisheries Commission find the Commonwealth of Virginia out of compliance for not fully and effectively implementing and enforcing Section 4.3.7 Chesapeake Bay Reduction Fishery Cap of Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden.

The Commonwealth of Virginia must implement an annual total allowable harvest from the Chesapeake Bay by the reduction fishery of no more than 51,000 metric tons. The implementation of this measure is necessary to achieve the goals and objectives of the Fishery Management Plan and maintain the Chesapeake Bay marine environment to assure the availability of the ecosystem's resource on a long-term basis.

Is there any discussion on the motion? Seeing none, any objection to the motion? Seeing none, we will adopt it by unanimous consent.

REPORT FROM THE RESOLUTIONS COMMITTEE

CHAIRMAN GILMORE: That brings us to our Resolutions Committee. I understand that Steve Murphy, the Chair of the Resolution Committee is going to have something for us. Steve.

MR. STEVE MURPHY: Happy Halloween! Congratulations to the Nationals on their win. I didn't know I was on the Resolutions Committee. I think I got "voluntold" for this. Here is our best shot at it. Whereas the Atlantic States Marine Fisheries Commission conducted its 78th Annual meeting in the spectacular coastal town of New Castle, New Hampshire, which provided a magnificent venue for the Commissioners, Commission staff and Committee members to deliberate on difficult issues of mutual concern.

And, whereas the weather was crisp and cool and a bit damp, perhaps indicative of a traditional New England fall, but what we call in the south, winter. Whereas the place is full of rocks, the deer are tame, the tides are insane, and if you have 45 minutes to spare, you can drive the entire coast, but your car will get wet.

Whereas we've all been mesmerized by the stunning beauty of the fall colors, and refreshed by the wholesale dearth of loblolly pine trees and Spanish moss, whereas the New Hampshire Commissioner's spouses outdid themselves by providing an outstanding gift bag, including homegrown honey courtesy of Dennis Abbott, maple syrup, which is difficult to carry onboard your airplane, and Cheri's hand turned pens, and the spouse gift bag including a rock, which really is not as odd as it sounds.

Whereas the gracious host state of New Hampshire and the Commission provided most excellent adult beverages and hors d'oeuvres at the Monday reception, especially when you strategically station yourself near the kitchen door. And whereas the Commission recognized outstanding leadership and habitat conservation efforts of the Massachusetts DMF Eelgrass Team, including Tay Evans, Jillian Carr, Katelyn, Fred, and Alex Boeri, with the Commission's Melissa Laser Habitat Conservation Award.

And, whereas the spouse and guest tour of Portsmouth was a huge success, visiting Strawberry Bank, lunch at the Oar House followed by shopping and sightseeing, and whereas the annual ASMFC banquet, our host provided each of us with the biggest lobster dinner many of us have ever had, also resulting in what might be deemed a lobster coma, causing many of us to fall asleep and miss most of game six of the World Series.

And, whereas rumors are circulating that the Maine delegation was concerned about the optics of being seen consuming New Hampshire lobsters and opted for chicken. And whereas Roy Miller presented the Captain David H. Hart Award to Tom Fote, a most deserving recipient, who also has an uncanny ability to remember every person he ever met, what they said, and repeat it to you.

And, whereas the 28th Annual Laura Leach Fishing Tournament was a huge success in supporting two charities helping introduce kids to fishing, with prizes being awarded to almost every state north of the Mason/Dixon Line. And whereas Jim Gilmore was recognized for a job well done as he steps down as Chair, Pat Keliher slides one chair to the right, as he takes on this leadership role with Spud taking on his dream role of retirement as the Vice-Chair, both unanimously elected by the Commission. Now therefore let it be resolved that the Atlantic States Marine Fisheries Commission expresses its profound appreciation to the New Hampshire Commissioners; Doug Grout, David Watters, represented by the venerable Dennis Abbott, and Ritchie White, and the staff of the New Hampshire Fish and Game Department, especially Cheri Patterson, for their terrific assistance in the planning and execution of this outstanding 78th Annual Meeting. (Applause)

ADJOURNMENT

CHAIRMAN GILMORE: Very well done, Steve and without objection I think we will adopt that by unanimous consent as a resolution job well done. Is there any other business to come before the Business Session? Seeing none, I will hand the baton off to Pat, and we are adjourned. Thank you.

(Whereupon the meeting adjourned at 10:22 o'clock a.m. on October 31, 2019)