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

Douglas E. Grout (NH), Chair *James J. Gilmore, Jr., (NY), Vice-Chair* *Robert E. Beal, Executive Director*

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEMORANDUM

April 26, 2017

TO: Commissioners; Proxies; American Lobster Management Board; Atlantic Coastal Cooperative Statistics Program (ACCSP) Coordinating Council; Atlantic Herring Section; Atlantic Menhaden Management Board; Atlantic Striped Bass Management Board: Coastal Sharks Management Board; Climate Change Work Group; Executive Committee; ISFMP Policy Board; Law Enforcement Committee; South Atlantic State/Federal Fisheries Management Board; Summer Flounder, Scup, and Black Sea Bass Management Board; Tautog Management Board

FROM: Robert E. Beal REB
Executive Director

RE: ASMFC Spring: May 8 – 11, 2017 (TA # 17-064)

The Atlantic States Marine Fisheries Commission's Spring Meeting will be held May 8 – 11, 2017 at **The Westin Alexandria** (Telephone: 703.253.8600) located at 400 Courthouse Square, Alexandria, Virginia. Meeting materials are available on the Commission website at http://www.asmfc.org/home/2017-spring-meeting. Supplemental materials will be posted to the website on Wednesday, May 3, 2017.

Board/Section meeting proceedings will be broadcast daily via webinar beginning May 8th at 1:00 p.m. and continuing daily until the conclusion of the meeting (expected to be 3:00 p.m.) on Thursday, May 11th. The webinar will allow registrants to listen to board/section 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. Please go to https://attendee.gotowebinar.com/register/936308200287732994 to register.

I look forward to seeing you at the Spring 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#17-064, and Travel Reimbursement Guidelines

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:

For issues that are not on the agenda, 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.

For topics that are on the agenda, 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.

For agenda action items that have already gone out for public comment, 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 **submission of written comment for issues for which the Commission has *NOT* established a specific public comment period** (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 ***May 2, 2017***) 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, ***May 2, 2017 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.

Monday May 8, 2017

8:00 a.m. – Noon **Climate Change Working Group**
Members: Abrams, Armstrong, Arnott, Brady, Clark, Gartland, Gibson, Grout, McKown, Morrison, Muffley, Nowalsky, Train, White, Woodward
Chair: Grout
Staff: Kerns, Campfield

- Continue to Draft White Papers on Science and Policy Strategies to Assist the Commission in Adapting its Management to Changes in Species Abundance and Distribution Resulting from Climate Change Impacts

1:00 – 2:30 p.m. **Atlantic Herring Section**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey
Other Members: NEFMC (Non-voting)
Chair: White
Other Participants: Eastman, Kaelin, Zobel
Staff: Harp

1. Welcome/Call to Order *(R. White)*
2. Board Consent
    - Approval of Agenda
    - Approval of Proceedings from February 2017
3. Public Comment
4. Consider Addendum I for Final Approval **Final Action**
    - Review Options *(A. Harp)*
    - Public Comment Summary *(A. Harp)*
    - Advisory Panel Report *(J. Kaelin)*
    - Law Enforcement Committee Report *(M. Robson)*
    - Consider Final Approval of Addendum I
5. Review Scoping Comments on a Tiered Weekly Landing Limit **Possible Action**
6. Discuss 2016 Spawning Closure Pilot Program *(R. Zobel)* **Final Action**
    - Consider Permanent Implementation of the GSI_{30} Based Forecast System
7. Consider Approval of 2017 Fishery Management Plan Review and State Compliance Reports *(A. Harp)* **Action**
8. Review and Populate the Atlantic Herring Advisory Panel **Possible Action**
9. Other Business/Adjourn

2:45 – 5:15 p.m. **American Lobster Management Board**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia
Other Members: NEFMC, NMFS
Chair: Borden
Other Participants: Moore, Cloutier, Reardon, Bachman
Staff: Ware

1. Welcome/Call to Order *(D. Borden)*
2. Board Consent
    - Approval of Agenda
    - Approval of Proceedings from January 2017
3. Public Comment
4. Discuss New England Fishery Management Council Deep-Sea Coral Amendment **Possible Action**
    - Overview of Deep-Sea Coral Amendment Management Alternatives *(M. Bachman)*
5. American Lobster Gulf of Maine/Georges Bank Subcommittee Report *(M. Ware)*
6. Update on Development of American Lobster Draft Addendum XXVI *(M. Ware)*
7. Consider American Lobster Addendum XXV for Final Approval **Final Action**
    - Review Options *(M. Ware)*
    - Public Comment Summary *(M. Ware)*
    - Law Enforcement Committee Report *(M. Robson)*
    - Advisory Panel Report *(G. Moore)*
    - Consider Final Approval of Addendum XXV
8. Recess

Tuesday May 9, 2017

8:00 – 10:15 a.m. **American Lobster Management Board (continued)**

9. Reconvene
10. Consider Addendum XXV for Final Approval **Final Action**
11. Consider Inconsistencies between State and Federal Regulations **Possible Action**
    - Addenda XXI and XXII Provisions in Federal Waters *(M. Ware)*
    - Lobster Conservation Management Area 4 Season Closure *(M. Ware)*
12. Other Business/Adjourn

8:30 a.m. – 5:00 p.m. **Law Enforcement Committee (LEC)**

(A portion of this meeting will be a closed session for Law Enforcement Committee members only to discuss ongoing enforcement activities)

Members: Anthony, Blanchard, Burton, Cloutier, Donovan, Eastman, Furlong, Gadomski, Garner, Gordon, Green, Hettenbach, Kersey, King, Lynn, Messeck, Moore, Moran, Overturf, Santiago, Snellbaker

Chair: Eastman

Staff: Robson

1. Call to Order/Roll Call of the LEC Representatives *(M. Eastman)*
2. Approval of Agenda and Minutes from May 2016
3. Public Comment
4. Review and Update of Regional Tautog Management Options
5. Review 2017 Action Plan Items
6. Report on Atlantic Herring Addendum I Final Action
7. Discuss Storm Preparedness, Training and Equipment
8. Discuss New or Emerging ASMFC Species Management Issues
9. Review and Discuss American Lobster Management Issues
10. Review and Discuss Ongoing Enforcement Activities **(Closed Session)**
11. Federal Agency Reports
12. State Agency Reports
13. Discuss NOAA Priority-setting and Planning for ASMFC Input
14. Update Survey for Enforceability Guidelines
15. Discuss ISFMP Species Management Issues
16. Develop Orientation Process for New LEC Members
17. Other Business/Adjourn

10:30 a.m. – 12:30 p.m. **Tautog Management Board**

Member States: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia

Other Members: NMFS, USFWS

Other Participants: McNamee, Snellbaker

Chair: Nowalsky

Staff: Harp

1. Welcome/Call to Order (*A. Nowalsky)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2017
3. Public Comment
4. Review Consistent Management Measures by Region *(J. McNamee, A. Harp)*
   - Massachusetts/Rhode Island
   - Long Island Sound

- New Jersey/New York Bight
- Delaware/Maryland/Virginia

5. Consider Draft Amendment 1 for Public Comment **Action**
   - Review Management Options *(A. Harp)*
   - Law Enforcement Report *(J. Snellbaker)*
   - New York Letter to the Board Regarding the Long Island Sound Boundaries *(J. Gilmore)*
6. Other Business/Adjourn

1:00 – 3:15 p.m. **Atlantic Striped Bass Management Board**

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: Gilmore
Other Participants: Lengyel
Staff: Appelman

1. Welcome/Call to Order *(J. Gilmore)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2017
3. Public Comment
4. Consider Draft Addendum V for Public Comment *(M. Appelman)* **Action**
   - Technical Committee Report *(N. Lengyel)*
5. Consider Approval of 2018 Atlantic Striped Bass Benchmark Stock Assessment Terms of Reference *(K. Drew)* **Action**
6. Board Guidance to Stock Assessment Subcommittee Regarding Development of Biological Reference Points for the 2018 Benchmark Stock Assessment *(K. Drew)*
7. Other Business/Adjourn

3:30 – 5:45 p.m. **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
Other Participants: McNamee, Kersey
Chair: Ballou
Staff: Ware

1. Welcome/Call to Order *(R. Ballou)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2017
3. Public Comment
4. Consider Hilborn et al. 2017 Paper for Technical Review (*R. Ballou*) **Possible Action**
5. Biological Ecological Reference Points Work Group Progress Report (*S. Madsen*)
6. Update on Draft Amendment 3 *(M. Ware)* **Possible Action**

- Review Allocation Workgroup Recommendations
- Provide Guidance/Additional Input to Plan Development Team Regarding Management Options

7. New York Participation in Episodic Events Program (*J. Gilmore*) **Possible Action**
8. Provide Guidance to Technical Committee Regarding Stock Projections
   - Review Stock Projection Methodology *(J. McNamee)*
9. Consider Approval of 2017 FMP Review and State Compliance Reports *(M. Ware*) **Action**
10. Other Business/Adjourn

6:30 – 8:00 p.m. **Annual Awards of Excellence Reception**

Wednesday May 10, 2017

8:00 – 9:30 a.m. **Executive Committee**

Breakfast to be served ***(A portion of this meeting may be a closed session for Committee members and Commissioners only)***

Members: Abbott, Allen, Blazer, Boyles, Jr., Bull, Clark, Davis, Estes, Gilmore, Grout, Keliher, McNamee, Miller, Miner, Pierce, Shiels, Woodward
Chair: Grout
Staff: Leach

1. Welcome/Call to Order *(D. Grout*)
2. Committee Consent
   - Approval of Agenda
   - Approval of Meeting Summary from February 2017
3. Public Comment
4. Report of the Administrative Oversight Committee
   - Presentation of FY18 Proposed Budget
5. Discussion on Advisory Panel Members Serving as Board Proxies
6. Consider the Necessity for Technical Committee Meeting Weeks *(R. Beal)*
7. Future Annual Meetings Update *(L. Leach)*
8. Executive Director's Annual Performance Review *(R. Beal)* **(Closed Session)**
9. Other Business/Adjourn

9:45 – 10:45 a.m. **Coastal Sharks Management Board**

Member States: Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: NMFS, USFWS
Chair: Miller
Other Participants: Garner, Gillingham
Staff: Harp

1. Welcome/Call to Order *(R. Miller)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2016

3. Public Comment
4. Final Rule for Highly Migratory Species (HMS) Amendment 5b (Dusky Sharks)
   - Review Final Rule for HMS Amendment 5b *(K. Brewster-Geisz)*
   - Advisory Panel Report (*L. Gillingham*)
   - Consider Complementary Management Measures (*R. Miller*) **Possible Action**
5. Other Business/Adjourn

11:00 a.m. – Noon **Atlantic Coastal Cooperative Statistics Program Coordinating Council**
Members: Alexander, Baum, Beal, Blazer, Boyles, Jr., Carmichael, Cimino, Clifford, Coit, Cyr, Detlor, Fegley, Gary, Geer, Gilmore, Grout, Keliher, King, McCawley, Michels, Moore, Nies, Perkins, Pierce, Ponwith, Risenhoover, Shiels, Stephen, White
Chair: Boyles, Jr.
Staff: Cahall

1. Welcome/Introductions *(R. Boyles, Jr.)*
2. Public Comment
3. Council Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2016
4. ACCSP Status Report
   - Program Status *(M. Cahall)*
   - Committee Updates *(P. Campfield)*
5. Review and Consider Approval of 2017 Request for Proposals *(M. Cahall)* **Action**
6. Other Business/Adjourn

1:00 – 5:30 p.m. **Summer Flounder, Scup, and Black Sea Bass Management Board and Mid-Atlantic Fishery Management Council (MAFMC)**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina
MAFMC Members: Batsavage, Baum, Beaty, Dancy, DeFur, DiLernia, Elliott, Heins, Hemilright, Hughes, King, Luisi, Mann, McMurray, Michels, Moore, Muffley, Nolan, Nowalsky, O'Reilly, Shiels, Slacum, Townsend, Winslow
Other Members: NMFS, PRFC, USFWS
Other Participants: Wojcik, Snellbaker
Chair: Luisi
Staff: Rootes-Murdy

1. Welcome/Call to Order *(M. Luisi)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2017
3. Public Comment

4. Scup Addendum XXIX for Final Approval *(K. Rootes-Murdy)* **Final Action***
   - Review Management Alternatives
   - Public Comment Summary
   - Technical Committee Report
   - Advisory Panel Report
   - Consider Final Approval of Addendum XXIX
     ** Council will also take action on Scup Framework 10*
5. Review Summer Flounder Draft Comprehensive Amendment Range of Alternatives for Commercial Issues (*K. Rootes-Murdy, K. Dancy*)
6. Consider 2017 Black Sea Bass Recreational Measures *(K. Rootes-Murdy)* **Final Action**
   - Review Final 2016 Recreational Black Sea Bass Harvest Estimate
   - Consider Management Response to the Final Harvest Estimate
7. Review White Paper on Potential Experimental Recreational Wave 1 Black Sea Bass Fishery *(B. Muffley)* **Possible Final Action***
   - Consider Postponed Motion to Allow Experimental Wave 1 For-hire Fishery:
     Motion to allow an experimental 2018 January/February (wave one), recreational federally permitted for-hire fishery for black sea bass with a 15 fish per person possession limit, a suspended minimum size limit, and a zero discard policy to allow for barotrauma, and a mandatory trip reporting requirement.
     ** Joint Board and Council Action*
8. Review State Compliance with Addendum XXVIII Summer Flounder Recreational Measures for 2017 **Possible Action**
9. Review White Paper on Summer Flounder Recreational Specifications *(R. Ballou)*
10. Other Business/Adjourn

Thursday May 11, 2017

8:00 – 10:30 a.m. **Interstate Fisheries Management Program (ISFMP) 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
Other Participants: VanVoorhees
Chair: Grout
Staff: Kerns

1. Welcome/Call to Order *(D. Grout)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from January 2017
3. Public Comment
4. Executive Committee Update *(D. Grout)*
5. Review and Consider New Jersey Appeal of Addendum XXVIII to the Summer Flounder Fishery Management Plan **Final Action** *(D. Grout*)
6. Update on Climate Change Working Group *(T. Kerns*)
7. Review and Discuss 2017 Commissioner Survey Results *(D. Tompkins)*
8. Committee Report on Safe Harbor Landings *(J. Gilmore)* **Possible Action**

9. Update on the Marine Recreational Information Program Transition of the Fishing Effort Survey and APAIS *(D. Van Voorhees*)
10. Review and Consider Approval of Standard Meeting Practices *(T. Kerns)* **Action**
11. Progress Update on the 2017 Sturgeon Benchmark Stock Assessment *(K. Drew)*
12. Review and Consider Approval of the Assessment Schedule *(S. Madsen*) **Action**
13. Standing Committee Reports
    - Law Enforcement Committee *(M. Robson)*
    - Habitat and Artificial Reefs *(L. Havel)*
    - Atlantic Coastal Fish Habitat Partnership *(L. Havel)*
14. Review Non-compliance Findings (if necessary) **Final Action**
15. Other Business/Adjourn

10:30 – 11:00 a.m. **Business Session (if necessary)**

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

1. Welcome/Introductions *(D. Grout)*
2. Board Consent
    - Approval of Agenda
3. Public Comment
4. Review Non-compliance Findings (if necessary) **Final Action**
5. Other Business/Adjourn

11:15 a.m. – 3:00 p.m. **South Atlantic State/Federal Fisheries Management Board**

Member States: New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: DC, PRFC, NMFS, SAFMC, USFWS
Other Participants: Jiorle, Lynn, Lee, McDonough, Powers, Rickabaugh
Chair: Estes
Staff: Schmidtke, Daniel

1. Welcome/Call to Order *(J. Estes)*
2. Board Consent
    - Approval of Agenda
    - Approval of Proceedings from February 2017
3. Public Comment
4. 2017 Atlantic Croaker Benchmark Stock Assessment **Final Action**
    - Presentation of Benchmark Stock Assessment Report *(C. McDonough)*
    - Peer Review Panel Report *(P. Campfield)*
    - Consider Acceptance of Benchmark Stock Assessment and Peer Review Report for Management Use
    - Consider Management Response to Benchmark Stock Assessment and Peer Review Report *(J. Estes)*

5. 2017 Spot Benchmark Stock Assessment **Final Action**
   - Presentation of Benchmark Assessment Report *(C. McDonough)*
   - Peer Review Panel Report *(P. Campfield)*
   - Consider Acceptance of Benchmark Stock Assessment and Peer Review Report for Management Use
   - Consider Management Response to Benchmark Stock Assessment and Peer Review Report *(J. Estes)*
6. Progress Report on Cobia Draft Fishery Management Plan *(L. Daniel)*
   - Provide Guidance to the Plan Development Team
7. Other Business/Adjourn

Atlantic States Marine Fisheries Commission

Atlantic Herring Section

May 8, 2017
1:00 – 2:30 p.m.
Alexandria, 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 *(R. White)*	1:00 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from February 2017	1:00 p.m.
3.	Public Comment	1:05 p.m.
4.	Consider Addendum I for Final Approval **Final Action** • Review Options *(A. Harp)* • Public Comment Summary (*A. Harp*) • Review Advisory Panel Report *(J. Kaelin)* • Review Law Enforcement Committee Report (*M. Robson*) • Consider Final Approval of Addendum I	1:15 p.m.
5.	Review Scoping Comments on a Tiered Weekly Landing Limit **Possible Action**	1:55 p.m.
6.	Discuss 2016 Spawning Closure Pilot Program *(R. Zobel)* **Final Action** • Consider Permanent Implementation of the GSI_{30} Based Forecast System	2:15 p.m.
7.	Consider Approval of 2017 Fishery Management Plan Review and State Compliance Reports *(A. Harp)* **Action**	2:25 p.m.
8.	Review and Populate the Atlantic Herring Advisory Panel **Possible Action**	2:29 p.m.
9.	Other Business/Adjourn	2:30 p.m.

The meeting will be held at the Westin Alexandria; 400 Courthouse Square; Alexandria, VA; 703.253.8600

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEETING OVERVIEW

Atlantic Herring Section Meeting
May 8, 2017
1:00 - 2:30 p.m.
Alexandria, Virginia

Chair: Ritchie White (NH) *Assumed Chairmanship 2/16*	Technical Committee Chair: Renee Zobel (NH)	Law Enforcement Committee Michael Eastman
Vice Chair: Mark Gibson	Advisory Panel Chair: Jeff Kaelin	Previous Section Meeting: January 31, 2017
Voting Members: ME, NH, MA, RI, CT, NY, NJ (7 votes)		

2. Section Consent
- Approval of Agenda
- Approval of Proceedings from January 2017

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 Section 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 Section Chair may allow limited opportunity for comment. The Section Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Consider Addendum I for Final Approval (Final Action)
Background • The intent of the addendum is to implement effort controls that can slow the rate of Area 1A catch so the seasonal quota can be spread throughout the entirety of each trimester, specifically Trimester 2. • The addendum includes 6 alternatives to modify the Days Out program. • Public hearings were held in Maine, New Hampshire, Massachusetts and New Jersey. Staff received 17 written comments, including a small-mesh bottom trawl petition with 82 signatures. • Draft Addendum I, public hearing summary, written comment summary, Advisory Panel report and LEC report are in **Briefing Materials**

- NMFS Letter Regarding Access to VMS data and NEFMC written comment in **Supplemental Materials**

5. Review Scoping Comments on a Tiered Weekly Landing Limit (Possible Action)
Background • Staff will provide a summary of the feedback garnered on 9 scoping questions • Public hearing summary, written comment summary in **Briefing Materials**

5. Discuss 2016 Spawning Closure Pilot Program (Final Action)
Background • Upon approval of Amendment 3 the Atlantic Herring Section granted a one-year pilot of a new method, known as the GSI30-Based Forecast System, to be tested in the 2016 fishing season, followed by a performance review. The Section has the option to permanently implement the forecast system or to revert back to the length-based closure system (from prior years). • 2016 Spawning Closure Overview in **Supplemental Materials**

6. Consider 2017 FMP Review and State Compliance Reports (Action)
Background • No compliance issues to report • New York has requested *de minimis* status. • FMP Review in **Supplemental Materials**

7. Review and Populate the Advisory Panel (Possible Action)
Background • An overview of current membership and vacant seats is in **Briefing Materials.**

8. Other Business/Adjourn

2017 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR

ATLANTIC HERRING
(Clupea harengus)

2015 - 2016 FISHING YEARS

Atlantic Herring Plan Review Team

Renee Zobel, New Hampshire Fish and Game
Melissa Smith, Maine Department of Marine Resources
Ashton Harp, Atlantic States Marine Fisheries Commission

Table of Contents

I. Status of Fishery Management Plan

<u>Date of FMP Approval</u>	November 1993
<u>Amendments</u>	Amendment 1 (February 1999) Amendment 2 (March 2006) Amendment 3 (February 2016)
<u>Addenda</u>	Addendum I to Amendment 1 (July 2000) Technical Addendum #1A to Amendment I (October 2001) Addendum II to Amendment I (February 2002) Technical Addendum 1 to Amendment 2 (August 2006) Addendum I to Amendment 2 (March 2009) Addendum II to Amendment 2 (December 2010) Addendum V to Amendment 2 (October 2012) Addendum VI to Amendment 2 (August 2013)
<u>Management Unit</u>	US waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the Exclusive Economic Zone (East Coast of Maine), and from the US/Canadian border to the southern end of the species range (Cape Hatteras, North Carolina).
<u>States With Declared Interest</u>	Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey
<u>Active Boards/Committees</u>	Atlantic Herring Section, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Development Team, and Plan Review Team

Atlantic herring (*Clupea harengus*), also known as sea herring, are an oceanic fish that occur in large schools and undergo seasonal inshore-offshore migrations. Herring are important to the Northwest Atlantic ecosystem as a forage species and to industry as bait for lobster, blue crab, and tuna. To a lesser degree this resource also serves as a food fish, typically canned, pickled, or smoked. The U.S. Atlantic herring fishery is currently managed as a single stock through complementary plans by the Atlantic States Marine Fisheries Commission (ASMFC) and the New England Fishery Management Council (NEFMC).

The stockwide annual catch limit (ACL) is divided amongst four distinct management areas: inshore Gulf of Maine (Area 1A), offshore Gulf of Maine (Area 1B), Southern New England/Mid-Atlantic (Area 2), and Georges Bank (Area 3). The Area 1A fishery is managed by ASMFC's Atlantic Herring Section (Section), which includes representatives from Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York and New Jersey.

The 1993 ASMFC Atlantic Herring Fishery Management Plan (FMP) was implemented to address the growth of the herring resource and interest in Internal Waters Processing (IWP) operations.

Amendment 1 to the FMP was developed to complement the goals and objectives of the NEFMC federal management plan. It established total allowable catch limits (TACs) for specific management areas. The Days Out program was established for state waters.

Addendum I (2000) redefined spawning areas in state waters. It also reduced the exploitation of herring spawning aggregations by imposing a limited landing restriction on herring caught in spawning areas (20% tolerance for spawn herring in Maine and Massachusetts). Technical Addendum #1A (October 2001) was approved to change the delineation of the Eastern Maine spawning area.

Addendum II (2002) was developed in conjunction with NEFMC's Framework Adjustment 1 to allocate the Management Area 1A TAC on a seasonal basis. This addendum also specifies procedures to allocate the annual Internal Waters Processing (IWP) quota.

Amendment 2 (2006) to the FMP was developed to complement management measures in Amendment 1 to the federal FMP. Identical management area boundaries were adopted, in addition to a joint TAC specification setting process between NEFMC and ASMFC, and management area closure when 95% of the TAC is harvested. Technical Addendum I to Amendment 2 (2006) was developed to address inconsistent interpretation of the zero tolerance spawning provision.

Addendum I (2009) identifies tools to address effort in Area 1A in order to maintain a steady supply of herring throughout the fishing season. States adjacent to Area 1A can set bi-monthly, trimester or seasonal quotas and roll the quota into later periods if there is under-harvest. It also requires states to implement weekly reporting for timely quota management.

Addendum II (2010) was developed to complement Amendment 4 to the federal FMP. It revises the specifications process (sets measures for three-years) and terminology (e.g., TAC is now called ACL) to be consistent with federal management.

Addendum V (2012) compiles the previously approved spawning regulations into one document and revises the spawning sample provisions.

Addendum VI (2013) was developed to complement the NEFMC's Framework Adjustment 2 to the federal FMP. It established new provisions and consistent measures for the four management areas. States may seasonally split sub-ACLs for each management area, and up to 10% of unused sub-ACL may be carried over to the following fishing year (after data is available). Addendum VI also set new closure triggers: a directed fishery will close when 92% of an area's sub-ACL is projected to be reached, and the stockwide fishery will close when 95% of the total ACL is projected to be reached.

Amendment 3 (2016) to the FMP consolidates prior amendments, addenda, and recent management decisions into a single document; it is now the comprehensive document for Atlantic herring management in state waters. The amendment refines the spawning closure system using a modified GSI-based spawning monitoring system. Additionally, the fixed gear set-aside is now available to fixed gear fishermen through December 31.

The Section initiated Draft Addendum I to Amendment 3 in October 2016 to address herring shortages for the bait market. The Draft Addendum includes management options to ensure the seasonal quota is distributed throughout Trimester 2 (June through September), are applied consistently by the states adjacent to Area 1A, and address excessive capacity. It will be considered for final approval in 2017.

II. Status of the Stock

A benchmark stock assessment was published in 2012. An update was released in 2015 to incorporate data through 2014. Both assessments indicate the stock is not overfished and not experiencing overfishing.

In the 2015 update, the maximum sustainable yield (MSY) based reference points were updated; the overfishing threshold is $F_{MSY} = 0.24$ and the overfished threshold is $½SSB_{MSY}$ = 342 million lbs. (155,573 mt). The 2015 update estimated fishing mortality to be 0.16 in 2014 and spawning stock biomass to be 1.3 billion lbs (623,000 mt). The 2012 age-1 recruitment was estimated to be the second largest in the time series and equaled 42.4 billion fish.

For the 2016-2018 fishing season, the Council and Commission set the ACL at 231 million pounds (104,800 mt), a mere 2.6% decrease from the 2013-2015 fishing limits. For all three years, the ACL is further subdivided by Atlantic herring management areas as follows: Area 1A = 66.79 million pounds, Area 1B = 9.9 million pounds, Area 2 = 64.1 million pounds, and Area 3 = 90.16 million pounds. The Area 1A sub-ACL is distributed seasonally with 72.8% available from June 1-September 30 and 27.2% available from October 1-December 31. Underages from June through September may be rolled into the October through December period. Directed fisheries within a management area will close when 92% of the sub-ACL has been harvested, and the stock-wide fishery will close when 95% of the ACL is projected to be reached.

III. Fishery Performance in 2015 and 2016

There is an Atlantic herring fishery in the United States and Canada. The U.S. Atlantic herring fishery is controlled by annual catch limits (ACL) set by NOAA Fisheries. The stockwide ACL is distributed among the four management areas. Specifications are set every three years and adjusted annually to account for overages or underages from the previous fishing season. Once 92% of the sub-ACL for an area is reached, the respective fishery will be closed. The stockwide fishery will close when 95% of the total ACL is projected to be reached (Addendum VI). Following a closure, there is a 2,000 lb trip limit to allow for incidental bycatch of Atlantic herring for the remainder of the fishing year. In addition to quota-based closures, the “days out” and spawning closure programs provide additional measures to control fishing effort.

The domestic Atlantic herring fishery is predominantly commercial; recreational catch accounts for less than 1% of landings. Over the time series from 1965 to 2016, annual landings by the

United States Atlantic herring fleet generally increased and averaged about 58,335 mt. Landings reached the lowest level in 1983, with 23,254 mt and peaked in 2006 with 121,807 mt. Average landings are 78,838 mt since the FMP was implemented in 1993. Landings totaled 78,972 mt in 2015 and 62,348 mt in 2016, with the majority taken by trawl and purse seine gears.

State Fisheries

Based on preliminary data provided in state compliance reports, Maine and Massachusetts accounted for 89.7% of the commercial Atlantic herring landings in 2015, and 91.1% in 2016 (Table 1).

Table 1. Commercial landings by state and percent of total harvest. Source: State compliance reports

	2015		2016*	
State	**Commercial Landings**	**Percent of Total**	**Commercial Landings**	**Percent of Total**
ME	85,030,089	48.8%	78,358,902	57%
NH	3,998,860	2.3%	89,730	0.07%
MA	71,135,004	40.8%	46,877,215	34.1%
RI	10,390,744	5.9%	9,278,837	6.75%
CT	21,914	0.01%	51,458	0.04%
NY	128,596	0.07%	72,538	0.05%
NJ	3,526,334	2.02%	2,798,128	2.03%
Total	174,231,541		137,526,808	

*2016 data is preliminary

In 2015 and early in the 2016 fishing season, the Area 1A seasonal quota was harvested at an above-average rate and there were concerns about the availability of Atlantic herring bait throughout the summer and early fall months (June-September). For more information on historical Area 1A effort controls and the 2015/2016 fishing season, refer to the fishery performance white paper.
http://www.asmfc.org/uploads/file/58124582AtlHerringArea1AFisheryPerformance_2015_2016.pdf

2015 Fishing Season

Summary: In Area 1A the rate of landings accelerated in August such that the seasonal quota was exceeded on August 28; triggering a zero landing day scenario for all of September.

The increase in Area 1A landings occurred as Area 3 landings became stagnant, likely due to Georges Bank haddock catch cap concerns. Based on preliminary haddock data, 63% of the Georges Bank haddock catch cap had been used by the midwater trawl fleet at the end of July, which likely deterred vessels from continuing to fish in Area 3. This lack of Area 3 landings in August disrupted the flow of herring supply to markets and put more pressure on Area 1A.

On August 26, the Commission scheduled an emergency days out call to discuss the increase in Area 1A landings. Some harvesters agreed to stop fishing until the next landings report was released. Ultimately, the sudden increase in effort in August could not be diminished by decreasing the number of landing days, rather the Area 1A fishery moved to zero landing days on August 28. As a result, Atlantic herring vessels could not fish in Area 1A during the month of September, when demand for herring is strong. Area 1A re-opened for Trimester 3 on October 5, 2015 with three landing days and closed on November 9, 2015.

2016 Fishing Season

Summary: Above-average landings at the start of the season and thereafter led to emergency restrictions for vessels landing in Maine (on behalf of Maine DMR), which were more restrictive than those of the Commission.

The 2016 Area 1A Atlantic herring fishing season opened in June to almost double the projected landings. For example, three weeks into June the fishery was projected to have harvested 1,300 mt; however, 2,837 mt had been harvested. During June – August, the primary source of Atlantic herring landings was from Area 1A. Similar to 2015 but earlier in the season, Area 3 landings became stagnant and Area 1A landings increased. Area 3 herring fishermen reported finding some Atlantic herring schools, but in deep waters and intermixed with haddock schools. Utilization of more than half of the Georges Bank haddock catch cap so early in the 2015 fishing season prompted a small number of midwater trawl vessels to shift effort to Area 1A in 2016 to operate as purse seiners.

The New Hampshire landings dropped significantly in 2016 due to the restrictive landing regulations for Maine vessels. In prior years a Maine purse seine vessel landed in New Hampshire. In 2016, New Hampshire herring harvesters were primarily small mesh bottom trawl vessels.

The Area 1A fishery moved to zero landing days on September 18. Area 1A re-opened for Trimester 3 on October 2, 2016 with four landing days and closed on October 18, 2016.

Spawning Area Closures

The Atlantic Herring Area 1A (inshore Gulf of Maine) fishery regulations include seasonal spawning closures for portions of state and federal waters in Eastern Maine, Western Maine and Massachusetts/New Hampshire. In 2016, the Commission's Atlantic Herring Section approved a one-year pilot of a new forecasting method that relies upon at least three samples, each containing at least 25 female herring in gonadal stages III-V, to trigger a spawning closure.

Vessels were not fishing in the Eastern Maine spawning area during Trimester 2, as a result there were no samples to determine spawning condition. The Eastern Maine spawning area was closed from August 28, 2016 to September 24, 2016.

Sampling in the Western Maine spawning area began on August 7, 2016; five samples totaling 216 female herring were collected to evaluate spawning condition. Based on the analysis of the samples, the Western Maine spawning area was closed from September 18, 2016 to October 15, 2016.

Sampling in the Massachusetts/New Hampshire spawning area began on August 8, 2016; nine samples totaling 654 female herring were collected to evaluate spawning condition. Based on the analysis of the samples, the Massachusetts/New Hampshire (MA/NH) spawning area was closed from October 2, 2016 to October 29, 2016.

IV. Status of Assessment Advice

The following research recommendations were included in the 2012 benchmark stock assessment (also in Section XI). The 2015 stock assessment update did not provide additional research recommendations.

<u>Research Recommendations from the 54th Northeast Region Stock Assessment for Atlantic Herring (2012)</u>

a. More extensive stock composition sampling including all stocks (i.e. Scotian Shelf).
b. Develop (simple) methods to partition stocks in mixed stock fisheries.
c. More extensive monitoring of spawning components.
d. Analyze diet composition of archived mammal stomachs. Improve size selectivity of mammal prey. Also sea birds.
e. Consider alternative sampling methods such as HabCam.
f. Research depth preferences of herring.
g. Simulation study to evaluate ways in which various time series can be evaluated and folded into model.
h. Evaluate use of Length-based models (Stock Synthesis and Chen model)
i. Develop indices at age from shrimp survey samples
j. Evaluate prey field to determine what other prey species are available to the predators that could explain some of the annual trends in consumption.
k. Develop statistical comparison of consumption estimates and biomass from model M.
l. Consider information on consumption from other sources (i.e. striped bass in other areas) and predators inshore of the survey.
m. Investigate why small herring are not found in the stomachs of predators in the NEFSC food habits database.
n. Develop an industry-based LPUE or some other abundance index (Industry Based Survey).

o. Develop objective criteria for inclusion of novel data streams (consumption, acoustic, larval, etc) and how can this be applied.

V. Status of Research and Monitoring

Under Amendment 3, states are not required to conduct fishery independent surveys for Atlantic herring. However, state survey programs designed to catch other species may encounter herring regularly, so some states do collect biological information on Atlantic herring. A summary of these surveys results follow.

Spawning Area Closure Monitoring Program

Upon approval of Amendment 3, the Atlantic Herring Section granted a one-year pilot of a new method, known as the GSI30-Based Forecast System, to be tested in the 2016 fishing season. The closure date for a spawning area will be projected based on a minimum of three fishery dependent or independent samples, each containing <u>at least</u> 25 female herring in ICNAF gonadal stages III-V. See Section III for 2016 results.

Maine and New Hampshire: The states jointly operate an inshore bottom trawl survey in the spring and fall that is designed to catch groundfish, but regularly encounters Atlantic herring. From 2003 to 2016, the number of herring per tow was generally increasing, with variance between years.

In 2015, preliminary data indicate 53 Atlantic herring (lengths ranging between 9 and 24 cm) were captured during the spring inshore trawl survey, while 8,332 Atlantic herring (lengths ranging between 13 and 27 cm) were captured during the fall survey. In 2016, preliminary data indicate 96 Atlantic herring (lengths ranging between 11 and 27 cm) were captured during the spring inshore trawl survey, while 661 Atlantic herring (lengths ranging between 19 and 27 cm) were captured during the fall survey.

Maine Department of Marine Resources also conducts commercial portside catch sampling as part of an ACCSP grant to examine bycatch. In 2015 and 2016, 144 and 88 samples were taken each year, respectively. The fish were processed for length, weight, age, sex, spawning condition, gut fullness, etc.

New Hampshire Fish and Game Department also conducts the juvenile finfish seine survey in the Great Bay, its tributaries, and other coastal harbors. In 2015, 124 Atlantic herring were observed during the months of June, July, and August. In 2016, 8 herring were observed during June and July.

In 2015, **Massachusetts** Division of Marine Fisheries and UMass-Dartmouth School for Marine Science and Technology (SMAST) applied for the 2016-2018 Atlantic herring Research Set-Aside (RSA), and were awarded the majority of RSA quota. Portside sampling and the River Herring Bycatch Avoidance program were conducted with both the midwater trawl (MWT) fishery (primarily operating out of Massachusetts ports) and the small-mesh bottom trawl (SMBT) fishery operating out of Rhode Island ports. These programs have been ongoing since 2010 and 2011, respectively.

The primary goals of the River Herring Bycatch Avoidance programs are to characterize the landings of vessels and advise the fleets of river herring bycatch, in an effort to minimize bycatch independent of management actions. Similar to the 2015 fishing year, participating fishermen were not able to pursue RSA quota until November of 2016, therefore funds were not generated until late in the year. Eventually 873 of 2,136 metric tons of RSA quota were harvested (41%); however industry partners compensated for additional uncaught quota, helping the RSA generate over $68,000 towards the sampling and bycatch avoidance program. Some of the funds generated in late 2016 will allow for sampling in 2017, when the awarded RSA quota will likely be harvested late in the calendar year.

Rhode Island Division of Fish & Wildlife conducts a Seasonal Trawl Survey to develop abundance indices for Atlantic herring. Fishery-independent monitoring for 2015-2016 suggested a recent increase in relative biomass and abundance of Atlantic herring in Rhode Island waters in the spring component of the RIDFW seasonal trawl survey (2016, 3.82 kg/tow, 189.88 fish/tow; 2015, 0.92 kg/tow, 27.90 fish/tow). Atlantic herring are rarely observed in the fall component of the survey, but are not uncommon in the spring.

Connecticut Department of Energy and Environmental Protection monitors Atlantic herring through the Long Island Sound Trawl Survey (LISTS), which is conducted each spring and fall since 1984. The spring abundance index was 0.69 fish/tow for both 2015 and 2016, which is 51% below the previous 10 year average. Few herring are caught in the fall survey, and most Atlantic herring taken in LISTS spring survey are greater than 20 cm fork length. It is believed that juvenile Atlantic herring are a significant component of the LIS forage base despite low survey indices of adults.

New York has *de minimis* status and does not conduct directed monitoring of Atlantic herring. Western Long Island Juvenile Striped Bass Survey and Peconic Estuary Small Mesh Trawl Survey encounter juvenile Atlantic herring with great variance from year to year, but does not routinely summarize the data. However, the information can be prepared at the request of management.

New Jersey
New Jersey Division of Fish and Wildlife monitors Atlantic herring through the New Jersey Ocean Trawl Survey, which collects samples during five surveys conducted throughout the year between Sandy Hook, NJ and Cape Henlopen, Delaware. In 2016, 869 pounds, or 3,556 individual Atlantic herring were caught.

VI. Management Measures and Issues

Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring lists the following state regulatory requirements:

1. Each jurisdiction shall prohibit the landing of herring when the management area sub-ACL has been attained.
2. Vessels are prohibited from landing more than 2,000 lbs. of Atlantic herring from Area 1A when the fishery is closed, during a 'day out' or during spawning closures.
3. Jurisdictions will close the directed fishery when 92% of a management area's sub-ACL is projected to be harvested.
4. Each jurisdiction must enact spawning area restrictions that are at least as restrictive as those in Section 4.2.6.
5. States adjacent to Area 1A will implement days out restrictions as identified in Section 4.2.4.1.
6. States are required to implement weekly reporting by all non-federally permitted fishermen on Atlantic herring (including mobile and fixed gear).
7. Any herring vessel transiting a management area that is under a herring spawning closure or a 'day out' must have all of its fishing gear stowed.
8. The harvest of herring for the primary purpose of reduction to meal or meal-like product is prohibited.
9. Internal Water Processing operations will be prohibited from processing herring caught in all state waters.

VII. PRT Recommendations

State Compliance
All states are required to submit annual compliance reports by February 1.

All states with a declared interest in the management of Atlantic herring have submitted compliance reports and have regulations in place that meet or exceed the requirements of the Interstate Fisheries Management Plan for Atlantic herring as described in Amendment 3.

There is a PRT request for the following information to be included in next year's compliance reports:

- **Maine:** Need to show the fixed gear harvest from state versus federal waters
- **All states:** Provide a web link to the regulations

Request for *De Minimis* Status
A state may be eligible for *de minimis* status if its combined average of the last three years of commercial landings (by weight) constitute less than one percent of the coastwide commercial landings for the same three-year period.

New York has requested and met the requirements for *de minimis* status in 2017. Landings have averaged 0.06% of the coastwide landings since 2014. New York landed 116,982 lbs in 2014; 128,596 in 2015; and 72,538 in 2016.

VIII. Law Enforcement Report

There were no law enforcement concerns in 2015-2016.

IX. Future Compliance Issues

None.

X. Research and Monitoring Recommendations

Fishery-Dependent Priorities

High

- Develop (simple) methods to partition stocks in mixed stock fisheries.
- Investigate bycatch and discards in the directed herring fishery through both at sea and portside sampling.
- Continue commercial catch sampling of Atlantic herring fisheries according to ACCSP protocols

Fishery-Independent Priorities

High

- Conduct more extensive stock composition sampling including all stocks (i.e., Scotian Shelf).
- Expand monitoring of spawning components.

Low

- Continue to utilize the inshore and offshore hydroacoustic and trawl surveys to provide a fishery-independent estimation of stock sizes. Collaborative work between NMFS, DFO, state agencies, and the herring industry on acoustic surveys for herring should continue to be encouraged.
- Consider alternative sampling methods such as HabCam.

Modeling / Quantitative Priorities

High

- Evaluate use of length based models (Stock Synthesis and Chen model).
- Develop statistical comparison of consumption estimates and biomass from model M.

Moderate

- Develop indices at age from shrimp survey samples.
- Conduct simulation studies to evaluate ways in which various time series can be evaluated and folded into the assessment model.
- Develop new approaches to estimating recruitment (i.e., juvenile abundance) from fishery-independent data.
  Examine the possible effects of density dependence (e.g., reduced growth rates at high population size) on parameter estimates used in assessments.

Low

- Develop an industry based LPUE or some other abundance index (Industry Based Survey).
- Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age structured assessment.
- Investigate the M rate assumed for all ages, the use of CPUE tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring.
- Develop objective criteria for inclusion of novel data streams (consumption, acoustic, larval, etc.) and how this can be applied.

<u>Life History, Biological, and Habitat Priorities</u>

High

- Consider information on consumption from other sources (i.e. striped bass in other areas) and predators inshore of the current surveys.

Moderate

- Continue tagging and morphometric studies to explore uncertainties in stock structure and the impacts of harvest mortality on different components of the stock. Although tagging studies may be problematic for assessing survivorship for a species like herring, they may be helpful in identifying the stock components and the proportion of these components taken in the fishery on a seasonal basis.
- Analyze diet composition of archived mammal and sea bird stomachs. Improve knowledge on prey size selectivity of mammals and sea birds.
- Evaluate prey field to determine what other prey species are available to predators that could explain some of the annual trends in herring consumption.
- Investigate why small herring are not found in the stomachs of predators in the NEFSC food habits database.

Low

- Research depth preferences of herring.

<u>Management, Law Enforcement, and Socioeconomic Priorities</u>

High

- Evaluate the current herring spawning closure design in terms of areas covered, closure periods, catch-at-age within (before fishing prohibition in 2007) and outside of spawning areas to determine minimal spawning regulations (Maine DMR).
- Continue to organize annual US-Canadian workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

Moderate

- Develop a strategy for assessing individual spawning components to better manage heavily exploited portion(s) of the stock complex, particularly the Gulf of Maine inshore spawning component.

- Develop socioeconomic analyses appropriate to the determination of optimum yield.

Low

- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.

Atlantic Herring Research Priorities Identified as Being Met

Evaluate the merit of acoustic surveys and other techniques to achieve sub-stock complex monitoring (Gulf of Maine Research Institute).

XI. Figures

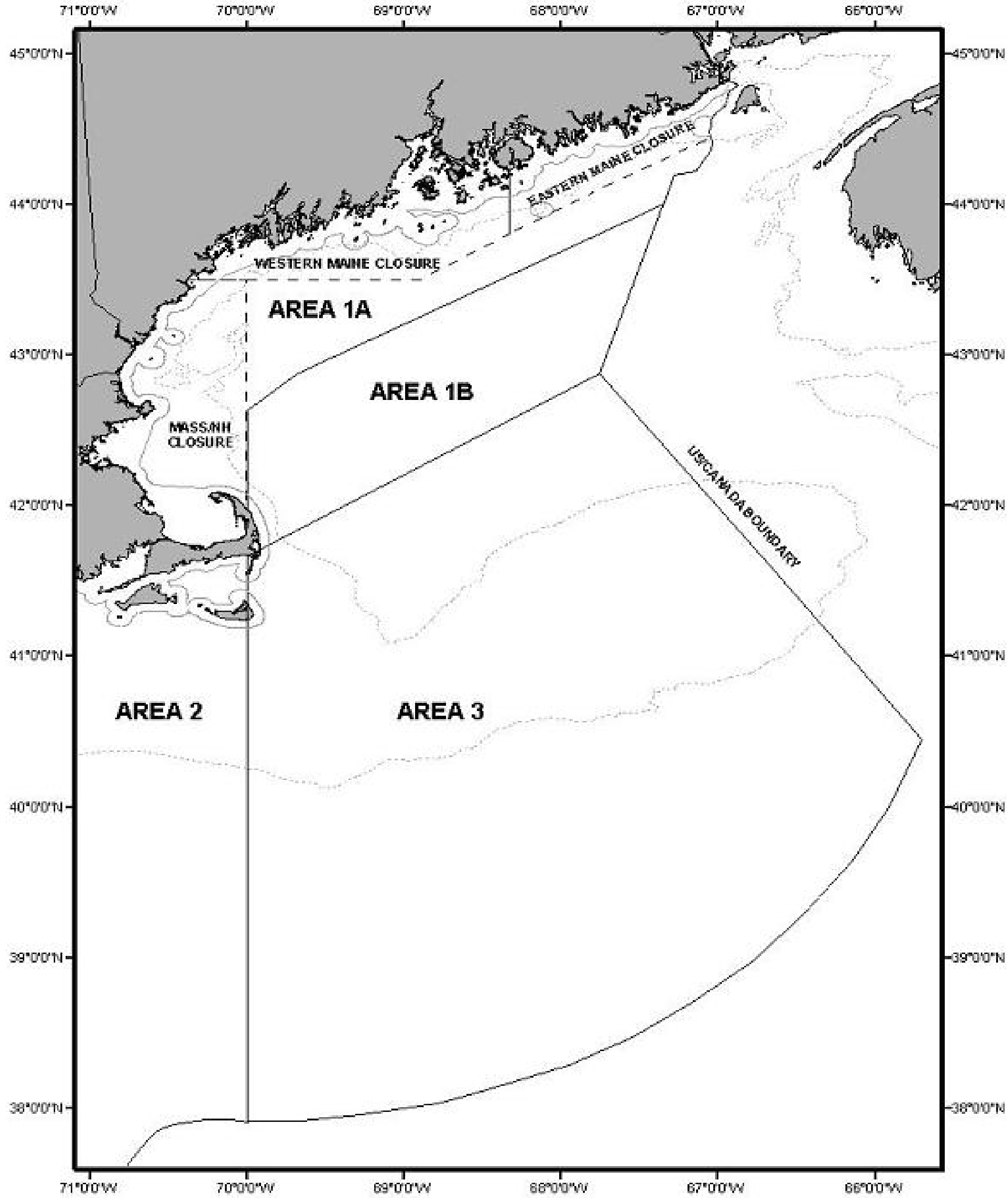


Figure 1. Map of Atlantic herring management areas with boundaries and the three spawning areas are within Area 1A, the inshore region of Gulf of Maine.

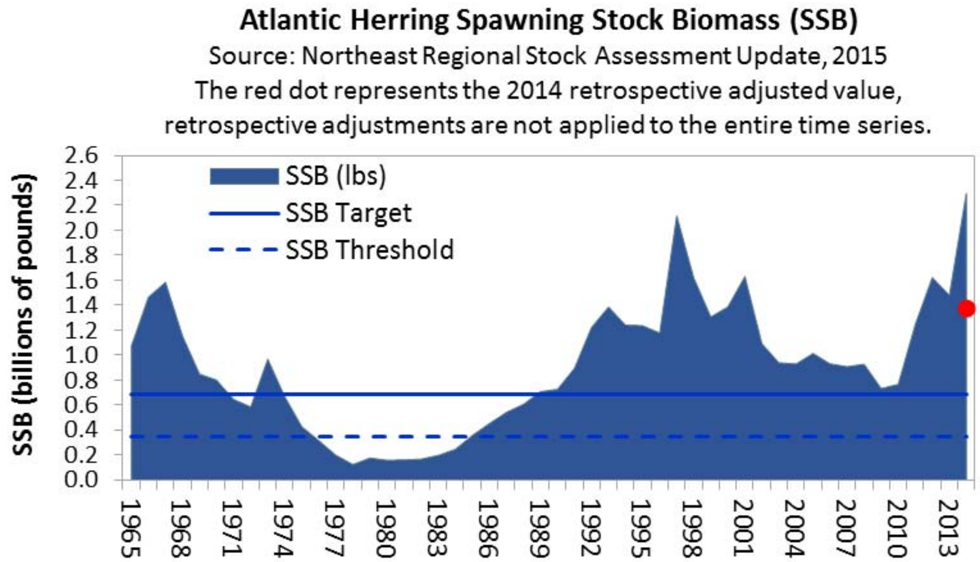


Figure 2. Spawning stock biomass from 1965 to 2014.

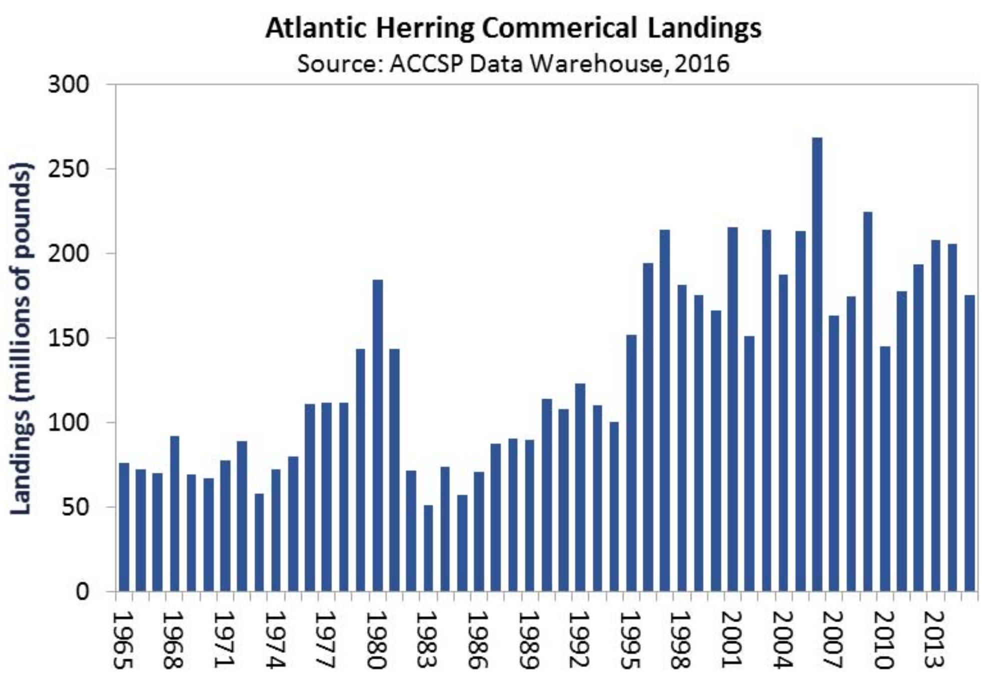


Figure 3. Commercial Atlantic herring landings by the U.S. fleet from 1965-2015

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Law Enforcement
Northeast Enforcement Division
55 Great Republic Drive, Suite 02-300
Gloucester, MA 01930-2276

April 28, 2017

Mr. Robert E. Beal
Executive Director
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200A-N
Arlington, VA 22201

Re: **Your letter of April 10, 2017**

Dear Mr. Beal:

Thank you for your letter requesting access to VMS-submitted herring catch report data for the states of Maine, New Hampshire, and Massachusetts.

I support your request and discussed your letter with Jim St. Cyr, Acting Chief, Analysis and Program Support Division, GARFO. The Region has access to the data and is in the best position to support your need. His staff is working with the Region's Information Resource Management Division to provide data access to the three state employees identified in your letter.

If you have questions on this data request, please contact Jim St. Cyr at (978) 281-9369. If you have any questions about the Northeast VMS Program, please don't hesitate to contact Bill Semrau, Investigative Support Program Manager, at (978) 281-9151.

Sincerely,

Timothy Donovan
Assistant Director

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

Douglas E. Grout (NH), Chair *James J. Gilmore, Jr., (NY), Vice-Chair* *Robert E. Beal, Executive Director*

Vision: Sustainably Managing Atlantic Coastal Fisheries

April 10, 2017

Timothy Donovan
Assistant Director
NOAA Office of Law Enforcement, Northeast Division
55 Great Republic Drive
Gloucester, Massachusetts 01930-2276

Dear Mr. Donovan,

I am writing on behalf of the Atlantic States Marine Fisheries Commission's Atlantic Herring Section (Section). The Section is requesting access to the Vessel Monitoring System (VMS) pre-landing reports for one staff member at each of the following state agencies: Maine Department of Natural Resources, New Hampshire Fish and Game Department and Massachusetts Division of Marine Fisheries (i.e., states adjacent to Management Area 1A). This access would provide states with timely landing reports to monitor catch rates in Area 1A and adjust effort controls as necessary. Currently states rely on weekly landing reports from the Greater Atlantic Regional Fisheries Office, but in a high volume fishery, such as Atlantic Herring, this is not timely.

During the Trimester 2 (June through September) 2015 and 2016 fishing seasons, the Area 1A fishery harvested herring at a rate that if left unrestricted would exceed the seasonal quota in weeks, not months. The Section has proposed alternative effort controls in Draft Addendum I to Amendment 3 of the Atlantic Herring Interstate FMP in an effort to spread the seasonal quota throughout the entirety of Trimester 2. The proposed effort controls rely on access to daily landing reports.

Vessels with a Category A Limited Access Permit comprise 99% of the Area 1A landings and are required to submit daily VMS reports. The states are requesting access to these existing VMS pre-landing reports. If access is not granted then the states will have to develop a duplicate reporting system. Harvesters would then be required to complete the VMS reports and a state landing report, thus creating additional administrative burdens on both agencies and fisherman. By granting access to the states these inefficiencies would be avoided.

The states are willing to comply with all requirements involved with access to the VMS pre-trip landing reports. Each state agency has selected one member of their staff for consideration. All three individuals have also been granted confidential data access from Massachusetts, New Hampshire, Maine, and NMFS Northeast (covers data from both GARFO and the NEFSC).

Matt Cieri, Maine Department of Natural Resources
Renee Zobel, New Hampshire Fish and Game Department
Micah Dean, Massachusetts Division of Marine Fisheries

Thank you for your consideration and please contact me with any questions.

Sincerely,

Robert E. Beal

cc: ASMFC Atlantic Herring Section L17-37

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John F. Quinn, J.D., Ph.D., *Chairman* | Thomas A. Nies, *Executive Director*

April 28, 2016

Mr. Robert Beal
Executive Director
Atlantic States Marine Fisheries Commission
1050 N. Highland St., Suite 200 A-N
Arlington, VA 22201

Dear Bob:

On April 20, 2017 the Council reviewed draft Addendum 1 to Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring. The deadline for comments recently passed (April 7, 2017), but this was the first time the full Council could review the draft Addendum document at a meeting. The Council appreciates the opportunity to submit these comments.

Trimester 2 herring landings from Area 1A are a very important component of the overall herring fishery, as well as associated lobster fisheries in this region. The Council supports developing measures to address the concerns raised about increases in fishing effort and capacity in this area and season. However, these concerns may be better addressed through the federal plan since there are potential impacts on federal permit holders and associated fishing communities. The Council also reviewed the public comment letter from the National Marine Fisheries Service (NMFS) on this action, and shares the agency's concern that some of the measures under consideration may not be consistent with, or may substantially and adversely affect, the Federal Atlantic Herring Fishery Management Plan (FMP).

Overall, the New England Council discussed that measures in Addendum 1 need to support the goals of the Federal FMP. The final action should clearly demonstrate how the proposed measures are consistent with and support the federal plan (see FMP goals attached). For example, if the primary intent of Addendum 1 is to spread Area 1A herring landings throughout Trimester 2, that would be in line with one of the goals of the federal FMP: to minimize, to the extent practicable, the race to fish. Regarding another goal of the federal FMP, to provide for long-term, efficient, and full utilization of the optimum yield, the Council is not concerned that measures under consideration in Addendum 1 have the ability to prevent vessels from harvesting the Area 1A ACL. .

The Council supports adopting measures designed to prevent derby fishing and associated impacts in Area 1A. Furthermore, since fishing year 2017 may have similar derby fishing patterns as 2016, an action developed through ASMFC may address this issue more quickly than the federal process. However, the Council notes that it may be more appropriate to consider some of the other concerns identified in the Addendum through the Federal FMP This includes the issues of s excess capacity and consistency between states . Measures that affect fishery allocation or access to the resource should receive a full evaluation of potential impacts on the environment and fishing communities. Finally, the additional scoping questions related to a potential tiered weekly landings limit that may be considered in a future ASMFC action may conflict with several National Standards of the Magnuson-Stevens Fishery Conservation and Management Act. The Council believes that if ASMFC is interested in pursuing a tiered weekly landing limit, it would be more appropriate to consider measures that have direct impacts on fishery allocation and access under the Federal FMP.

We offer the following specific comments for each alternative under consideration.

1. **Harvester Reporting Requirements**

Harvesters are already required to comply with many reporting requirements, so any additional requirements should be critical to the management program. If landings can be tracked by other means (e.g. state agencies getting access to NOAA VMS pre-landings reports), that approach should be pursued first. The Council was not clear about the status of the data sharing request that ASMFC made to NMFS. Limitations on sharing confidential data need to be carefully considered.

2. **Prohibit Landings of Herring Caught in Area 1A During a Day Out of the Fishery**

Considering this type of measure would benefit from full development and impact analysis with relevant federal requirements (e.g. National Standards of Magnuson Stevens Act (MSA), requirements of National Environmental Policy Act (NEPA), and other applicable laws). Both Option B and C have the potential to affect herring fishing activity by federal herring permit holders. While the prohibition is on landing herring in particular states, the intent and impact of this measure would be to constrain fishing activity in Area 1A. The federal FMP does not limit fishing activity using days out; therefore, this may not be consistent with the federal FMP. If the prohibition on landings only applies to certain states this may conflict with the National Standard 4 and would be inconsistent with the federal FMP.

3. **Weekly Landings Limit Per Vessel**

Weekly landing limits can be effective at slowing down the catch to extend a fishing season, but landings limits can have differential impacts on permit types. These potential impacts have not been fully considered in the draft Addendum. Furthermore, the Council is very concerned that this measure may increase slippage and discards. In some cases large volumes of herring can be caught in one set. If more vessels opt into this fishery the weekly landings limits could be restrictive, and landings limits could increase mortality from discarded catch if a vessel catches more than their weekly landing limit.

The Council is also concerned the requirement to opt into this fishery could unnecessarily reduce the weekly landing limit. To preserve flexibility, all herring vessels may opt into this fishery and some may not ultimately fish in the area. Weekly landing limits could be set lower than necessary based on the potential for increased effort. While landing limits could be adjusted upwards as the season goes on, lower levels at the beginning of the season could have negative impacts on vessels and bait markets. The additional requirement to opt in 45 days before the start of the season may not have the intended effect. Finally, the 45 day notice requirement seems problematic, at least for FY2017. If this Addendum is not effective until June 2017, vessels will not be able to comply with this requirement for FY2017.

4. **Landings Restriction on Transfers At-Sea**

These measures have direct effects on federal herring permit holders, and the differential economic impacts have not been analyzed. Again, while this is a landings restriction, it has direct impacts on fishing activity in federal waters and would completely remove some federal permit holders from participating in the Area 1A fishery. Carrier vessels have been in the herring fishery all along, and some do not harvest herring at all. This measure would prevent or limit their participation in the herring fishery in Area 1A. The Magnuson-Stevens Act, Section 204(d) allows transshipment of Atlantic herring by several Canadian carrier vessels. It is not clear that ASMFC can restrict this activity, and it creates questions of equity if U.S. carrier vessel activity is constrained more than that of Canadian carrier vessels.

5. Small Mesh Bottom Trawl (SMBT) Fleet Days Out

These measures do not have consistent federal regulations and would require new permit, reporting and monitoring requirements for vessels that harvest a very small fraction of total herring landings. Again, the 45 day notice requirement seems problematic, at least for FY2017. If this Addendum is not effective until June 2017, vessels will not be able to comply with this requirement for FY2017.

6. Clarification of Days Out Procedure

The Council does not have any concerns about this measure. The Council supports defining operation procedures so the public knows what to expect and the process is transparent.

Please accept our thanks for considering these comments. Mr. Peter Kendall will represent the NEFMC at the Atlantic herring section meeting in May 2017, and can address any questions that arise.

Sincerely,

Thomas A. Nies

Thomas A. Nies
Executive Director

Attachment

Atlantic Herring Fishery Management Plan Goals and Objectives

The goals and objectives of the Atlantic Herring FMP remain as identified through Amendment 1 (NEFMC 2006) and will continue to frame the long-term management of the resource and fishery.

GOAL: Manage the Atlantic herring fishery at long-term sustainable levels consistent with the National Standards of the Magnuson-Stevens Fishery Conservation and Management Act.

OBJECTIVES:

1. Harvest the Atlantic herring resource consistent with the definition of overfishing contained in the Herring FMP and prevent overfishing.
2. Prevent the overfishing of discrete spawning components of Atlantic herring.
3. Avoid patterns of fishing mortality by age which adversely affect the age structure of the stock.
4. Provide for the orderly development of the herring fishery in inshore and offshore areas, taking into account the viability of current and historical participants in the fishery.
5. Provide for long-term, efficient, and full utilization of the optimum yield from the herring fishery while minimizing waste from discards in the fishery. Optimum yield is the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, taking into account the protection of marine ecosystems, including maintenance of a biomass that supports the ocean ecosystem, predator consumption of herring, and biologically sustainable human harvest. This includes recognition of the importance of Atlantic herring as one of many forage species of fish, marine mammals, and birds in the Northeast Region.
6. Prevent excess capacity in the harvesting sector.
7. Minimize, to the extent practicable, the race to fish for Atlantic herring in all management areas.
8. Provide, to the extent practicable, controlled opportunities for fishermen and vessels in other Mid-Atlantic and New England fisheries.
9. Promote and support research, including cooperative research, to improve the collection of information in order to better understand herring population dynamics, biology and ecology, and to improve assessment procedures.
10. Promote compatible U.S. and Canadian management of the shared stocks of herring.
11. Continue to implement management measures in close coordination with other Federal and State FMPs and the ASMFC management plan for Atlantic herring, and promote real-time management of the fishery.

Atlantic Herring
Spawning Area Closure Monitoring System
Pilot Program

Presented to the Atlantic Herring Section
May 8, 2017

Amendment 3

Upon approval of Amendment 3 the Atlantic Herring Section granted a one-year pilot of a new method, known as the **GSI30-Based Forecast System**, to be tested in the 2016 fishing season.

The Section can:

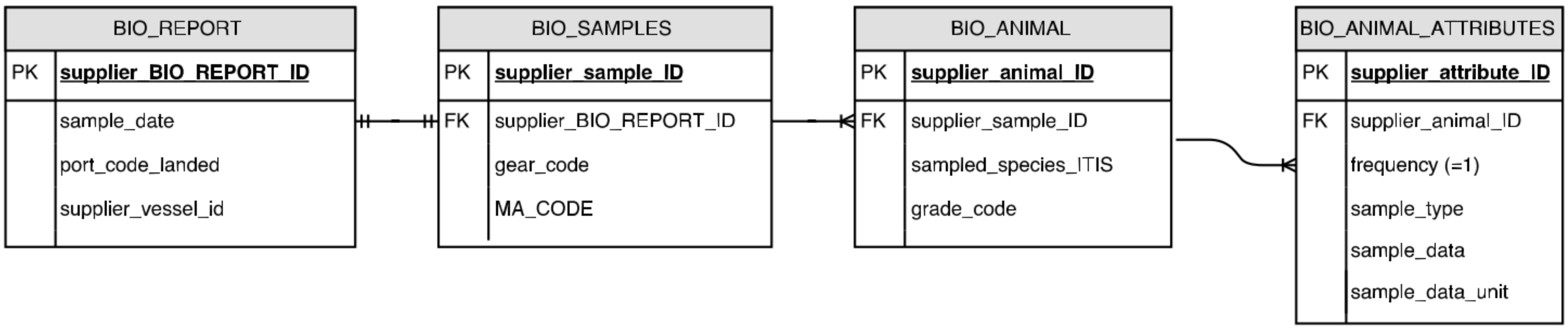
1. Permanently implement the forecast system
2. Revert back to the length-based closure system (from prior years)

ACCSP Partnership

- Formal coordination
- Central database for all herring spawning samples utilizing pre-existing biological module
- All states have access
- Allowed for standardized methods and results

ACCSP
Good Data, Good Decisions

Developing the Biological Module

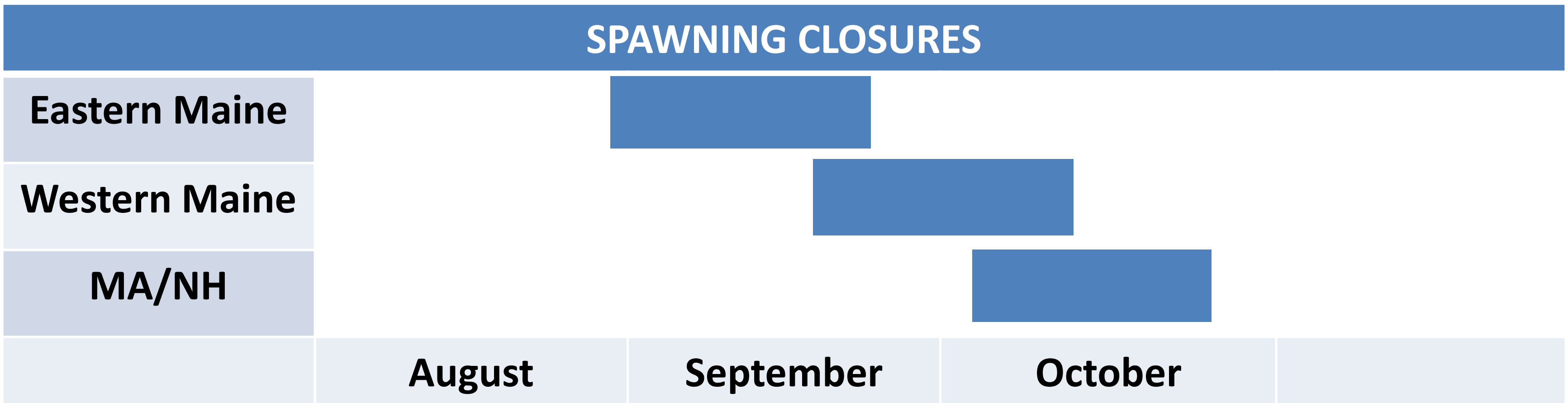


- MA_CODE ~ spawning areas (EM, WM, MANH)
- grade_code ~ fresh vs frozen
- sample types:
- total length (cm)
- sex (M or F)
- maturity (1 through 7)
- gonad wt (g)
- whole wt (g)

Implementation

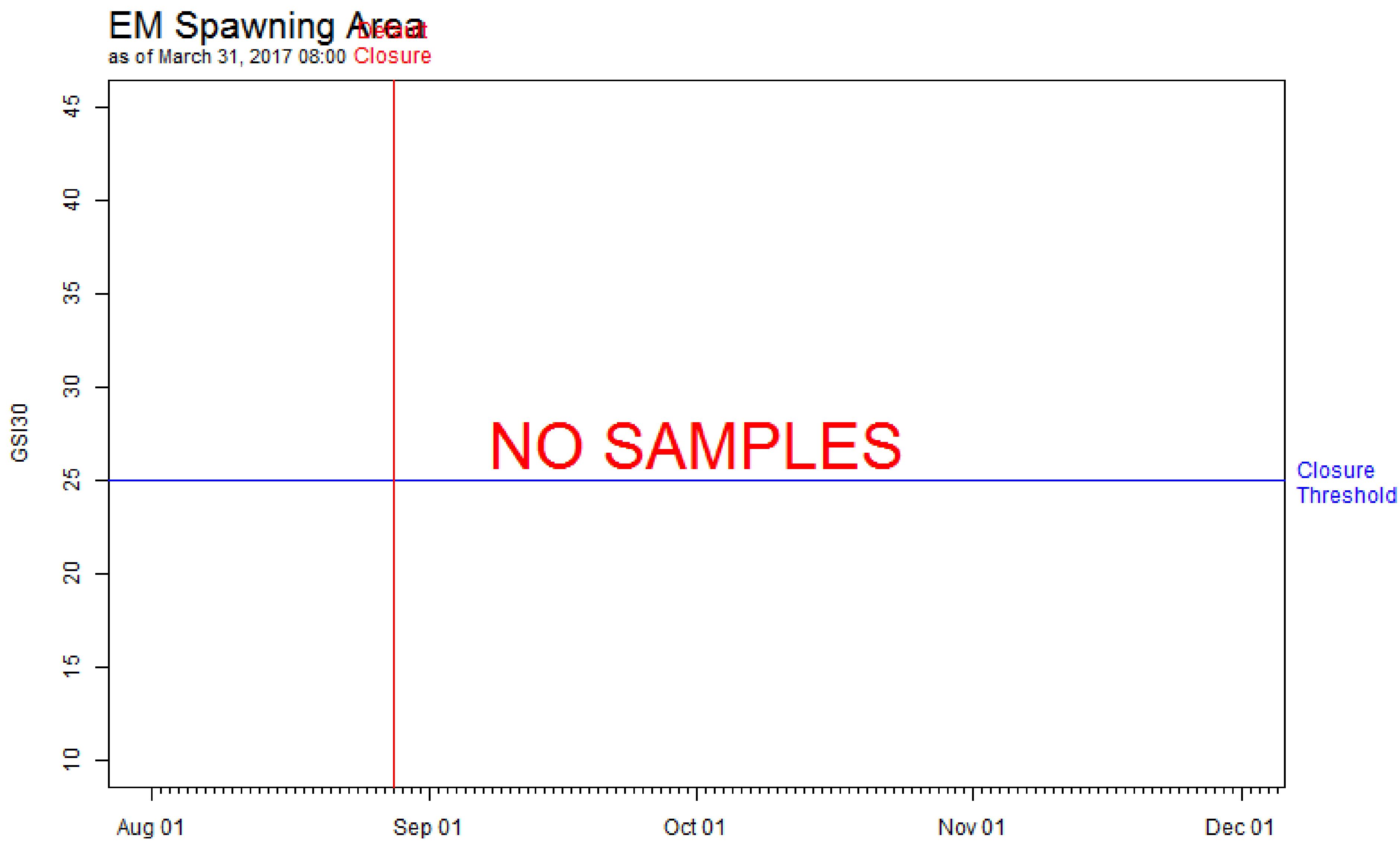
- Data housed by ACCSP are run through R script and refreshed every two hours
- Results are displayed on a webpage for each spawning closure area
- Relies upon three samples each containing *at least* 25 female herring in gonadal stages III-V, to trigger a spawning closure
- Once three samples are collected, closure dates are forecasted
- Closure dates are set and notifications are made 5 days prior to closure
- Closures occur on default dates if three samples are unavailable

2016 Timeline

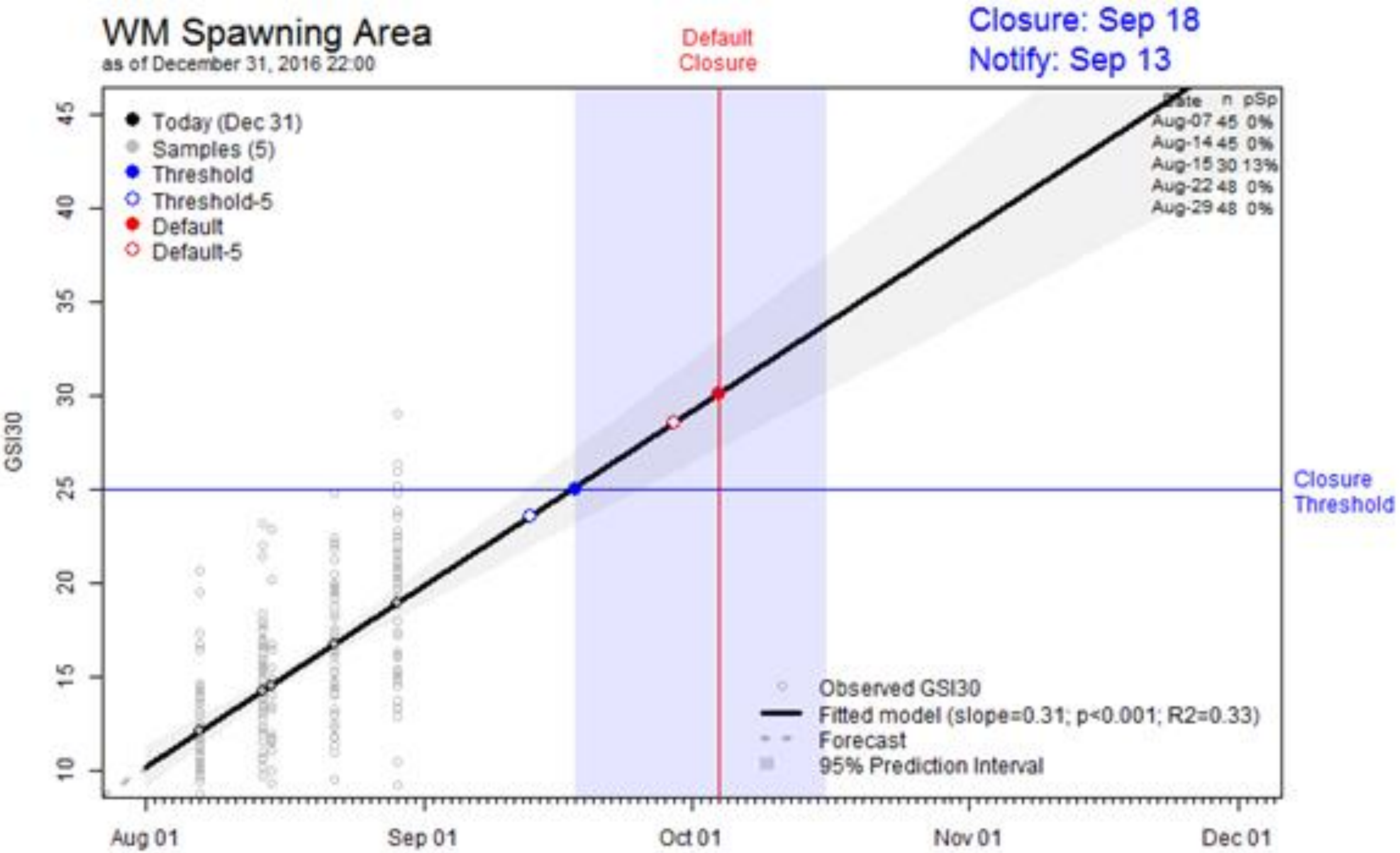


- Eastern Maine: August 28-September 24 (Default)
- Western Maine: September 18-October 15 (Forecast)
- MA/NH: October 2-October 29 (Forecast)

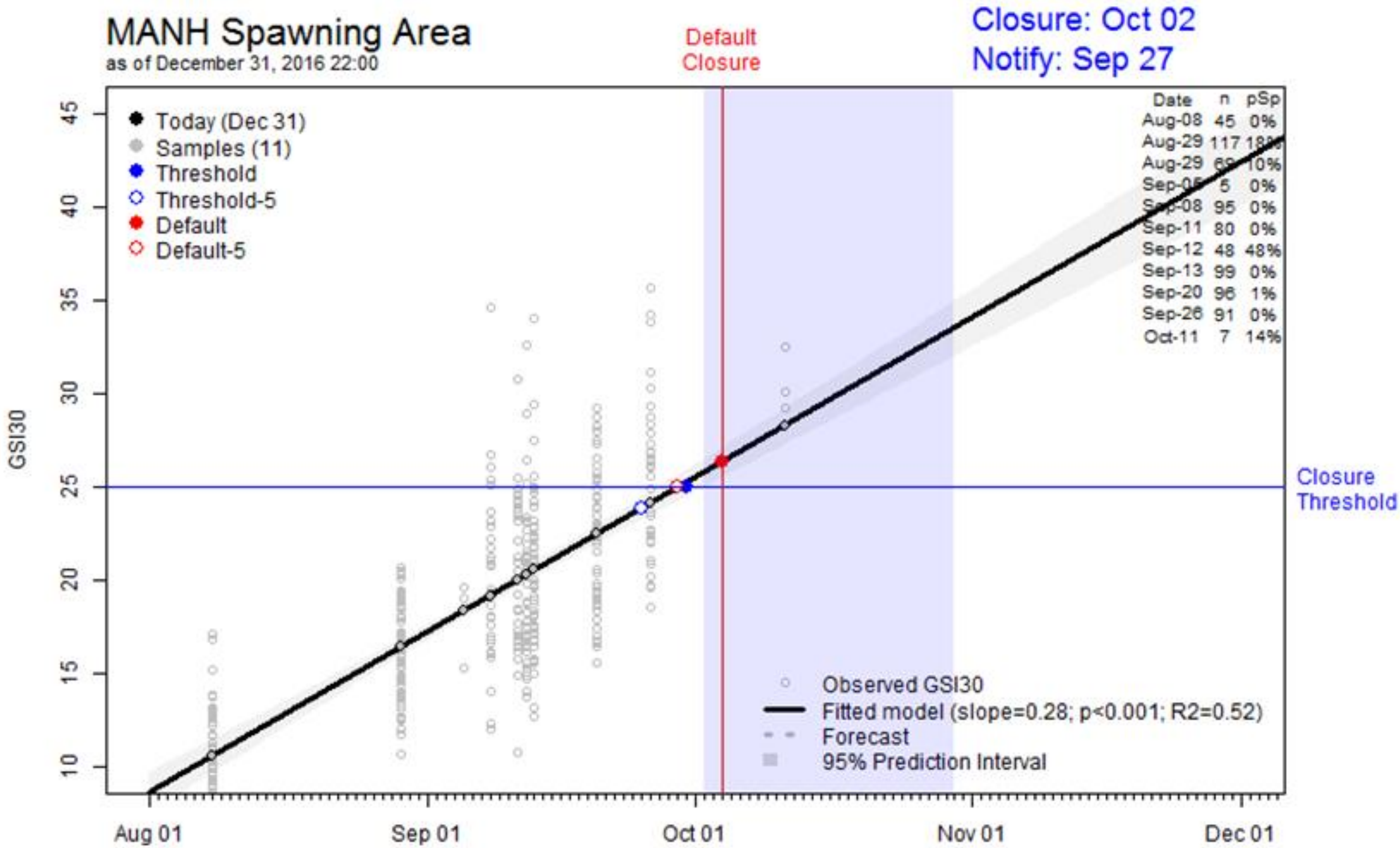
Eastern Maine



Western Maine



MA/NH



MANH Spawning Area
as of December 31, 2016 22:00
Default Closure
Closure: Oct 02
Notify: Sep 27
Today (Dec 31)
Samples (11)
Threshold
Threshold-5
Default
Default-5
Date n pSp
Aug-08 45 0%
Aug-29 117 18%
Aug-29 69 10%
Sep-05 5 0%
Sep-08 95 0%
Sep-11 80 0%
Sep-12 48 48%
Sep-13 99 0%
Sep-20 96 1%
Sep-26 91 0%
Oct-11 7 14%
Closure Threshold
GSI30
10
15
20
25
30
35
40
45
Observed GSI30
Fitted model (slope=0.28; p<0.001; R2=0.52)
Forecast
95% Prediction Interval
Aug 01
Sep 01
Oct 01
Nov 01
Dec 01

Evaluation

- 92% of the Area 1A sub-allocation was taken and the area was closed effective October 18; prior to the opening of the spawning closure in MA-NH
- Some RSA samples in MA-NH the week after it re-opened; 6% were in spawning condition (well below 25%)
- Personal correspondence with industry members indicated the timing of the closures seemed to line up with what was observed on the water

Next Steps

TC is comfortable sharing the link with managers and public in 2017 pending the inclusion of caveats

- Data are refreshed every two hours
- The fewer the samples, the greater the changes in forecasted dates as new samples are added
- The closure date is not fixed and can change until 5 days prior to the closure

TC Recommendation

The TC believes the forecast system was successful tested and recommends the Section permanently implement the **GSI30-Based Forecast System** for spawning closures in Area 1A.

Questions

LOOK LOBSTER CO
SINCE 1910
NEW ENGLAND'S OLDEST

May 2, 2017

Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200 A-N
Arlington, VA 22201
Phone: 703-842-0740 Fax: 703-842-0741

Dear Commission Members,

We are a Down East company that has been in business since 1910, buying lobsters and processing bait. We are gravely concerned about the herring supply for our area.

Our wharf supplies a great deal of fishermen with the herring needed in the lobster industry. We have a fish pumping facility to offload fish directly from the boats, making it more economical and time efficient for all involved. A carrier is a must for this type of operation to work with the distance the herring boats have to travel to unload. We would recommend Option C or a similar option in your plan with carrier capacity limits set of five or six loads in place to protect the industry. If carriers are not allowed, it would cause an extreme hardship for our area lobster fishermen. Currently, an estimate of 40 percent of herring used in the industry is used within 20 miles of the Jonesport/Beals area.

Our belief is that the herring fishery quota, as a whole, should be equally divided between any and all permitted boats that show landing history in area 1A in the last ten years. A regulation as such would keep the herring affordable. Maine Department of Marine Resources should have the authority to adjust the quotas as needed to insure that the herring supply extends through the lobster season. A carrier boat would then bring the fish in for offloading.

Thank you for the dedication to this project. We appreciate you taking time to read how we feel and making your decision that best fits all parties involved.

Sincerely,

William "Bimbo" Look

O.W. & B.S. Look Co., Inc. dba Look Lobster Co.
P.O. Box 504 – Jonesport, ME 04649
Phone: 207-497-2353 Fax: 207-497-5559 Cell: 207-266-9406

TAUTOG: Summary of Management Options in Draft Amendment 1

2.2 Goals (pg. 48-49)

Option A. Status Quo. Maintain the 1996 Goals

Option B. Revised Goal Statement

2.3 Objectives (pg. 49-51)

Option A. Status Quo: Maintain the 1996 Objectives

Options B-H: Modified Objectives

2.5 Biological Reference Points (pg. 53-54)

Option A. Status Quo - Reference Points can be modified via a Management Document

Option B. Reference Points can be modified via Board Action (i.e., Management Document Not Required)

2.7.1 Fishing Mortality (F) Target (pg. 54-55)

Option A. Status Quo

Option B. Managing to the Regional F Target

Sub-Option B1: No Time Requirement

Sub-Option B2: Board Action within One Year

Sub-Option B3: Board Action within Two Years

Probability of Achieving F Target (pg. 55)

Option A. Status Quo

Option B. 50% Probability of Achieving F Target

Option C. 70% Probability of Achieving F Target

2.7.2 F Reduction Schedule (pg. 55-56)

Option A: Status Quo

Option B: Three Years

Option C: Five Years

2.7.4 Stock Rebuilding Schedule (pg. 56)

Option A: Status Quo

Option B. A Stock Rebuilding Schedule can be developed via an Addendum

Option C. A Stock Rebuilding Schedule can be developed via an Addendum, Not to Exceed 10 Years

4.0 Management Program Implementation

4.1 Regional Boundaries (pg. 65-66)

Option A. Status Quo – Coastwide Management

Option B. Regional Management (Four Regions)

Long Island Sound Boundaries (pg. 69)

Sub-Option B1: LIS Boundaries, Montauk Point, NY to Watch Hill, RI

Sub-Option B2: LIS Boundaries, Orient, NY to Watch Hill, RI

4.2.2 MASSACHUSETTS-RHODE ISLAND (starting on pg. 72)

4.2.2.1 MARI Recreational Management Measures (pg. 73-74)

Option A. Status Quo

Option B. All measures consistent (16", 3 & 4 fish)

Option C. All measures consistent (16", 3 fish)

4.2.3 LONG ISLAND SOUND (starting on pg. 74)

4.2.3.1 LIS Recreational Management Measures (pg. 75-76)

50% Probability of Achieving F Target (47.2% or more harvest reduction)

Option A1. Status Quo; state-specific reduction

Option B1. Consistent Minimum Size (16") and Possession Limit (1)

Option B2. Consistent Minimum Size (17") and Possession Limit (2)

Option B3. All Measures Consistent (16", 1 fish)

70% Probability of Achieving F Target (52.6% or more harvest reduction)

Option A2. Status Quo; state-specific reduction

Option B4. Consistent Minimum Size (16") and Possession Limit (1)

Option B5. Consistent Minimum Size (17") and Possession Limit (3 & 1 fish)

Option B6. All Measures Consistent (16.5", 1 fish)

4.2.3.2 LIS Commercial Management Measures (pg. 77-78)

<u>50% Probability of Achieving F Target (47.2% or more harvest reduction)</u>

Option A1. Status Quo

Option B1. Regional Quota

<u>70% Probability of Achieving F Target (52.6% or more harvest reduction)</u>

Option A2. Status Quo

Option B2. Consistent Minimum Size (16")

Option B3. Commercial Quotas

4.2.3.3 LIS Slot Limit for the recreational and commercial fisheries (pg. 78-79)

Option C. 16-18" Slot Limit

4.2.4 NEW JERSEY - NEW YORK BIGHT (starting on pg. 80)

4.2.4.1 NJ-NYB Recreational Management Measures (pg. 81-82)

<u>50% Probability of Achieving F Target (2% or more harvest reduction)</u>

Option A1. Status Quo

Option B1. Consistent Minimum Size (15") and Possession Limit (4)

Option B2. Consistent Minimum Size (16")

C1. Slot Limit (15-18") with Consistent Possession Limits (4)

<u>70% Probability of Achieving F Target (11% or more harvest reduction)</u>

Option A2. Status Quo

Option B3. Consistent Minimum Size (15") and Possession Limit (3)

Option B4. Consistent Minimum Size (16") and Possession Limit (4)

Option B5. All Measures Consistent

Option C2: Slot Limit (15-18") with Consistent Possession Limits (4)

Option C3: Slot Limit (15-18") with All Measures Consistent

4.2.4.2 NJ-NYB Commercial Management Measures (pg. 83-84)

50% Probability of Achieving F Target (2% or more harvest reduction)

Option A1. Status Quo

Option B1. Consistent Minimum Size (15”)

Option B2. Consistent Minimum Size (16”)

Option B3. Commercial Quotas

Option C4: Slot Limit (15-18”)

70% Probability of Achieving F Target (11% or more harvest reduction)

Option A2. Status Quo

Option B4. Consistent Minimum Size (15”)

Option B5. Consistent Minimum Size (16”)

Option B6. Commercial Quotas

Option C5: Slot Limit (15-18”)

4.2.5 DELAWARE - MARYLAND – VIRGINIA (starting on pg. 84)

4.2.5.1. DelMarVa Recreational Management Measures (pg. 86)

Option A. Status Quo

Option B. Consistent Possession Limit (4) and Seasons

Option C. Consistent Minimum Size (16”)

Option D. All Measures Consistent (16” and 4 fish)

4.2.5.2 DelMarVa Commercial Management Measures (pg. 86)

Option A. Status Quo

Option B. Adopt recreational measures as commercial measures for DE and MD

4.3 Commercial Quota (pg. 87-88)

Option A. Status Quo

Option B. Commercial Quota Procedures

4.4 Commercial Harvest Tagging Program (pg. 88-91)

Option A. Status Quo

Option B. Implement a Commercial Harvest Tagging Program

4.4.3 Tag Application (pg. 89-90)

Option A. Harvester Application at Harvest or Upon Landing

Option B. Application by Dealer

4.6 Spawning Closures (pg. 91)

Option A. Status Quo

Option B. Regional Spawning Closures

4.11.2 Management Program Equivalency (pg. 93)

Option A. Any management measures can be adjusted under Conservation Equivalency

Option B. Any management measures, except the spawning closures, can be adjusted under Conservation Equivalency

Atlantic States Marine Fisheries Commission

DRAFT AMENDMENT 1 TO THE INTERSTATE FISHERY MANAGEMENT PLAN FOR TAUTOG FOR BOARD REVIEW

May 2017

ASMFC Vision: Sustainably Managing Atlantic Coastal Fisheries

This draft document was developed for Management Board review and discussion at the May 2017 meeting week. This document is not intended to solicit public comment as part of the Commission/State formal public input process. However, comments on this draft document may be given at the appropriate time on the agenda during the scheduled meeting. Also, if approved, a public comment period will be established to solicit input on the issues contained in the document.

Atlantic States Marine Fisheries Commission
Seeks Your Input on Tautog Management

The public is encouraged to submit comments regarding this document during the public comment period. Comments will be accepted until **TBD.** Regardless of when they were sent, comments received after that time will not be included in the official record.

You may submit public comment in one or more of the following ways:

1. Attend public hearings held in your state or jurisdiction.
2. Refer comments to your state's members on the Tautog Management Board or Tautog Advisory Panel, if applicable.
3. Mail, fax, or email written comments to the following address:

Ashton Harp
1050 North Highland St., Suite 200 A-N
Arlington, VA 22201
Fax: (703) 842-0741
aharp@asmfc.org (subject line: Tautog Draft Amendment I)

If you have any questions please call Ashton Harp at 703.842.0740.

Draft Amendment 1 Timeline

Winter 2015	Board Reviews the 2015 Benchmark Stock Assessment that Evaluates Stock Status Across Three Regions
Fall 2015	Board Solicits Public Comment on a Public Information Document (PID)
November 2015	Board Reviews PID Comments and Tasks Plan Development Team (PDT) to Develop Draft Amendment I
Spring 2016	Board Tasks Technical Committee to Develop a Regional Assessment to Evaluate Stock Status Across Two Additional Regions
August 2016	Board Reviews Regional Assessment and Tasks TC to Develop a Four-Region 2016 Stock Assessment Update that Includes Data through 2015
Winter 2016/17	Board Tasks TC and PDT to Develop Management Measures for Each Region Respective to Regional Stock Status
May 2017	**Board Reviews Draft Amendment 1 and Considers Approval for Public Comment**
June/July 2017	Board Solicits Public Comment on Draft Amendment 1 and States Conduct Public Hearings
August 2017	Board Reviews Public Comment, Selects Management Options and the Commission Considers Final Approval of Amendment I

Table of Contents

List of Figures

List of Tables

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission (ASMFC) is responsible for managing Tautog (*Tautoga onitis*), under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACFMA). The management unit consists of the coastal states from Massachusetts through Virginia. ASMFC has coordinated interstate management of tautog in state waters (0-3 miles) since 1996. Responsibility for compatible management action in the Exclusive Economic Zone (EEZ) from 3-200 miles from shore lies with the Secretary of Commerce through ACFCMA in the absence of a federal fishery management plan. If approved, Amendment 1 would consolidate the fishery management plan (FMP), subsequent addenda (Addendum I-VI) and new management measures into a single document.

1.1 STATEMENT OF THE PROBLEM

Since the Tautog FMP was implemented, in 1996, the resource has experienced changes in stock status, as well as management measures used to control harvest. Based on the 2015 Benchmark Stock Assessment and Peer Review Report (2015 assessment), tautog is overfished and overfishing is occurring on a coastwide scale.

The 2015 assessment suggested the delineation of separate, regional stock units as management areas to reduce the risk of overfishing and account for tautog's very limited coastwide movement. It explored multiple regional definitions for management purposes, including a three-region delineation of Massachusetts-Rhode Island-Connecticut, New York-New Jersey, and Delaware-Maryland-Virginia. The Tautog Management Board (Board) accepted the 2015 assessment for management use, but expressed concern with the proposed three-region stock delineation that would split Long Island Sound (LIS) into two assessment and management areas. This was seen as an issue because recent landings indicate a concentration of the effort in the LIS and fishermen from Connecticut and New York routinely cross states lines when fishing.

Therefore the Board requested a new regional assessment that would examine the population dynamics in Connecticut-New York-New Jersey in more detail. This regional assessment proposed two additional stock unit boundaries for consideration at a finer regional scale: Long Island Sound (LIS), which consists of Connecticut and New York waters north of Long Island, and New Jersey-New York Bight (NJ-NYB), which consists of New Jersey and New York waters south of Long Island. The Board approved the regional assessment for management use and selected a four-region management approach (Table 13) for inclusion in Draft Amendment 1.

Draft Amendment 1 updates the 1996 FMP with new fishery management principles and consolidates associated addenda into a single document. The document proposes regional management for tautog to address overfishing and overfished stock status present in some regions. In addition, a commercial harvest tagging program is proposed to address an illegal, unreported and undocumented fishery that has persisted for more than a decade. If approved, Draft Amendment 1 would be the comprehensive management document for tautog management in state waters.

1.2 BENEFITS OF IMPLEMENTATION

Unlike previous assessments, which assessed the stock on a coastwide basis, the 2015 benchmark stock assessment and 2016 regional assessment evaluated stock status regionally to reflect differences in life history characteristics and harvest patterns. Regional management of the species has been suggested since the onset of management, however the tools and data to run a regional stock assessment to determine regional stock status were not available until recently. The 2015 benchmark stock assessment peer review panel, 2016 regional assessment peer review panel and tautog technical committee consider the regional assessments to be a significant advancement from prior assessments.

The regional stock unit definitions are based on localized biological and socioeconomic trends, which allow managers to better address the management needs of each region. Evaluating stock status by regions allows managers to develop targeted management measures that restrict effort only where necessary. Whereas a coastwide assessment and management measures, required the entire coastwide fishery to take reductions regardless of where fishing effort was highest. Regional management is expected to have a positive impact on the resource and fishery.

1.2 DESCRIPTION OF THE RESOURCE

Tautog, a member of the wrasse (*Labridae*) family, is a stout fish with an arched head, large lips broad tail and a lack of scales on the gill covers. They are regionally referred to as blackfish, in reference to its common overall coloration. Juveniles and females more often exhibit a mottled and brown toned appearance, while males are most often grayish in color. Adults can live more than thirty years and stay close to a preferred home site moving only short distances longitudinally, if at all, during seasonal migrations. A sedentary life history and aggregation around structure makes tautog relatively easy to catch, even when biomass levels are low. Catchability and slow growth rate make tautog highly susceptible to overfishing and slow to rebuild.

1.2.1 Species Life History

1.2.1.1 Distribution

Tautog are distributed along the northeast Atlantic coast of North America (Figure 1) from the outer coast of Nova Scotia to Georgia (Collette and Klein-MacPhee 2002, Parker et al. 1994); although, most abundant from Cape Cod to Cape Hatteras (Bigelow and Schroeder 1953). They inhabit coastal and estuarine waters throughout this range. North of Cape Cod, they are usually found within 4 miles of shore in waters less than 60 feet deep (Bigelow and Schroeder 1953). South of Cape Cod, they can be found up to 40 miles offshore and at depths up to 120 feet (Hostetter and Munroe 1993).

Figure 1. Tautog Distribution

1.2.1.2 Life History Stages

Eggs and larvae have been collected on the inner continental shelf and within estuaries from May through August (Berrien et al. 1978, Colton et al. 1979, Ferraro 1980, Bourne and Govoni 1988, Monteleone 1992, Able and Fahay 1998, Witting et al. 1999). Viable eggs are 1 millimeter (mm) in diameter, buoyant and are found in the greatest numbers at the water surface. Hatching occurs in 81 hours at 15°C and 42 hours at 20°C (Auster 1989, Perry 1994). The larvae (2 mm at hatching) stay near the surface during the day and may go deeper at night (Malchoff 1993). After approximately 3 weeks, larvae undergo metamorphosis and settle out of the water column as juveniles (Sogard et al. 1992, Dorf 1994).

As juveniles, tautog begin a bottom dwelling (demersal) existence that continues for the remainder of their lives. Newly settled juveniles look similar to miniature adults and assume the color (green to mottled or striped brown) of the habitat they occupy. It is unknown if tautog larvae settle out of the water column in offshore locations or if small juvenile tautog are found in offshore habitats.

Tautog are attracted to some type of structure in all post larval stages of their life cycle. These habitats include both natural and man-made structures, such as submerged vegetation, shellfish beds, rocks, pilings, jetties, shipwrecks and artificial reefs (Olla et al. 1974, Briggs 1975, Briggs and O'Connor 1971, Orth and Heck 1980, Sogard and Able 1991, Dorf and Powell 1997, Steimle and Shaheen 1999). Juvenile tautog are found in estuaries and bays where newly settled individuals are reported to prefer areas less than 1 meter (m) deep (Sogard et al. 1992, Dorf and Powell 1997), and vegetated areas to unvegetated regions. Vegetation can include sea grass and various types of macroalgae (Briggs and O'Connor 1971, Sogard et al. 1992). With growth, these young-of-the-year move to deeper waters but are not usually found deeper than around 25 feet (Cooper 1964).

Larger juveniles become associated with various reef-like habitats and hard surfaces as long as the main habitat requirement of shelter is met. Young tautog may establish home sites, ranging within a few feet during the day and returning at night when they become dormant (Olla et al, 1979). Dixon (1994) found juvenile tautog showed a size-specific preference when choosing a shelter. Juvenile tautog remain inshore during the winter (Cooper 1964, Stolgitis 1970, Olla et al. 1974). When water temperatures drop below 4.5°C some large juveniles may move to deeper, more protected locations. Juveniles remaining inshore in shallow water can be found in a variety of shelters including grass and macroalgal beds, shells, discarded soda cans and bottles, fish pots, crevices and bottom depressions covered with silt (Cooper 1964, Olla et al. 1978, Olla et al. 1980). By the end of their first year juveniles reach a length of around 60 mm in Rhode Island waters (Cooper 1967) and 140 mm in Virginia waters (Hostetter and Munroe 1993).

During summer months, adult tautog are found in both inshore embayments and coastal waters in habitats similar to those of large juveniles (Cooper 1966, Briggs 1969, Briggs 1977, Steimle and Shaheen 1999, Arendt et al. 2001). They can be found in a variety of complex, structured locations including vegetation, rocks, natural and artificial reefs, pilings, jetties and groins, mussel and oyster beds, shipwrecks, submerged trees, logs and timbers (Steimle and Shaheen, 1999). Tautog exhibit diurnal activity and enter a torpid state at night during which they seek refuge in some type of structure. Adults stay relatively close to their preferred home site and, while moving away during the day to feed, they return to the same general location at night where they become dormant (Olla et al. 1974).

The mouths of estuaries as well as other inlets and artificial reefs may be extremely important habitats for tautog (Zawacki 1969, Briggs 1975), particularly south of Long Island where there are fewer natural rocky outcrops to provide shelter than in the more northern portion of the range. Localized populations form during the summer, in co-existence with large juveniles (Olla et al. 1974).

1.2.1.3 Age and Growth

Larval growth rates have been estimated to be between 0.25 - 0.76 mm per day (Malchoff 1993, Dorf 1994). During summer, young-of-the-year juveniles grow around 0.5 mm per day (Sogard et al. 1992, Dorf 1994). The size attained at the end of the first year increases along the coast from north to south. Since juvenile daily growth rates appear to be similar in all areas during the summer, size differences may be due to the longer duration of warmer water temperatures in southern portions of the species range (Sogard et al. 1992, Dorf 1994). Juvenile growth rates have been observed to be higher in vegetated than in unvegetated habitats. Among vegetated habitats, juvenile growth was higher in sea lettuce beds than in eelgrass beds in New Jersey (Sogard et al 1992).

Adult male tautog grow faster in length than adult females (Cooper 1967, Simpson 1989, Hostetter and Munroe 1993). In Rhode Island waters (Cooper 1967), the mean length of a seven year old male was 358 mm (14.1 inches), while a female was 335 mm (13.2 inches). Faster adult male growth has also been documented in Long Island Sound (Simpson 1989) and Virginia waters (Hostetter and Munroe 1993). Adult growth is relatively slow and varies with the season. Slowest body growth rates occur during maturation of the gonads in the spring prior to spawning. Maximum body growth occurs after spawning during the summer and fall followed by a period of slow or no winter growth associated with reduced water temperatures and feeding activity during the torpid period (Hostetter and Munroe 1993).

Mean adult growth rates are similar for tautog in northern and southern waters until the age of 13. After that age, growth rates decrease more rapidly in the northern part of the species range, with growth rates in Virginia being almost double those of tautog in Rhode Island waters (Hostetter and Munroe 1993). In Rhode Island, male annual growth rates were reduced to less than 12 mm (0.5 inches) per year after age 12 and to 2–4 mm per year after age 20. For females, annual growth decreased to less than 10 mm per year after age 13 and to 3–4 mm per year after age 17 (Cooper 1967) Tautog are long-lived fish with males living longer than 30 years and females around 25 years (Cooper 1966, Hostetter and Munroe 1993). Fish as old as 30 years have been caught in Rhode Island, Connecticut, and Virginia, but the majority of fish caught are four to eight years old.

As stated above, many variables may affect the observed length of an individual tautog at a given age. Age-length keys show significant overlap of age groups by length. On average, Table 1 provides a reasonably accurate guide.

Table 1. Tautog length-at-age relationship

Length (Inches)	Age (Years)
3	1
5.5	2
9	3
10.5	4
12.5	5
14	6
15.5	7
17	8
18	9
19	10
21	15
22	20

1.2.1.4 Spawning

Adult tautog generally migrate inshore in the spring from offshore wintering locations to spawn in April through July (Chenoweth 1963, Cooper 1966, Stolgitis 1970, Olla et al. 1974, Hostetter and Munroe 1993, White et al. 2003). Spawning usually occurs within estuaries or in nearshore marine waters (Chenoweth 1963, Sogard et al. 1992, Hostetter and Munroe 1993, White et al. 2003).

Surveys and tagging data suggest tautog spawn seasonally at specific locations. In Rhode Island, tagging studies showed that adults returned to the same spawning locations over a period of several years (Cooper 1966, Lynch 1991) and spawn in discrete groups in May and June (Cooper 1964, 1967). Studies in New York waters suggest adults from different populations may mix at specific spawning locations from year to year (Olla et al. 1980). Tautog collected from offshore hard bottom sites in Maryland and Virginia were found to be in spawning condition seasonally (Eklund and Targett 1990, Hostetter and Munroe 1993).

Some adults remain offshore throughout the year, particularly in the southern part of the range (Olla and Samet 1977, Eklund and Targett 1990, Adams 1993, Hostetter and Munroe 1993). Eggs and larvae collected in continental shelf waters from Georges Bank to North Carolina, with especially high concentrations off of southern New England and New York, suggest tautog spawn offshore as well as inshore locations (Ferraro 1980, Sogard et al. 1992, Hostetter and Munroe 1993, White et al. 2003). Tautog have been found in spawning condition 12 miles off the coast of Virginia in 60 feet of water (White et al. 2003).

1.2.1.5 Reproduction

Tautog normally reach sexual maturity at 3 to 4 years of age and 177 to 304 mm in length (7 to 12 inches), although there are some sexually mature 2 year old fish (Chenoweth 1963, Olla and Samet 1977, Hostetter and Munroe 1993). Tautog in Rhode Island waters reach sexual maturity at a smaller size of 190 to 200 mm (7.5 - 7.9 inches, Cooper 1966) than in New York at 215 to 241 mm (8.5 - 9.5 inches, Briggs 1977) or Chesapeake Bay waters at 271 to 289 mm (10.7 - 11.4 inches, Hostetter and Munroe 1993). The difference in size is likely related to the length of time which the water remains warm and growth occurs (Hostetter and Munroe 1993).

Spawning occurs in heterosexual pairs or in groups of a single female with several males. In laboratory studies, the type of spawning depends on the number of mates available for the female, the male dominance hierarchy, and the availability of shelter and food. Pair spawning is usually the dominant process (Olla and Samet 1977).

Spawning begins in the spring when water temperatures reach at least 9° C. Peak spawning varies annually with temperature. Generally spawning reaches peak in June, and continues throughout the summer (Bigelow and Schroeder 1953, Cooper 1964, Colton et al. 1979, Eklund and Targett 1990, Sogard et aL 1992, Hostetter and Munroe 1993). Chenoweth (1963) reported peak spawning in Narragansett Bay during the first two weeks of June 1961 and the last two weeks of May 1962, when average water temperatures were 13-14°C. Malchoff (1993) reported peak spawning in the New York Bight during July 1988. In Maryland and Virginia, reported peak spawning is between April and June (Eklund and Targett 1990, Hostetter and Munroe 1993, White et al. 2003). GSI off the south shore of New York has been found to peak in mid-June to mid-July when temperatures reached 11-12°C (Dumais 2005).

Tautog are batch spawners with a prolonged spawning season (White et al. 2003, Dumais 2005, LaPlante and Schultz 2007). Batch fecundity varies with female size (Chenoweth 1963, White et al 2003, Dumais 2005, LaPlante and Schultz 2007). In Rhode Island waters, estimates of batch fecundity for tautog between 200-685 mm were 5,000 to 637,500 mature eggs. (Chenoweth 1963). Similar results were found in Long Island Sound with batch fecundity for females 250 – 600 mm estimated between 8,000 and 600,000 eggs (LaPlante and Schultz 2007). Off the south shore of Long Island, batch fecundity for females 213 – 455 mm was estimated as 778 to 69,500 eggs (Dumais 2005). Batch fecundity in Virginia was estimated to be between 2,800 and 181,200 eggs for females 259 - 516 mm.

Larger females were found to spawn more frequently than smaller females and have a longer spawning season (LaPlante and Schultz 2007). During the peak part of the season, larger females were found to spawn almost daily (White et al. 2003, LaPlante and Schultz 2007).

Total annual fecundity has been found to vary yearly as well as with fish size (LaPlante and Schultz 2007, White et al 2003). Estimates of annual fecundity were higher in Long Island Sound (LaPlante and Schultz 2007) than those reported for Virginia waters (White et al. 2003). In Long Island Sound, female tautog in the 500 mm size range produced around 26 to 55 million eggs where as a female in the 250 mm size range produced 0.6 to 1 million eggs. In Virginia, annual fecundity ranged from 160,000 eggs to 10 million eggs for females 259 mm and 511 mm respectively.

1.2.1.6 Migration

Tautog typically migrate offshore when water temperatures drop below approximately 50°F in the late fall. Migration behavior includes schooling to rugged bottom topography 80-150 feet deep. Tautog do not appear to make extensive long-shore migrations, although some fish from Long Island bays have been reported to overwinter in New Jersey coastal waters (Briggs 1977).

Seasonal migration is not uniformly exhibited. Some adults remain inshore and active throughout the year, particularly in the southern portion of the range (Auster 1989, Eklund and Targett 1991, Adams 1993, Hostetter and Munroe 1993, Arendt et al. 2001). Juvenile tautog have been collected in Maryland's Coastal Bays submerged aquatic vegetation (SAV) in September (Doctor et al 2015), and spawning tautog have been collected on artificial reefs near Ocean City in May. In Maryland and Virginia, populations of adults have been observed 12 - 40 miles offshore in 30 - 225 feet of water throughout the year (Eklund and Targett 1990, Hostetter and Munroe 1993). Offshore distributions decline toward the northern part of the species range (Chesapeake Bay Program 1994).

When water temperatures are very low, adults become torpid (Cooper 1966, Briggs 1977). This may allow tautog, a member of a mostly tropical family, to survive cold winter conditions in northern regions (Curran 1992). Suboptimal conditions (i.e., high water temperature, decline in mussel abundance) will cause adult and large juvenile tautog to leave an area (Olla et al. 1979, Adams 1993, Steimle and Shaheen 1999).

1.2.1.7 Feeding

Juvenile tautog feed primarily on small benthic and pelagic invertebrates including copepods, amphipods, isopods, ostracods, polychaetes, crabs and mussels (Olla et al. 1975, Festa 1979, Grover 1982, Sogard et al. 1992, Dorf 1994). The composition of the juvenile diet changes with fish size. In Narragansett Bay, Rhode Island, small young-of-the-year (20 - 50 mm total length) primarily consumed amphipods and copepods. Juveniles 50 - 68 mm in length consumed a variety of invertebrates. The largest young-of-the-year (68 - 99 mm) ate mainly small shrimp and crabs (Dorf 1994). Similar diets were reported in New Jersey (Festa 1979, Sogard et al. 1992), Chesapeake Bay (Orth and Heck 1980) and Connecticut waters (Clark et al. 2006). In New York waters, juveniles 104 - 205 mm in length fed primarily on blue mussels *(Mytilus edulis)* throughout the year (Olla et al. 1975). Larger juveniles (200 - 320 mm) in New Jersey were observed to feed on xanthid crabs (Festa 1979).

Adult tautog feed primarily on the blue mussel and other shellfish throughout the year. The diet can be extremely varied depending on location and availability. The following items have been found in the diets of adult tautog: hydroids, barnacles, various crabs, sand dollars, amphipods, isopods, polychaete worms, shrimp, lobster, periwinkles, jingle shells, scallops, soft shell clams and razor clams (Bigelow and Schroeder 1953, Olla et al. 1974, Steimle and Ogren 1982, Auster 1989, Dumais 2005).

Tautog have been found to select a limited size range of blue mussels as prey (Lankford 1999) which is 45-50% smaller than the size mussel the fish is capable of ingesting. Adults grasp mussels using their large canine teeth, tearing them from the surrounding surface by shaking their heads. Small mussels are swallowed whole, while larger, hard-shelled ones are crushed by the pharyngeal teeth prior to swallowing. The canine teeth are not used for crushing shells (Olla et al. 1974).

Tautog are visual predators and therefore, do not feed at night (Olla et al. 1974, Deacutis 1982). Tautog leave their home sites and begin actively searching for food at dawn (Briggs 1969, Olla et al. 1974, 1975). Generally venturing up to 1,500 feet away, although there have been reports of tautog traveling as far away as 10 kilometers from their home site (Olla et al. 1974, Arendt et al. 2001). Tautog have been observed to follow an incoming tide above low water levels to feed on concentrations of mussels in the intertidal, returning to deep water as the tide ebbs (Bigelow and Schroeder 1953). Most fish move to areas with large concentrations of mussels during the day and return to their home site at evening twilight (Olla et al. 1974). Food intake may be reduced due to high water temperatures (Olla et al. 1978), low winter temperatures (Cooper 1966), and during spawning (Bridges and Fahay 1968).

Tautog's high dependence on blue mussels creates an important trophic link influencing distribution, behavior, and perhaps, growth and survival. Periodic recruitment failure of mussels in tautog habitat can cause tautog to move to other feeding areas (Steimle and Shaheen, 1999). If they do not move, or the failure is widespread, tautog inhabiting the area may suffer some effects of an inadequate diet. Heavy consumption of mussels can cause a depletion of this food source before new prey recruitment occurs, especially if tautog are concentrated in an area for some climatological, water quality, or behavioral reason.

1.2.2 Stock Assessment Summary

The first tautog stock assessment was performed in 1995 using the ADAPT virtual population analysis (VPA) model (available through NMFS NEFSC toolbox, http://nft.nefsc.noaa.gov/). In order to incorporate perceived regional differences in biology and fishery characteristics throughout the range of the species, the Technical Committee (TC) attempted separate regional models for northern (Massachusetts to New York) and southern (New Jersey to Virginia) states. The assessment underwent peer review through the NMFS NEFSC Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC) process. Although the assessment was not accepted by the peer review panel, the resulting fishing mortality estimate from the assessment was incorporated into the initial FMP (ASMFC 1996).

The next benchmark stock assessment, performed in 1999, was also conducted using the ADAPT VPA. The regional approach was used for data consolidation, application of age keys, and preliminary VPA runs of the model. Unfortunately, results for the southern region were unreliable. The preferred run, therefore, was based on catch at age (CAA) developed separately for north (MA-NY) and south (NJ-VA) regions and combined for a total coastwide CAA. The assessment derived coastwide estimates of F, spawning stock biomass, and recruitment. In addition, tag based survival estimates were included in the assessment as corroborative evidence. A peer review of the model through the SAW/SARC process determined the model was suitable for management purposes. That assessment indicated the terminal F rate had dropped to 0.29, which was attributed to increases in minimum size required in the original FMP. This terminal F was close to the interim FMP target of 0.24, but well above the final plan target of F = 0.15.

A stock assessment update conducted in 2002 using the methods from the 1999 assessment found that recreational catch rates had returned to levels observed prior to the minimum size limit increase, and F had increased to F = 0.41. The Board responded by implementing reductions in recreational harvest in 2003, in an attempt to return F to the FMP target value. The target was revised to $F_{SSB\ 40\%} = 0.29$ by Addendum III (ASMFC 2002), based upon updated recruitment and weight at age parameters and a desire to adopt a target with more management flexibility.

A benchmark stock assessment conducted and peer-reviewed in 2005 (ASMFC 2006) continued the use of the coastwide ADAPT VPA model based on separate regional (north/south) CAA. The assessment indicated the coastwide population of tautog had declined about four-fold from 1982 to 1996 and had then remained relatively stable through the terminal year. The stock was considered overfished and overfishing was occurring with a 2003 coastwide fishing mortality estimate of F=0.299. In response to concerns from the Management Board and TC regarding the utility of a coastwide model on a mostly sedentary species, the 2006 assessment also presented results of state-specific assessments (primarily catch curves) of local tautog populations. The peer review panel generally agreed local or regional methods were more appropriate given the life history of the species, but expressed reservations about the paucity of data available at small regional scales and the use of catch curves for management purposes. The panel approved the coastwide model for use in management, encouraging further development and refinement of more localized models for future use (ASMFC 2006).

A “turn of the crank” update assessment was completed in 2011 using the same methodology as the 2006 assessment, with data through 2009. Fishing mortality was estimated as F = 0.23 in 2009, with the three-year average F = 0.31. Both estimates were above the Addendum IV target of $F_{target} = 0.20$. SSB was estimated to be 10,663 MT in 2009, well below Addendum IV’s target of 26,800 MT and threshold of 20,100 MT. Therefore, the 2011 stock assessment update concluded tautog was overfished and experiencing overfishing.

A benchmark stock assessment was completed and peer-reviewed in 2014 (ASMFC 2015). The assessment was conducted at a regional level. The TC used life history information, tagging data, fishery characteristics, and data availability considerations to split the coastwide population into three regions. Each region was assessed independently using the statistical catch-at-age model ASAP. All three regions were found to be overfished, with overfishing occurring in two regions (Massachusetts-Rhode Island and Connecticut-New York-New Jersey).

While the three-region approach in the benchmark stock assessment was applicable, there was interest in assessing and managing the Long Island Sound as a discrete area. A regional stock assessment was completed and peer-reviewed in 2016 (ASMFC 2016a). This regional assessment analyzed two additional regions (Long Island Sound and New Jersey-New York Bight) to comprise a four-region management scenario. The Long Island Sound (LIS) region includes harvest in Connecticut and New York LIS. The New Jersey-New York Bight (NJ-NYB) region includes harvest in New York's south shore and New Jersey. The two regions were found to be overfished and overfishing was occurring.

In 2016, the Board reviewed stock status across the three and four region management scenarios, ultimately electing to separate management into four regions. A four region stock assessment update was conducted using data through 2015 (ASMFC 2016b). The assessment estimated the maximum level of harvest (per region) in order to achieve the F target for each region by 2021 (Table 2). Spawning potential ratio (SPR) based reference points were utilized for all regions, except LIS, which used maximum sustainable yield (MSY) based reference points (See Section 2.5).

Table 2. 2013-2015 Average Landings Compared to the Proposed Maximum Removals by Region when Applying a 50% or 70% Probability of Achieving F Target in 2021. Parenthesis indicates the necessary harvest reduction to achieve the associated level of harvest. (ASMFC 2016b)

		Probability of achieving F target	
Region	**Status quo (mt) 3 yr avg: 2013-2015**	**50% (mt)**	**70% (mt)**
Massachusetts-Rhode Island	390	-	-
Long Island Sound	500	264 (-47%)	237 (-54%)
New Jersey-New York Bight	461	450 (-2)	410 (-11%)
Delaware-Maryland-Virginia	77	-	-

1.2.2.1 Massachusetts-Rhode Island

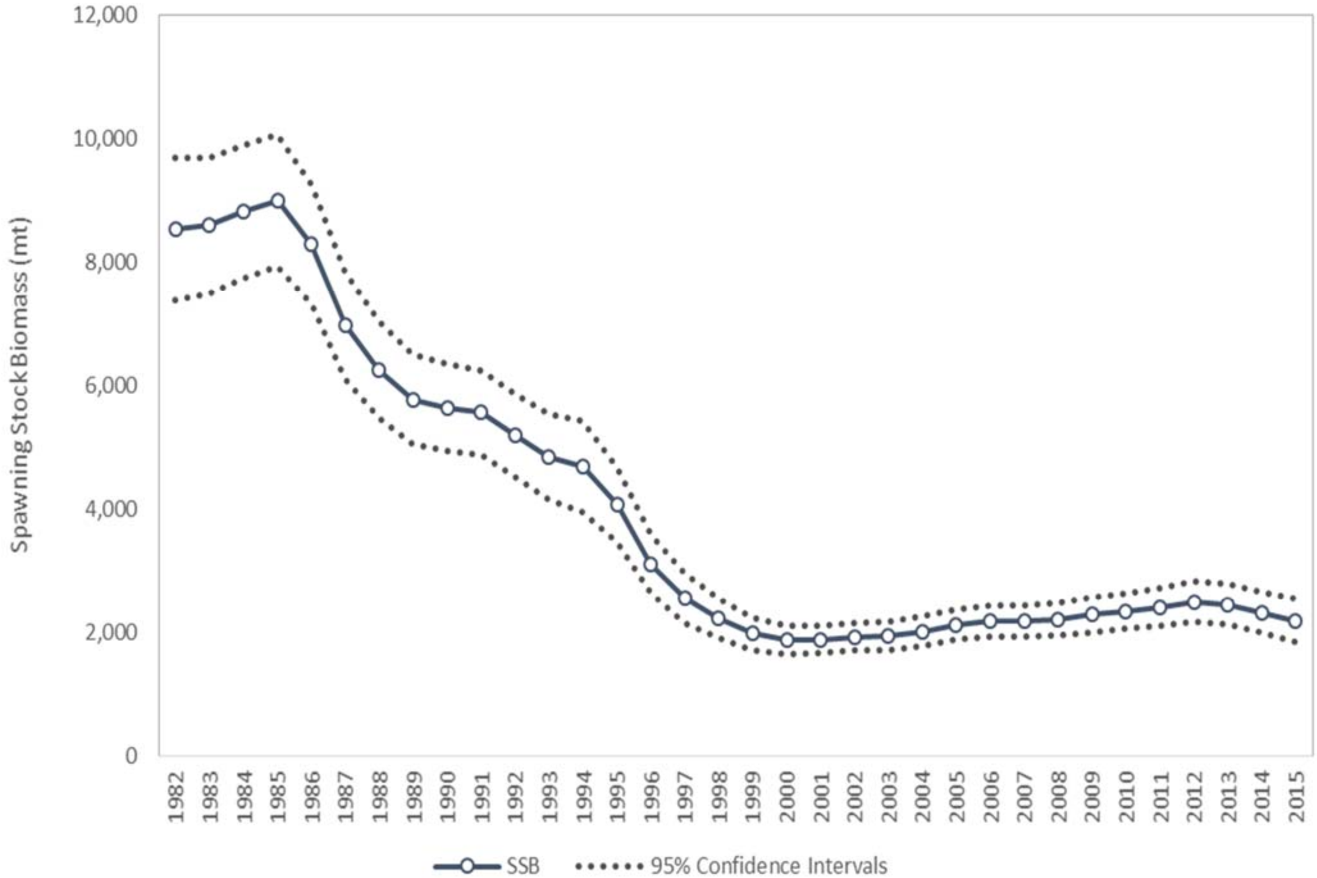
The 2016 stock assessment update indicates the Massachusetts – Rhode Island (MARI) stock is not overfished and overfishing is not occurring.

Fishing Mortality: For SPR estimates, the 3-year average value of F_{3yr} = 0.23 was below both F_{Target} = 0.28 and $F_{threshold}$ = 0.49, this stock is not experiencing overfishing and the fishing mortality rate is below the target.

Figure 2. Fishing mortality estimates for the MARI region.

<u>Spawning Stock Biomass</u>: For SPR estimates, the point estimate of SSB_{2015} = 2,196 mt is below the SSB_{Target} = 2,684 mt but is above the $SSB_{threshold}$ = 2,004 mt, indicating the stock is not overfished but is not yet rebuilt to the SSB target. Total abundance and spawning stock biomass declined rapidly from 1982 until 2000. Spawning stock biomass decreased from 8,994 mt in 1985 to the current estimate of 2,196 mt in 2015.

Figure 3. Spawning stock biomass estimates for the MARI region.



Recruitment: Recruitment was generally highest in the early years of the time-series, with a couple of average recruitment years in the mid-2000s. Observed recruitment has increased from time series lows during the 2013 – 2015 period, but remain below average in general.

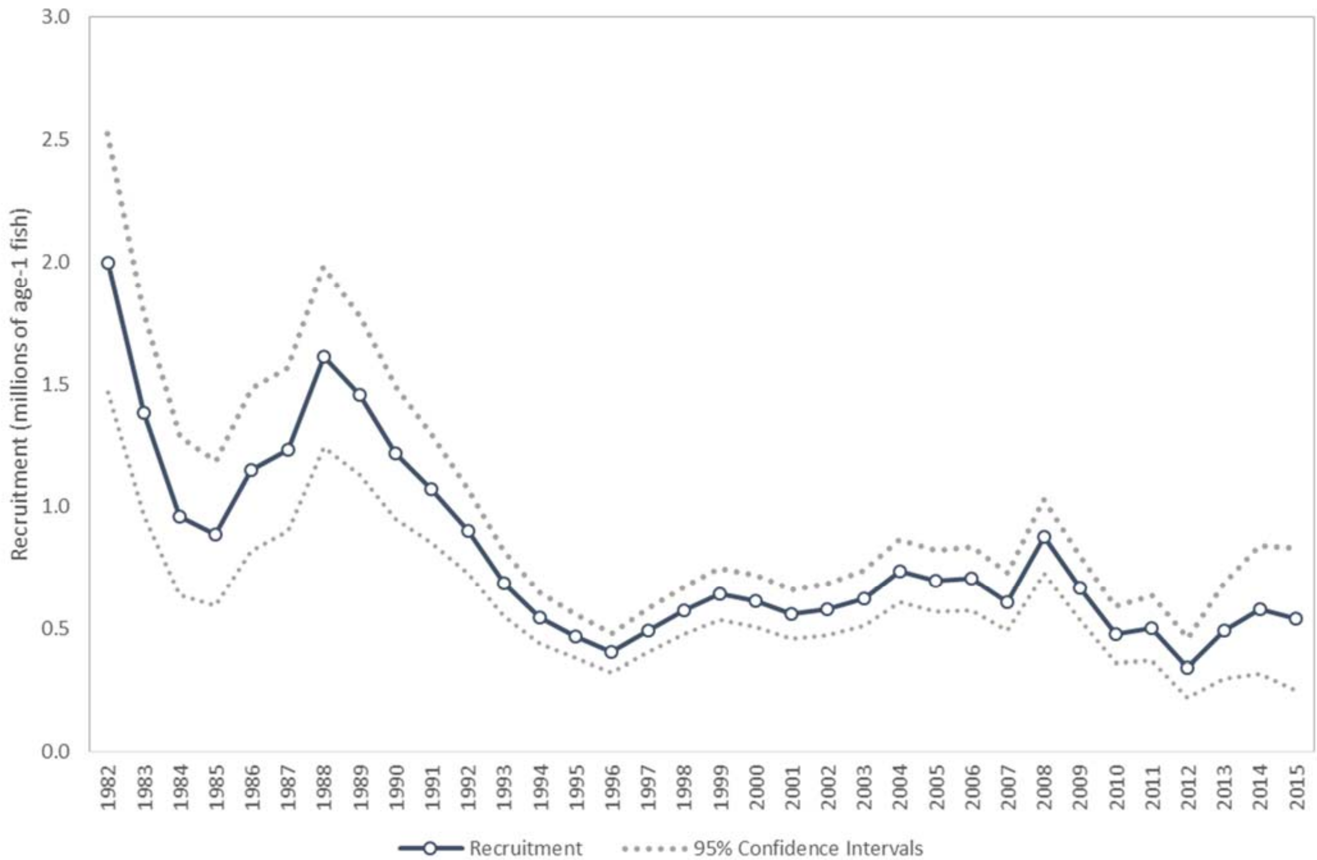
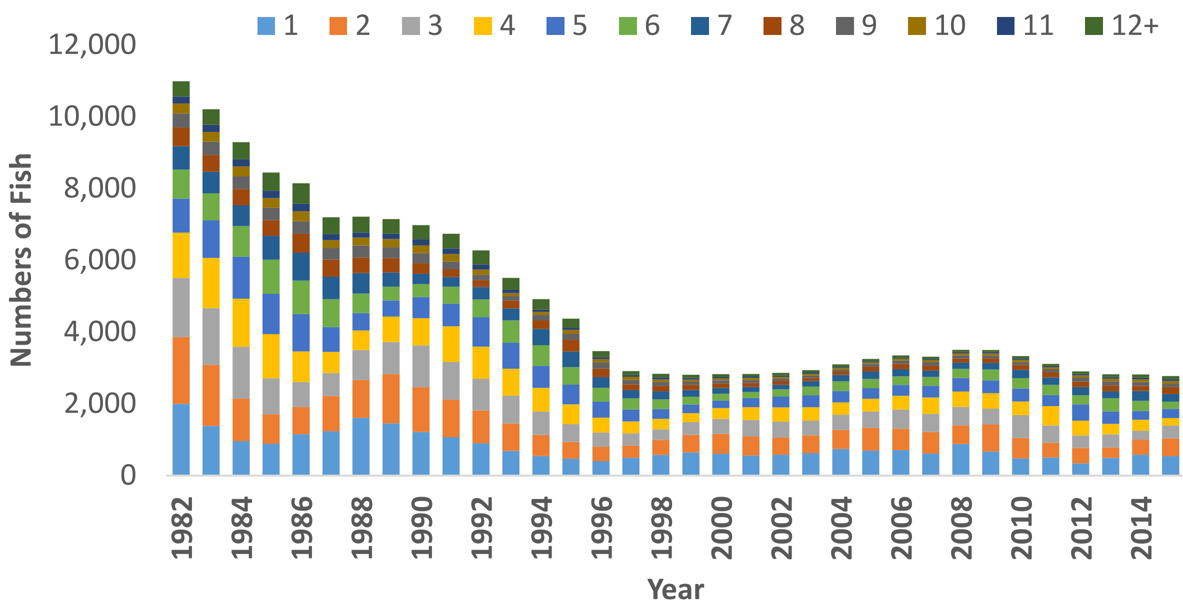


Figure 4. Recruitment estimates for the MARI region.

Abundance: Total abundance and spawning stock biomass declined rapidly from 1982 until 2000. Despite a period of slightly increased abundance in the early to mid-2000s, the overall trend has been flat from 2000 until 2015. Total abundance declined from a high of 10.9 million fish to the current estimate of 2.8 million fish in 2015.



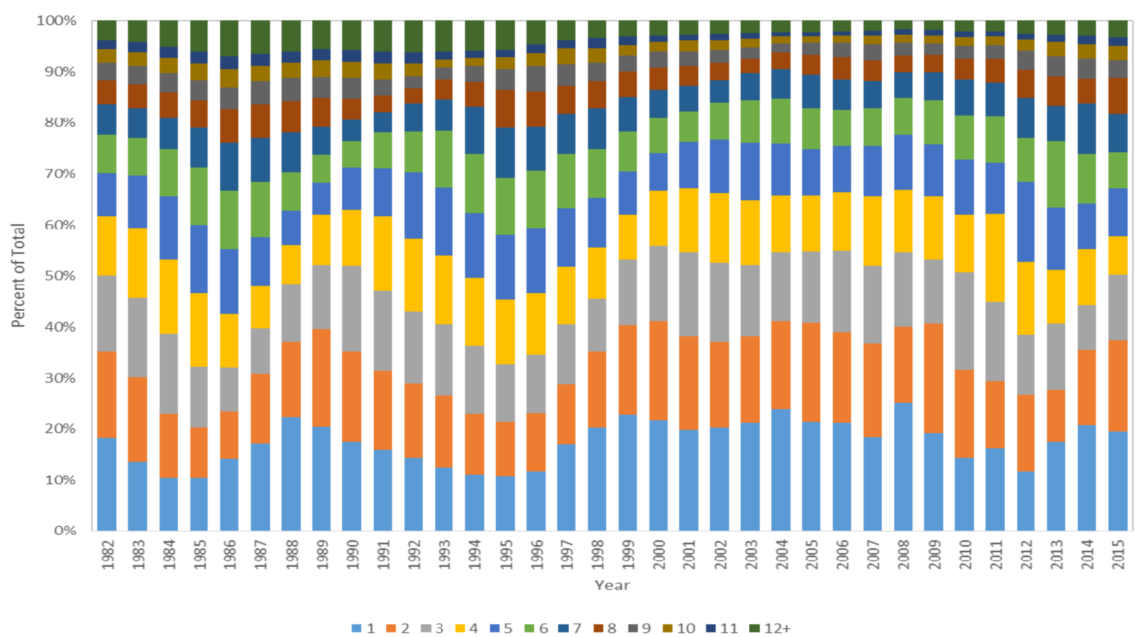


Figure 5. The top graph is the abundance at age for the MARI region in total numbers of fish. The bottom graph illustrates the data in terms of the overall percentage of fish at age within each year.

1.2.2.2 Long Island Sound

The 2016 stock assessment update indicates the LIS stock is overfished and overfishing is occurring.

<u>Fishing Mortality:</u> F_{target} is defined as F_{MSY} and $F_{threshold}$ is defined as the F rate that would maintain the population at 75%SSB_{MSY}. F_{target} for LIS was 0.28 and $F_{threshold}$ was 0.49. In 2013-2015, F ranged from 0.35 to 0.59. The 3 year-average estimates of F (F_{3yr} = 0.51) exceeded the MSY target and threshold.

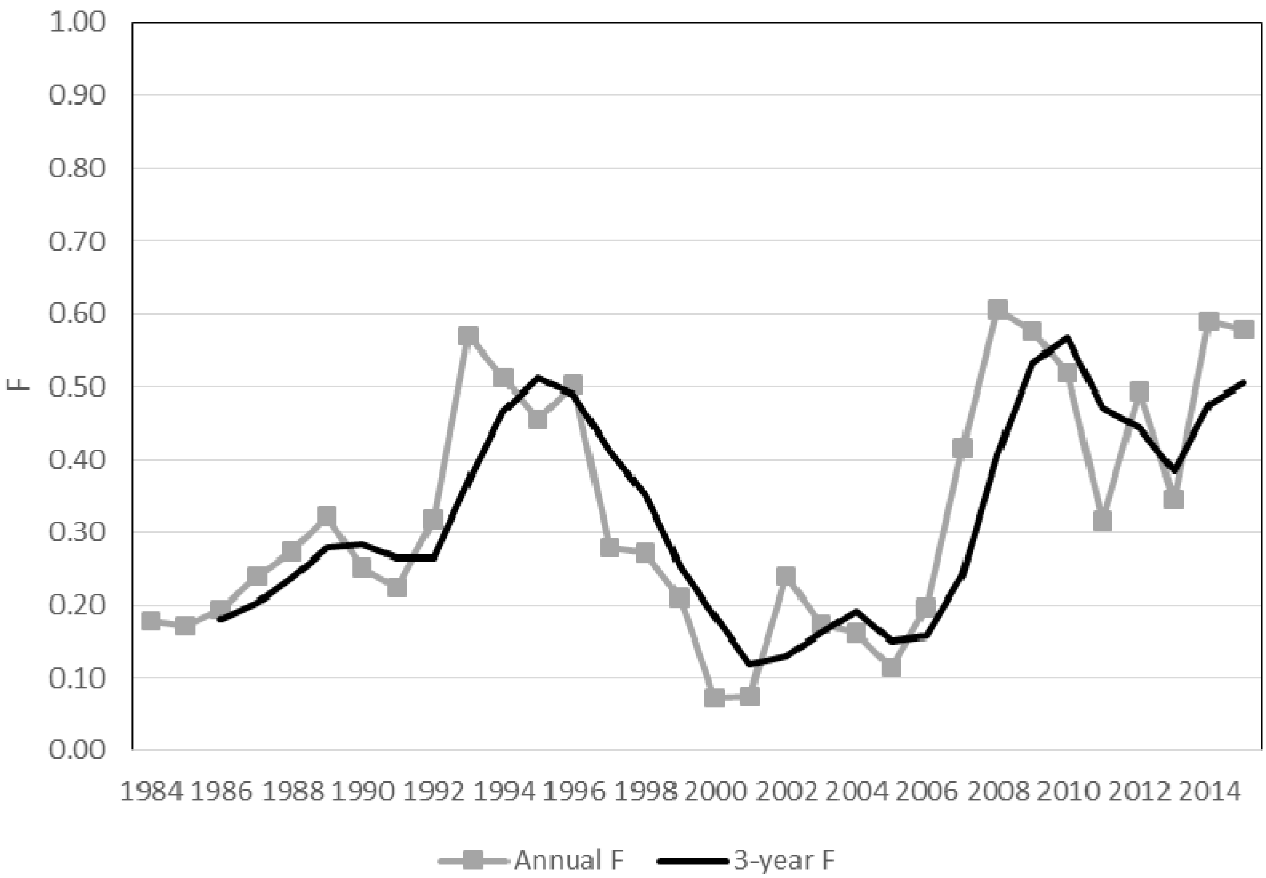


Figure 6. Annual fishing mortality (F) and 3-year average for LIS

Spawning Stock Biomass: SSB_{2015} (1,603 mt,) is below MSY target and threshold (SSB_{MSY} = 2,865 mt and $SSB_{75\%MSY}$ = 2,148 mt), indicating the stock is overfished.

Total abundance and spawning stock biomass declined rapidly from 1984 until the mid to late 1990s. Spawning stock biomass decreased by more than 75%, from over 6,350 mt at the beginning of the time-series to the current estimate of 1,551 mt.

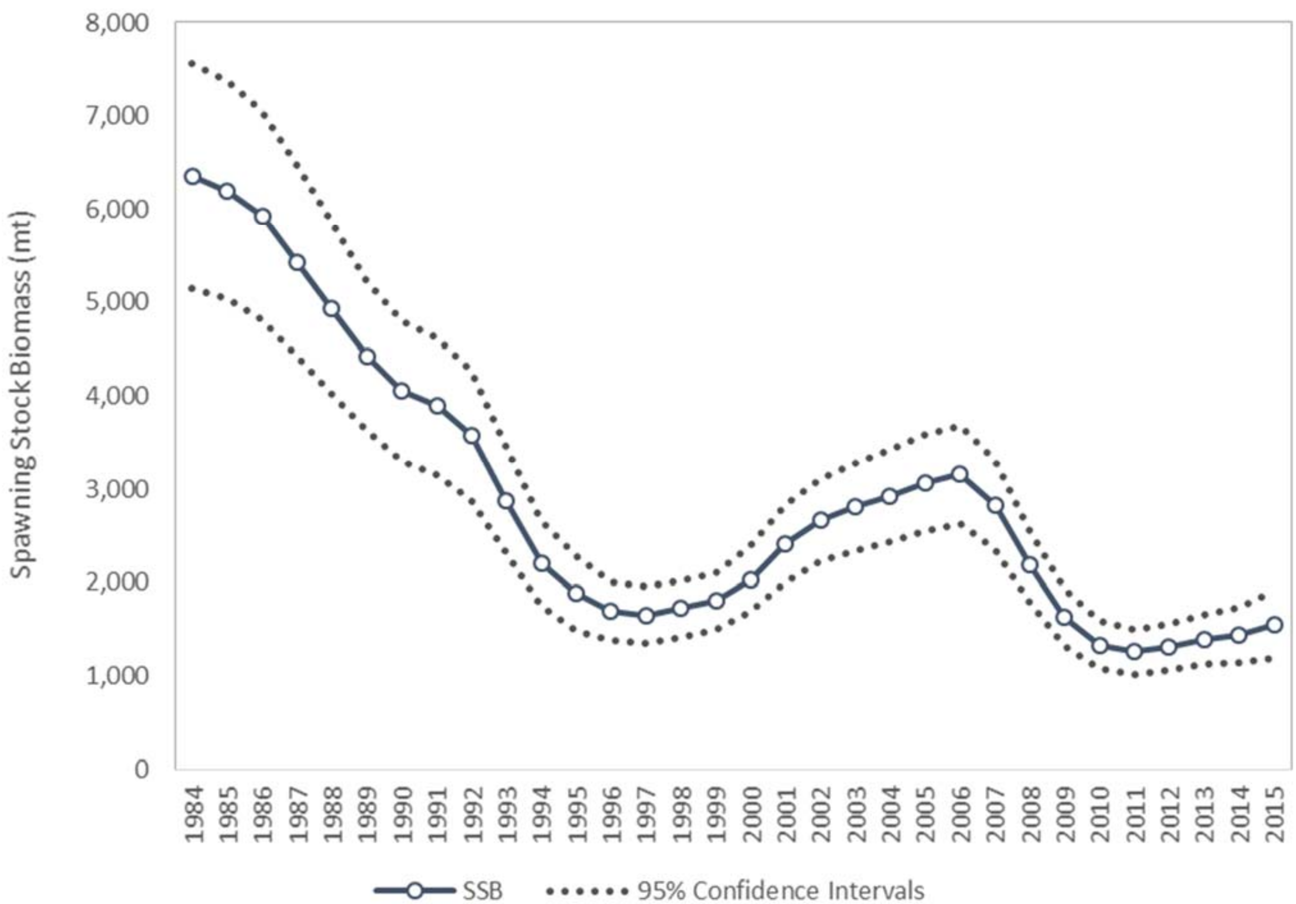


Figure 7. Estimates of spawning stock biomass for the LIS region.

Recruitment: Recruitment was highest in the early years of the time series and again in 2013 and 2015. The two recent peaks in recruitment bracketed the lowest recruitment year on record.

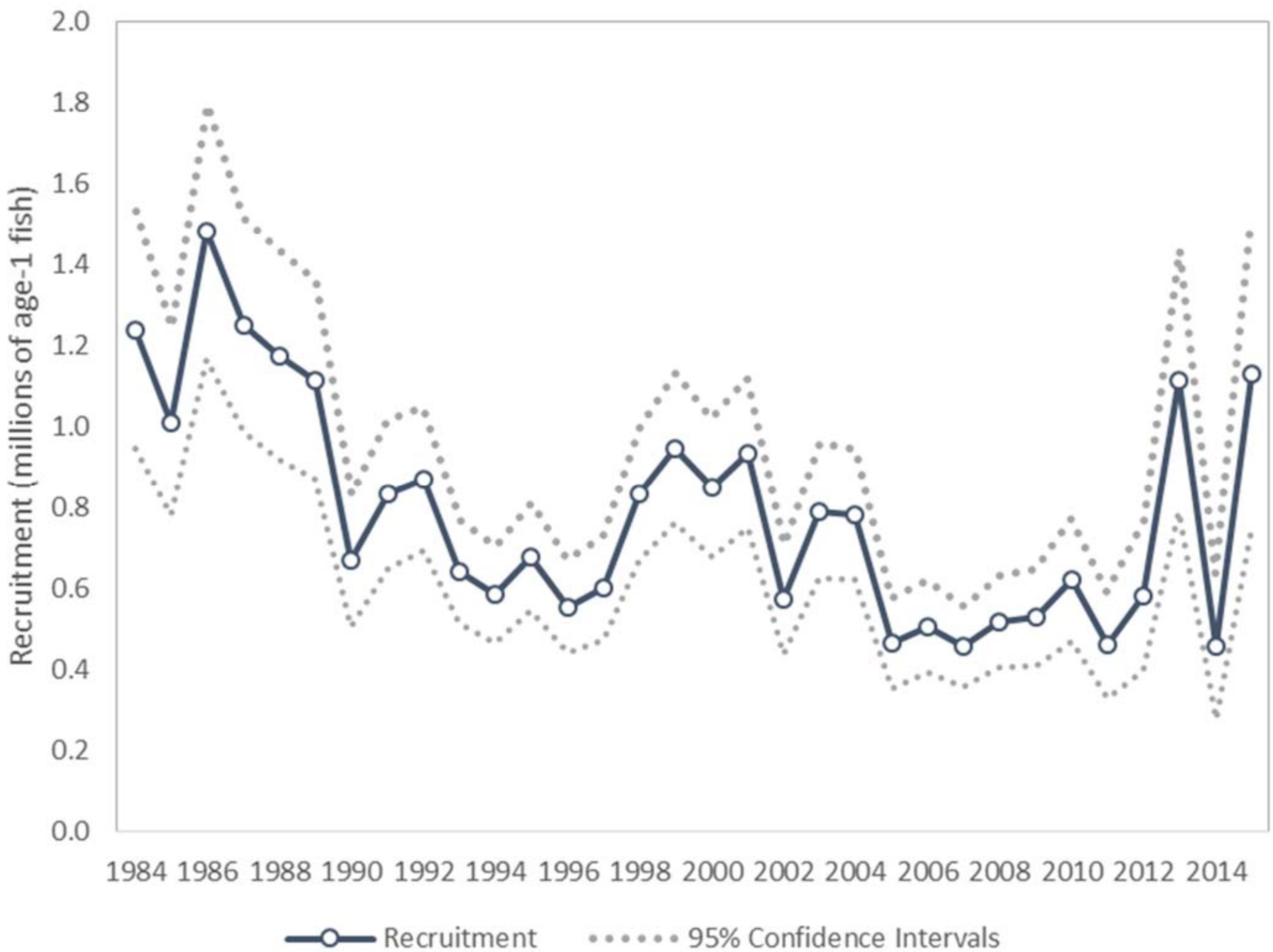


Figure 8. Recruitment estimates for LIS region

Abundance: Total abundance and spawning stock biomass declined rapidly from 1984 until the mid to late 1990s. Despite a period of slightly increased abundance in the early to mid-2000s, the overall trend has been a slower but consistent decline since 1995. Total estimated abundance declined by more than half, from 8 million fish (1984) to 3.5 million fish (2015). Abundance at age in the stock of the terminal year (2015) shows a dominance of fish aged 1 and 3, fewer age 2 fish and declining abundance from age 4 through age 12.

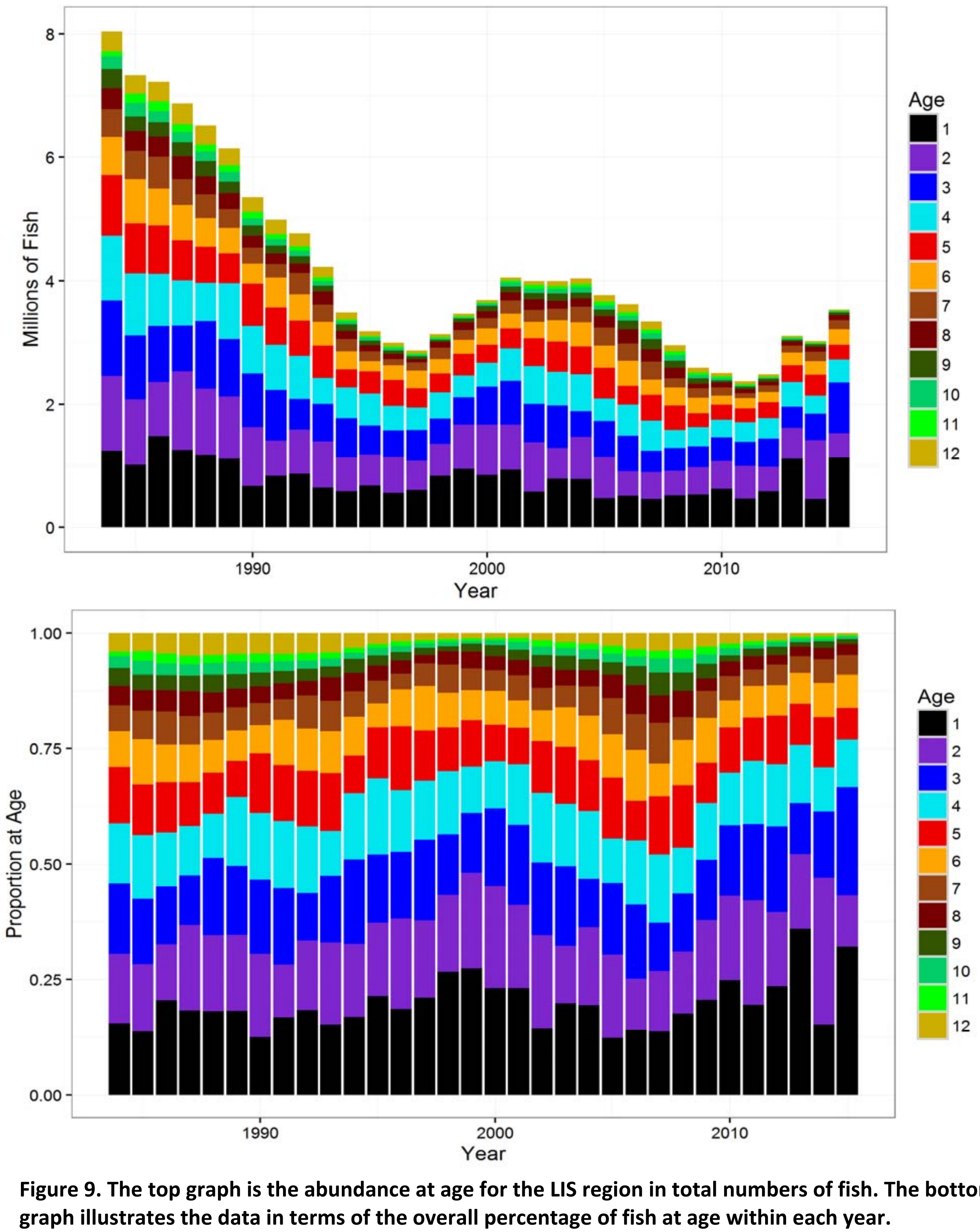


Figure 9. The top graph is the abundance at age for the LIS region in total numbers of fish. The bottom graph illustrates the data in terms of the overall percentage of fish at age within each year.

1.2.2.3 New Jersey – New York Bight

The 2016 stock assessment update indicates the New Jersey-New York Bight (NJ-NYB) stock is overfished and overfishing is occurring.

Fishing Mortality: Fishing mortality target and threshold reference points in the NJ-NYB region are defined as $F_{40\%SPR}$ and $F_{30\%SPR}$, respectively. ASAP model estimated values for the target and threshold are $F_{40\%}$ = 0.20 and $F_{30\%}$ = 0.34. The ASAP model runs indicated overfishing was occurring in the NJ-NYB region in 2015. Both the point estimate of F_{2015} = 0.45 and the 3-year average value of F_{3yr} = 0.54 were above the fishing mortality threshold.

Figure 10. Fishing mortality estimates for the NJ-NYB region.

<u>Spawning Stock Biomass:</u> SSB_{2015} was estimated at 1,809 mt, approximately 23% below the SSB threshold (2,351 mt) and 43% below the target (3,154 mt), indicating the stock is overfished.

SSB shows a general decline from approximately 6,000 mt in 1989 to around 1,900 mt by 1996. Regulations in 1997 and 2003 allowed slight increases in SSB in subsequent years, but these gains were short lived as F rebounded. From 2006 to 2011, SSB declined from around 2,000 mt to 1,000 mt, but has since recovered to 1,835 mt (90% confidence intervals 1,352 - 2,489 mt).

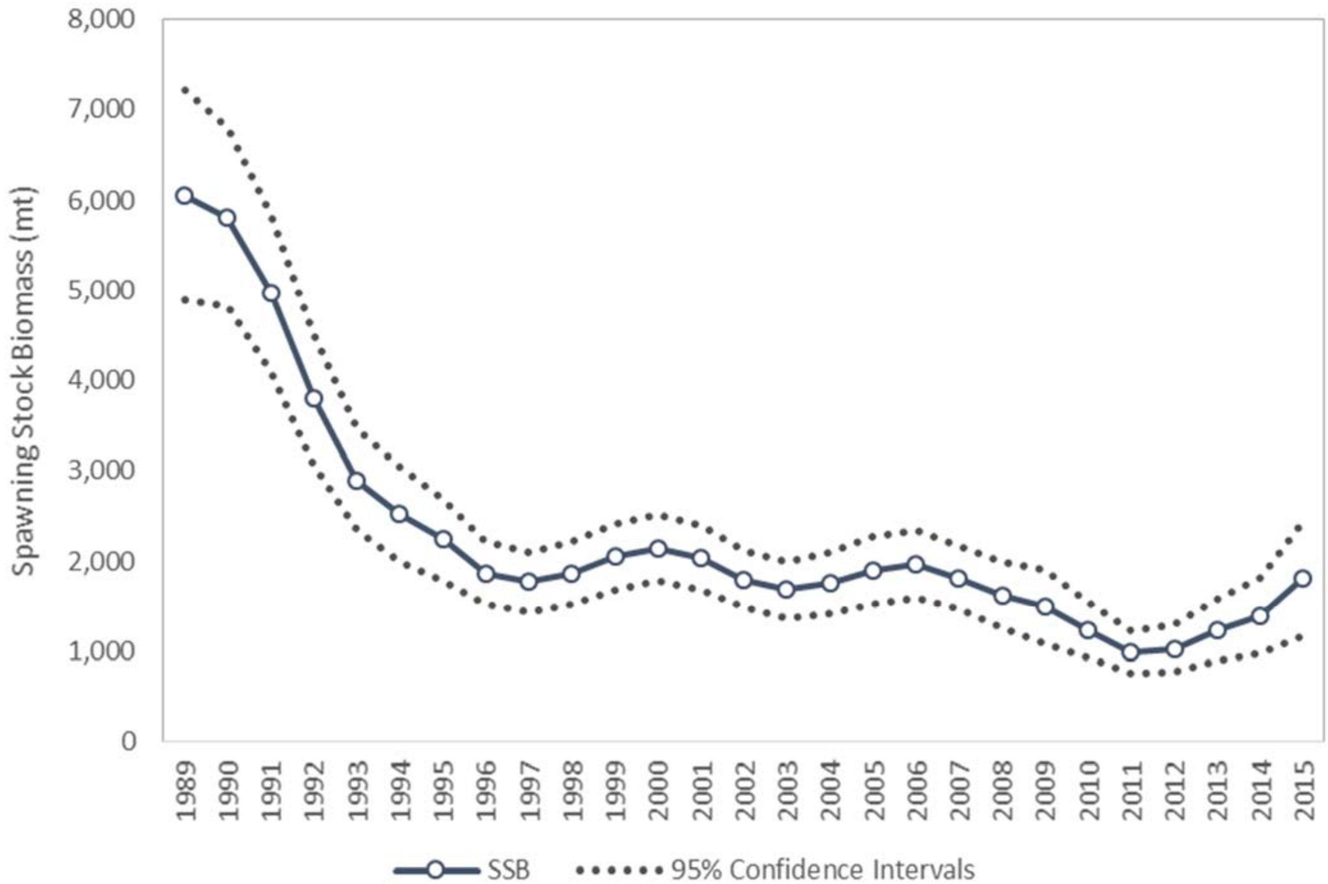


Figure 11. Spawning stock biomass estimates for the NJ-NYB region.

<u>Recruitment:</u> During the early 1990s, recruitment (age 1) follows a similar pattern as SSB, declining from 1.5 million in 1989 to less than 1 million by 1993. From 1993 to 2011, recruitment varied without trend between approximately 560,000 and 1,010,000 fish annually. Estimates of recruitment in the last four years of the model were above 950,000 fish, with an apparent strong year class in 2014, estimated at 2.26 million.

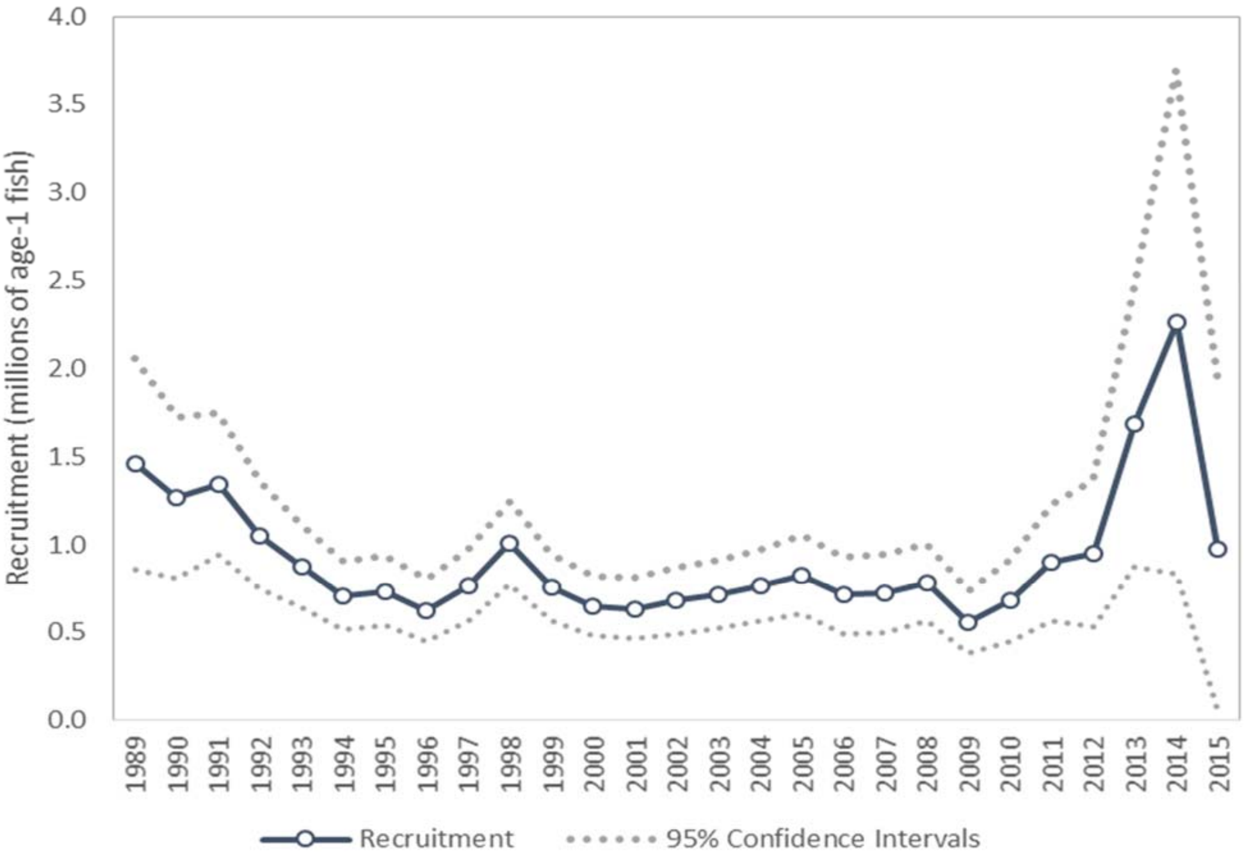


Figure 12. Recruitment estimates for the NJ-NYB region

Abundance: Abundance at age in the stock of the terminal year shows a dominance of fish aged 1 through 3 with declining numbers from age 4 through age 12.

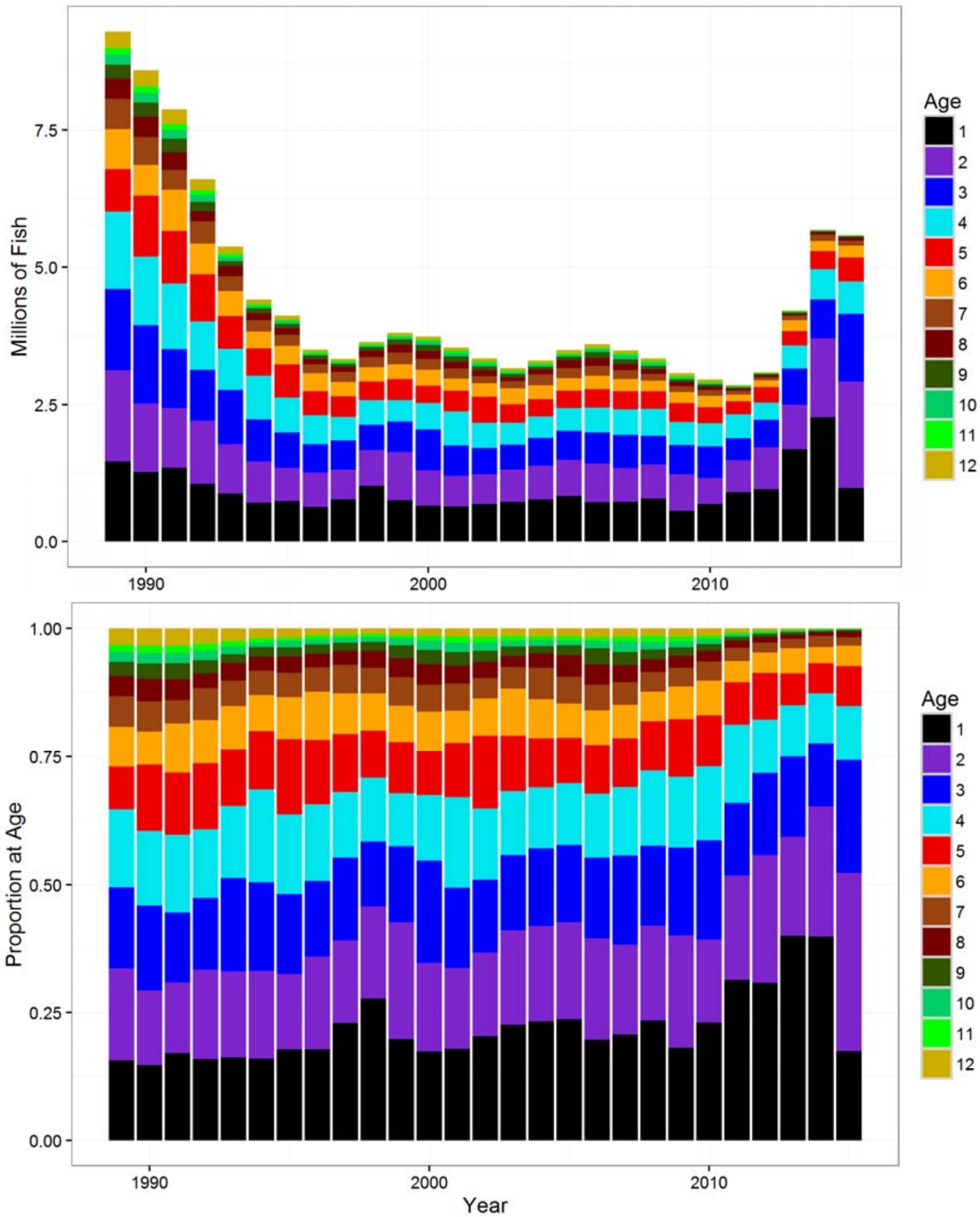


Figure 13. The top graph is the abundance at age for the NJ-NYB region in total numbers of fish. The bottom graph illustrates the data in terms of the overall percentage of fish at age within each year.

1.2.2.4 Delaware-Maryland-Virginia

The 2016 stock assessment update indicates the Delaware-Maryland-Virginia (DelMarVa) stock is overfished and overfishing is not occurring.

Fishing Mortality: F_{target} is defined as $F_{40\%SPR}$ = 0.16, and $F_{threshold}$ is defined as $F_{30\%SPR}$ = 0.24. The three year average F from 2013-2015 was 0.16, equal to the target and below the threshold, indicating overfishing is not occurring.

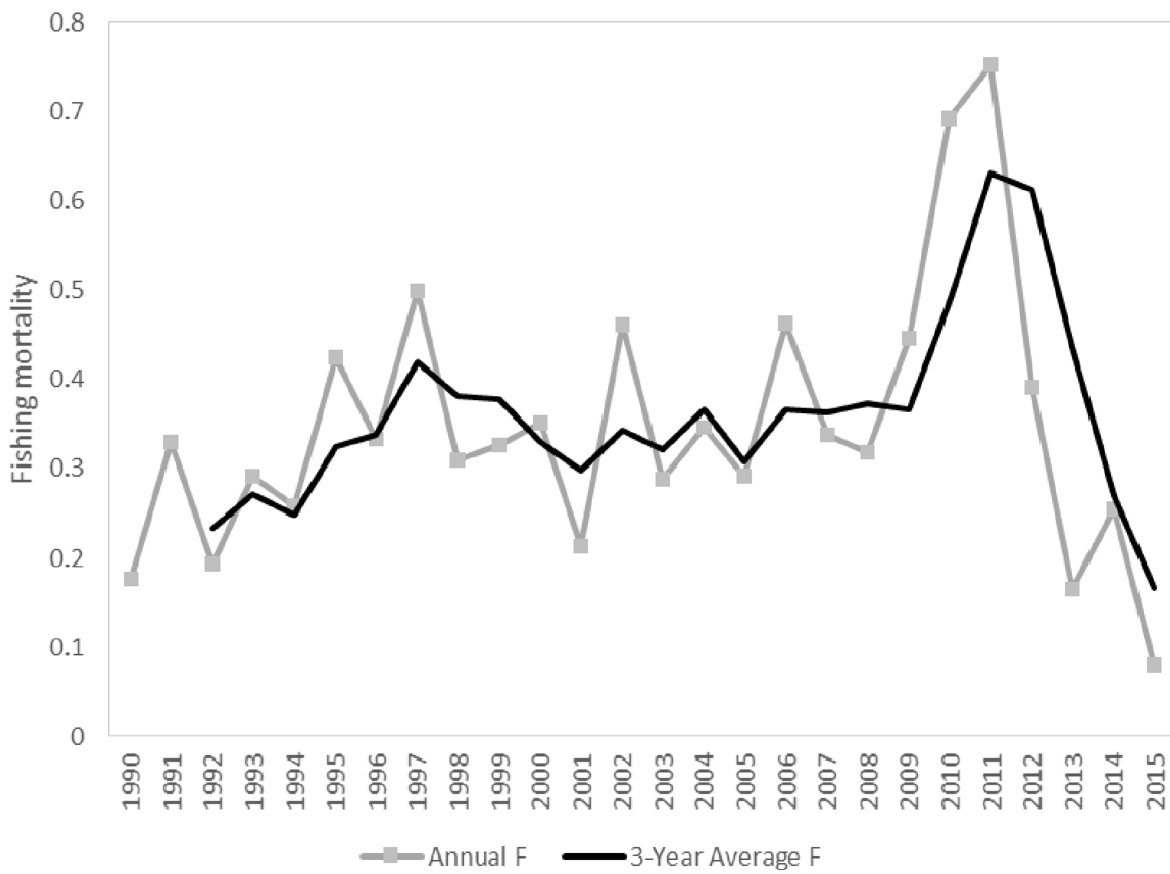


Figure 14. Fishing mortality estimates for the DelMarVa region

<u>Spawning Stock Biomass:</u> The SSB target for DelMarVa is the long-term equilibrium SSB associated with $F_{40\%SPR}$, equal to 1,919 mt. The SSB threshold is the SSB associated with $F_{30\%SPR}$ = 1,447 mt. Terminal year SSB 2015 estimate is 620.9 mt, below both the target and the threshold, indicating the stock is overfished.

Both total abundance and spawning stock biomass have declined steadily in the DelMarVa region since 2009, and SSB reached historically low level of 609 mt in 2015.

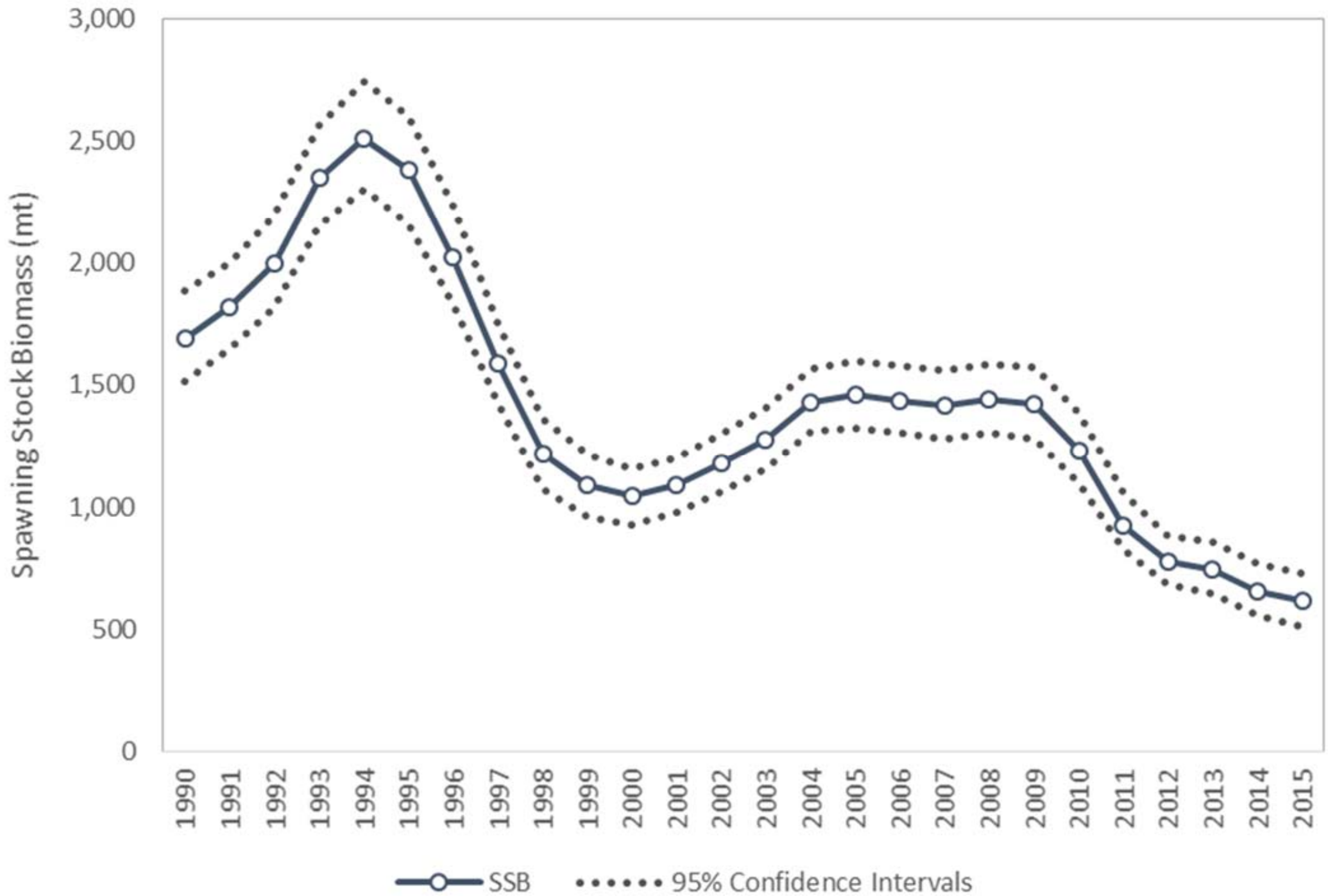


Figure 15. Spawning stock biomass estimates for the DelMarVa region

Recruitment: Recruitment appears to have been on the decline since 2009, reaching the lowest level in 2013 at 110,620 fish, but began to increase thereafter (Table 5.4.3, Figure 5.4.4). Overall, recruitment has exhibited low variability and a lack of sharp inter-annual changes.

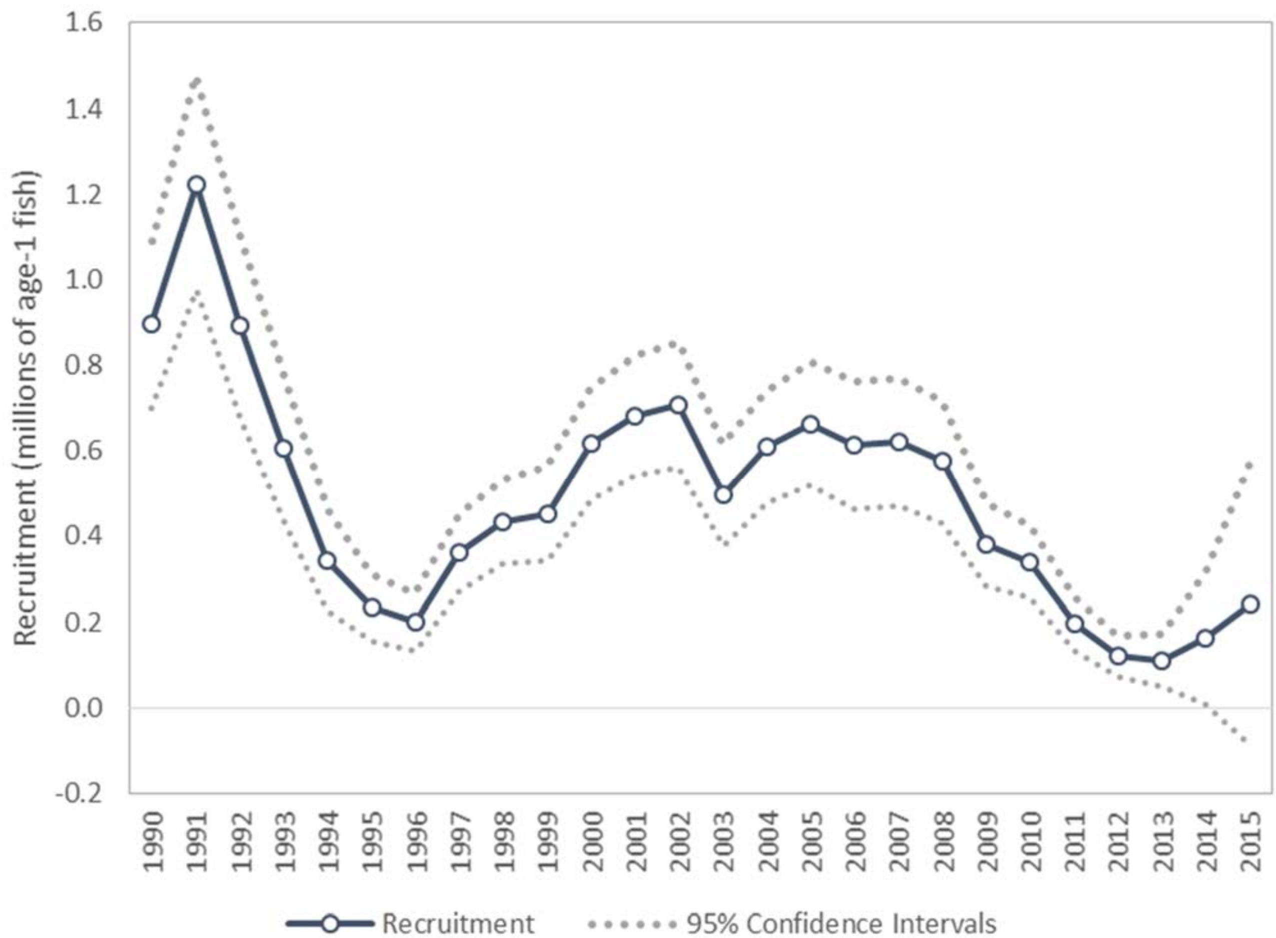
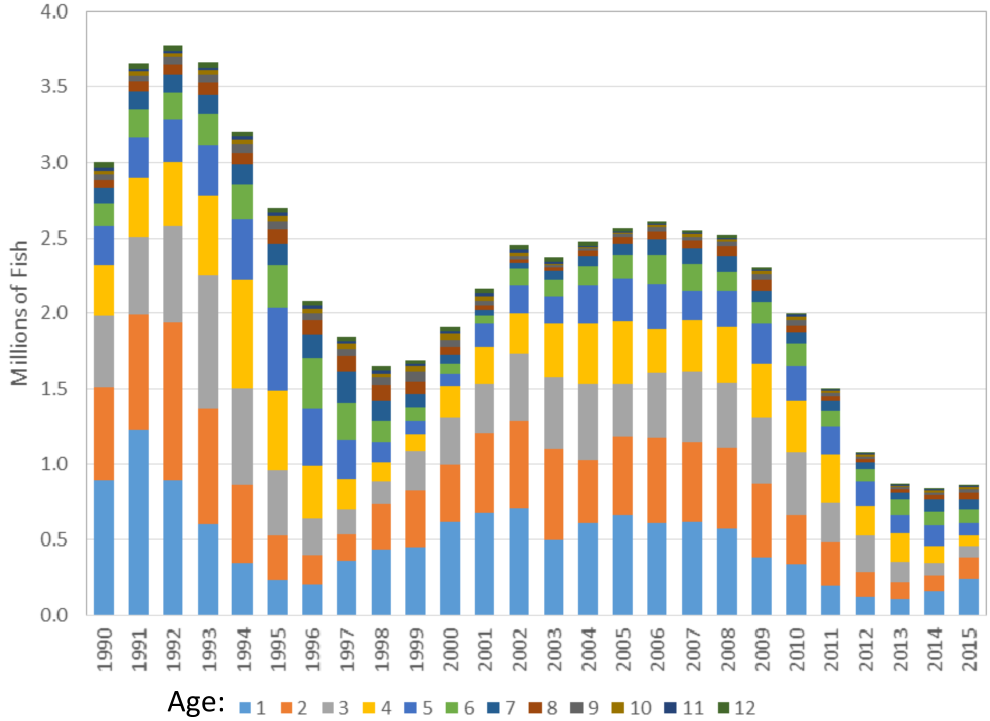


Figure 16. Recruitment estimates for the DelMarVa region

Abundance: Both total abundance and spawning stock biomass have declined steadily in the DelMarVa region since 2009. Total abundance declined from a stable level of about 2.5 million fish in 2002-2009 period to the current low of 0.86 million fish in 2015.



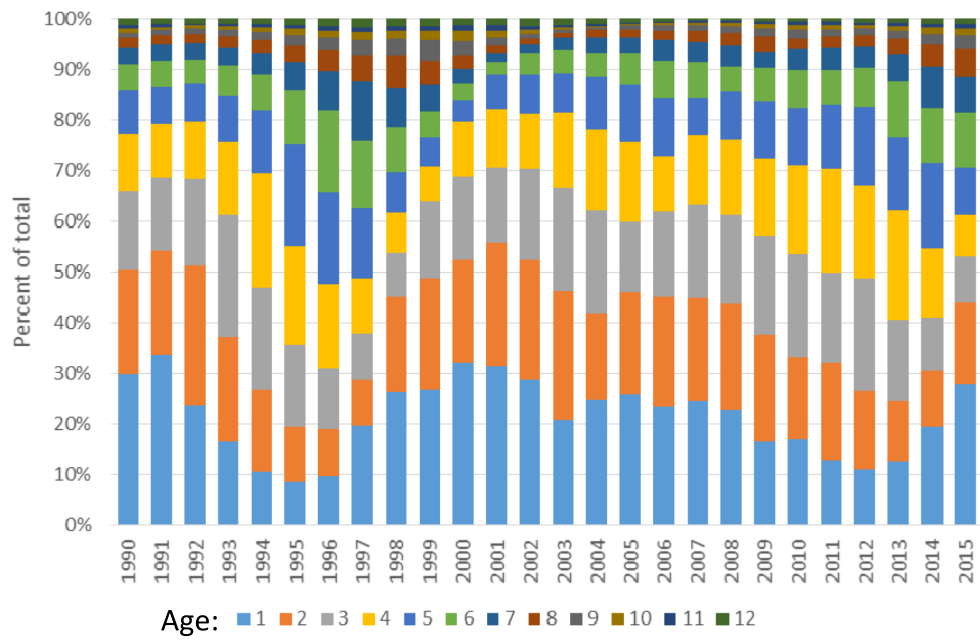


Figure 17. The top graph is the abundance at age for the DelMarVa region in total numbers of fish. The bottom graph illustrates the data in terms of the overall percentage of fish at age within each year.

1.3 DESCRIPTION OF THE FISHERY

The proportion of harvest from each region has fluctuated somewhat over the years (Figure 18), with the DelMarVa's proportion declining in recent years and the LIS region's proportion growing. From 2013-2015, MARI accounted for 27% of coastwide removals, LIS accounted for 35%, NJ-NYB accounted for 32%, and DMV accounted for 5%.

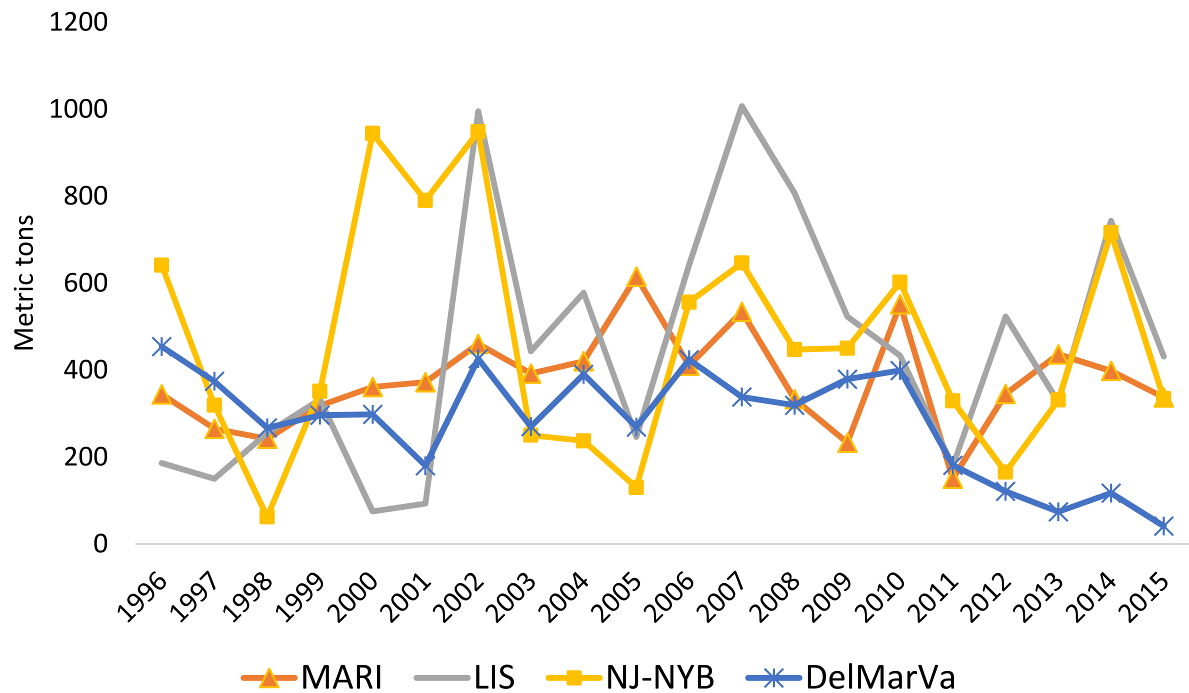


Figure 18. Harvest by Region (1996-2015); including recreation harvest, recreational release mortality, and commercial landings

Coastwide recreational harvest peaked in 1986 at over 7 million fish and since declined. Average recreational harvest from 2013-2015 was 708,136 fish, with 2014 nearly double the harvest of 2013 and 2015. In 2014, over 1 million fish were harvested compared to approximately 545,282 fish in 2015. The 2014 estimate was also more uncertain than the 2013 and 2015 estimates, with a PSE of 24.7% compared to 16-17% in 2013 and 2015.

Coastwide commercial harvest showed a similar pattern to recreational harvest, although the magnitude is smaller, representing approximately 9% of the total harvest over the entire time series. It peaked in the late 1980s at 1.2 million lbs (525 mt), and declined to an average of 0.27 million lbs (124 mt) in 2013-2015. Commercial harvest in 2014 was 0.28 million lbs (129 mt), not significantly different from the 2015 harvest of 0.26 million pounds.

1.3.1 Massachusetts and Rhode Island

Recreational anglers account for upwards of 90% of landings in this region. In the MARI region, recreational landings peaked in 1986 at nearly 2.7 million fish and fell sharply to about 13% of its peak by the mid-1990s. Since then landings have remained low and have varied in the range of 200,000 to 50,000 fish. The 2013-2015 average recreational landings are 167,085 fish. The majority (nearly 75%) of tautog recreational harvest in the MARI region comes from the private/rental boat mode. The remaining 25% is split relatively evenly among the shore and for-hire (party/charter boat) modes.

Commercial landings in the MARI region peaked in 1991 at approximately 725,300 lbs (329 mt), declined to 97,000 lbs (44 mt) in 1996, and since then has varied in the range of 110,000 – 200,000 lbs (50 to 90 mt). The 2013-2015 average landings in the MARI region were approximately 121,250 lbs (55 mt).

Total removals in the MARI region, including recreation harvest, recreational release mortality, and commercial landings averaged 390 mt from 2005-2015; 337 mt were taken in 2015 (Figure 19).

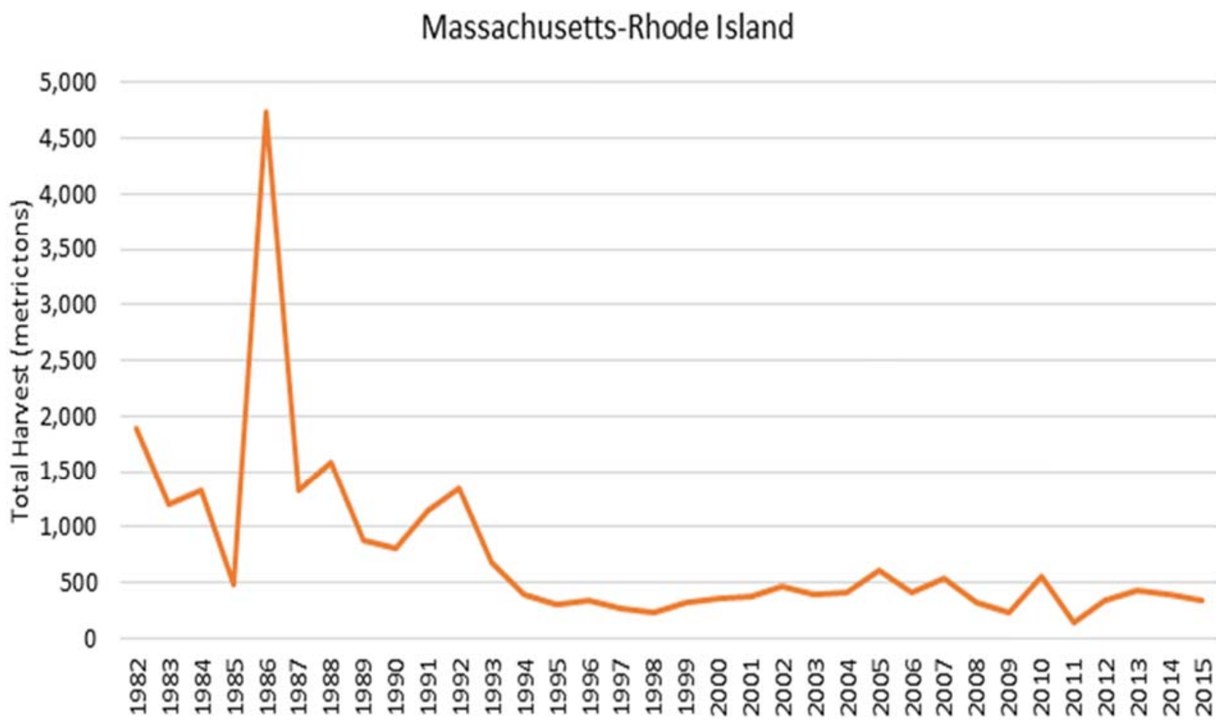


Figure 19. MARI Harvest; including recreation harvest, recreational release mortality, and commercial landings

1.3.2 Long Island Sound

Recreational anglers account for approximately 88% of harvest in this region (landings and dead discards). In the LIS region, recreational landings peaked in 1988 at 667,000 fish and declined to 29,000 fish in 2000. Since then landings have increased and have varied in the range from 76,000-514,000 fish. The 2013-2015 average recreational landing are 220,000 fish.

Commercial harvest accounts for approximately 12% of total harvest. In the LIS region, commercial landings peaked in 1987 at 350,535 lbs (159 mt), declined to 33,069 lbs (15 mt) in

1999 and 2000, and since then have stabilized in the range of 88,185 lbs (40 mt). The 2010-2014 average landings in LIS are 82,894 lbs (37.6 mt).

Total removals in the LIS region, including recreation harvest, recreational release mortality, and commercial landings averaged 1.16 million lbs (530 mt) from 2005-2015; 950,192 lbs (431 mt) were taken in 2015 (Figure 20).

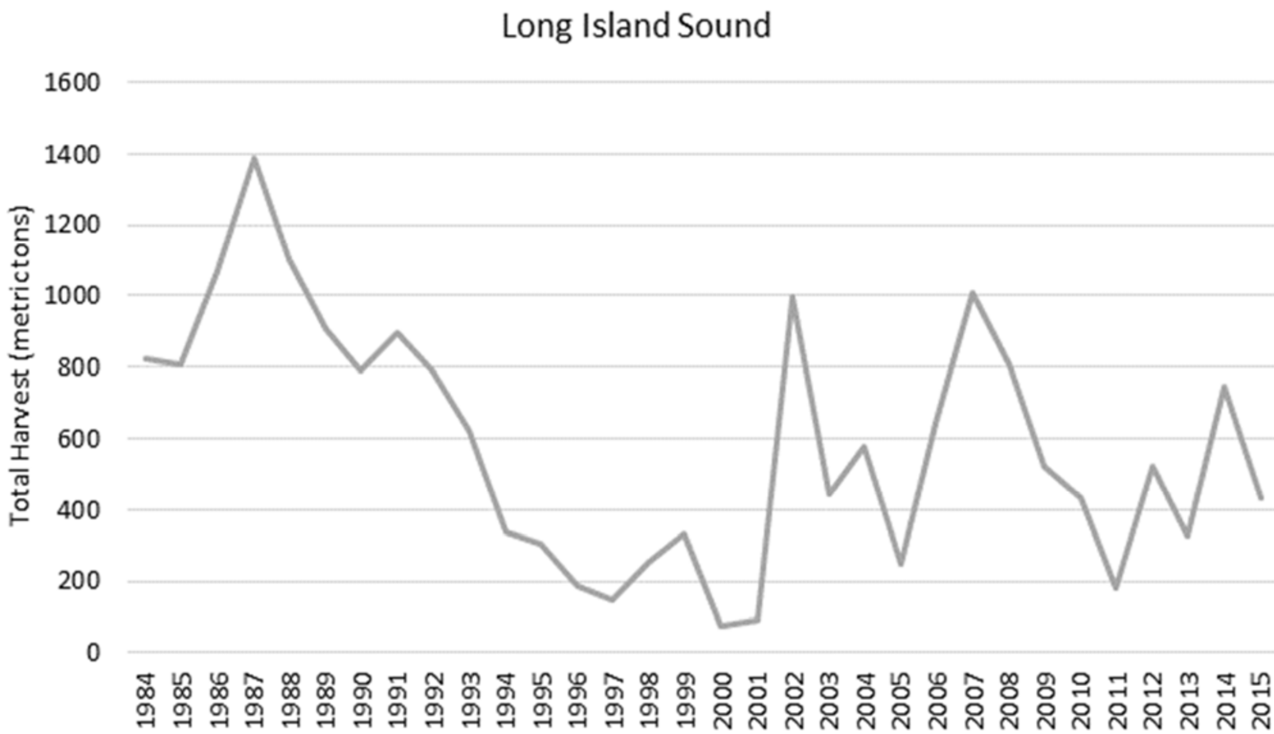


Figure 20. LIS Harvest; including recreation harvest, recreational release mortality, and commercial landings

1.3.2 New Jersey - New York Bight

Recreatinal harvest accounts for approximately 90% of landings within the NJ-NYB region. Recreational harvest exceeded one million fish per year in most years between 1988 and 1993, with a peak of 1.56 million fish in 1991. Harvest dropped quickly following the peak, however, reaching a time series low of just 24,000 fish in 1998 with an average annual harvest of 415,000 fish between 1994 and 2002. Recreational landings dropped again in 2003, falling below 200,000 fish before recovering slightly by 2006. Between 2006 and 2015, annual landings had high inter-annual variability without a trend, ranging from approximately 70,000 to 400,000 fish, with an average of 268,000 fish.

In the NJ-NYB region, commercial harvest during the late 1980s to mid-1990s fluctuated around 154,324 lbs (70 mt) annually, but declined rapidly to 44,092 lbs (20 mt) by 1999. Landings rebounded to 132,277 lbs (60 mt) by 2007 and 2008, and since then fell to 88,185 lbs (40 mt) and below. Commercial harvest during 2013 to 2015 has shown a declining trend falling from

99,207 lbs (44 mt) in 2013 to nearly 86,000 lbs (39 mt) in 2015 with an average harvest of 90,389 lbs (41 mt) for this time period.

Total removals in the NJ-NYB region, including recreation harvest, recreational release mortality, and commercial landings averaged 947,988 lbs (430 mt) from 2005-2015; 736,344 (334 mt) were taken in 2015 (Figure 21).

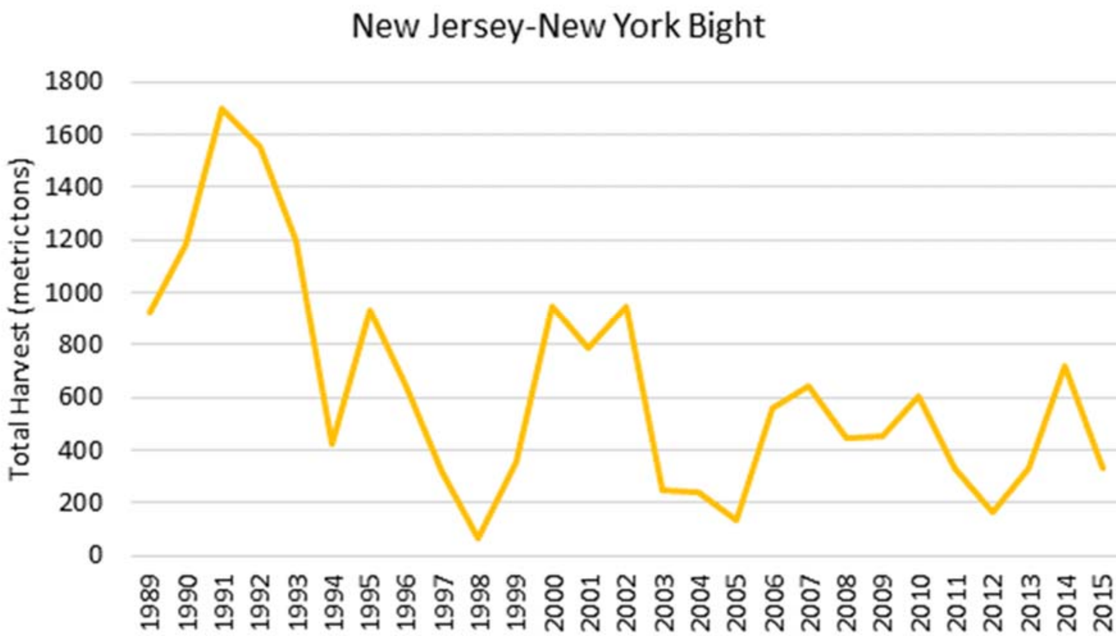


Figure 21. NJ-NYB Harvest; including recreation harvest, recreational release mortality, and commercial landings

1.3.3 Delaware, Maryland, Virginia

Recreational harvest peaked in 1988, 1989 and1995 at more than half a million fish. After the FMP was implemented, harvest levels decreased by half. Average recreational harvest from 2000-2009 was 188,000 fish and average harvest from 2010-2015 was 92,000 fish. Recreational harvest in DelMarVa has declined from 241,064 fish in 2010 to 22,215 fish in 2015. The decline coincided with the protective regulatory measures (minimum size increase and seasonal closures) instituted in 2012 to reduce fishing mortality. Recreational landings in 2015 were the lowest in time series. Recreational discards have also declined from 686,392 released fish in 2010 to 125,258 released fish in 2015.

Commercial landings have declined in recent years, primarily due to a decline in Virginia, which accounts for the majority of commercial effort. Average commercial landings for 2000-2009 were approximately 17,000 lbs. Average commercial landings for 2013-2015 were 10,740 pounds (4.9 mt), with 2015 being much lower at 6,233 lbs (2.8 mt). Data on commercial discards were not available, but discards are believed to be minimal.

Total removals in the DelMarVa region, including recreation harvest, recreational release mortality, and commercial landings averaged 529,109 lbs (240 mt) from 2005-2015; 90,390 lbs (41 mt) were taken in 2015 (Figure 22).

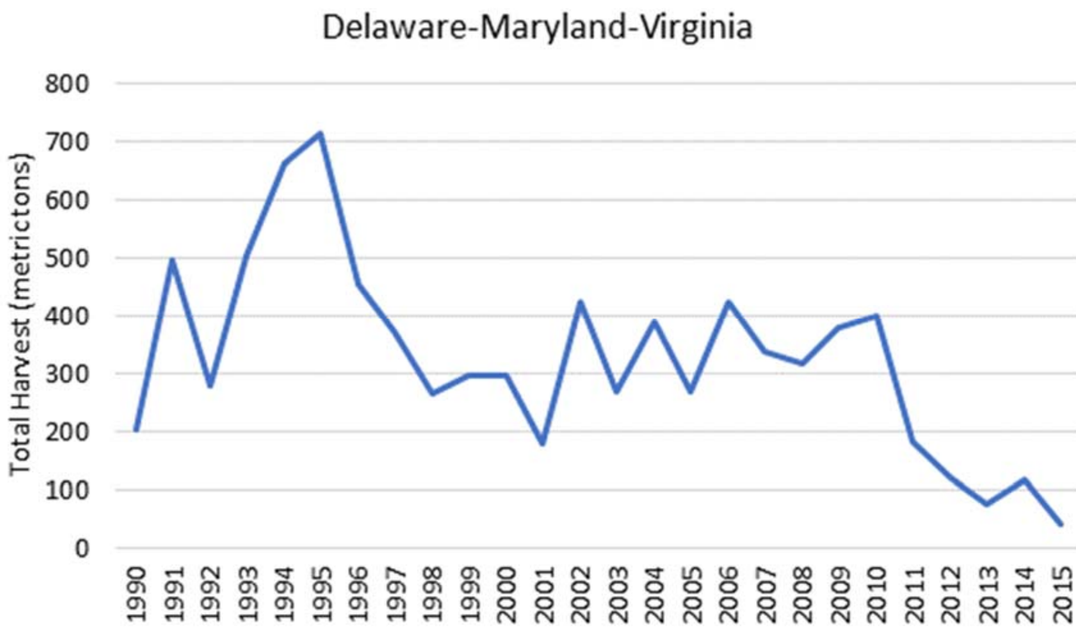


Figure 22. DelMarVa Harvest; including recreation harvest, recreational release mortality, and commercial landings

1.4 HABITAT CONSIDERATIONS

1.4.1 Description of the Habitat

Tautog are attracted to many types of structured habitat in all stages of their life cycle after their three-week planktonic larval stage. Suitable structures include both natural and man-made, such as submerged vegetation, shellfish beds, rocks, pilings, shipwrecks and artificial reefs (Olla et al, 1974; Briggs 1975; Briggs and O'Connor 1971; Orth and Heck 1980; Dorf and Powell 1997; Steimle and Shaheen 1999). North of Long Island, New York, rocks and boulders left by glacial deposition are abundant and provide rock-reef habitat, especially for larger tautog. South of Long Island, natural rocky habitats are rare (Flint 1971) and tautog in southern areas commonly inhabit shellfish beds, coastal jetties, pilings, shipwrecks, and artificial reefs. Tautog are principally coastal fish, occurring most commonly inshore from the intertidal zone to within about 50km from shore (Collette and Klein-MacPhee 2002).

Eggs and Larvae: Studies have collected them on the inner continental shelf and within estuaries from May through August (Berrien et al. 1978, Colton et al. 1979, Ferraro 1980, Bourne and Govoni 1988, Monteleone 1992, Able and Fahay 1998, Witting et al. 1999). Viable eggs are 1 millimeter (mm) in diameter, buoyant and are found in the greatest numbers at the water surface. Hatching occurs in 81 hours at 15°C and 42 hours at 20°C (Auster 1989, Perry 1994). The larvae (2 mm at hatching) stay near the surface during the day and may go deeper at night (Malchoff 1993). After approximately 3 weeks, larvae undergo metamorphosis and settle out of the water column as juveniles (Sogard et al. 1992, Dorf 1994).

Juveniles: Juvenile tautog require sheltered areas for feeding and protection from predators. They are most often found in shallow nearshore vegetated areas such as eelgrass (*Zostera marina*) or algal beds, (commonly sea lettuce *Ulva lactuca*), growing equally well in all of these habitat types (Kuropat et al. 2002). However, environmental factors associated with temperature and dissolved oxygen appear to influence growth rates in these shallow habitats (Phelan et al. 2000). Other studies have found that newly settled individuals prefer areas less than one meter deep (Sogard et al 1992, Dorf and Powell 1997), but move out to deeper water as they grow. Juvenile tautog have been shown to have size specific preference when choosing a shelter (Dixon 1994) and appear to have a strong affinity to their home site, rarely venturing more than a few meters away (Olla et al. 1974, Able et al. 2005).

Adults: Tautog of all sizes exhibit diurnal activity and enter a torpid state at night during which they seek refuge in some type of structure. Soon after morning twilight, tautog have been observed leaving their night time shelter to feed throughout the day (Olla et al. 1974; 1975). When tautog are not feeding during the day, they can be found resting on sand or within shelter, lying on their sides, often grouped together (Bigelow 1974). Elevated temperatures also evoke shelter seeking behavior and depress feeding (Olla and Studholme 1975, Olla et al. 1975a, 1978).

Adult tautog undertake seasonal inshore-offshore migrations in the northern part of their range (New York and north), moving into deeper water when temperatures drop to 8-12°C (Collette and Klein-MacPhee 2002). However a study of the seasonal occurrence of tautog in the lower Chesapeake Bay indicated that most fish tagged and released in these southern waters remained inshore for the winter rather than moving offshore (Arendt et al. 2001). When water temperatures fall between 5-8°C, tautog enter a torpid state and hide in some type of structured habitat (Cooper 1966, Olla et al. 1974, 1979). Juvenile tautog have been observed overwintering in shallow water, lethargic or torpid and partially buried in silt when water temperatures fell below 6°C (Olla et al. 1974). During winter, juveniles appear to remain inshore at perennial sites and disperse during the spring (Stolgitis 1970; Olla et al. 1979).

Tautog are sight feeders, feeding during the day on mollusks, especially mussels (*Mytilus edulis* in the north and *Brachiodontes exustus* in the south), barnacles, decapods including lobster, and echinoderms (Collette and Klein-MacPhee 2002). Juveniles feed primarily on copepods, amphipods, and small decapods (Dorf 1994).

1.4.2 Physical Habitat Characteristics

1.4.2.1 Dissolved Oxygen (DO) levels

No information is available on the effects of low DO levels on eggs or larval tautog. Juvenile tautog are considered to be “hypoxia-tolerant” (LC50 less than or equal to 1.6 mg/L) based on laboratory studies (D. Miller, EPA, Narragansett, Rhode Island, 1995, personal communication).

No laboratory information is available on effects of hypoxia on adult tautog. A field study showed that catch rates declined by half when DO levels drop below 3.0 mg/l and were absent in areas with DO below 2 mg/l (Howell and Simpson 1994). Tautog are capable of leaving low oxygen areas (Ogren and Chess 1969), although some adult mortality has been reported in association with major anoxic events (Perlmutter 1952, Azarovitz et al. 1979).

1.4.2.2 Temperature

High water temperatures (such as those that can result from passing through a power plant cooling water system) can result in egg mortality (Smith et al. 1979) as well as larval mortality or deformity (Olla and Samet 1978). At higher water temperatures larval metabolic rate and yolk usage increases. The resulting larvae may be smaller and at a competitive disadvantage with larger larvae, or other planktivores, when first required to feed on plankton (Laurence 1973). This may slow growth and reduce success in reaching the protected habitats required for settlement.

Adults seek shelter during the day at high water temperatures, and reduce their feeding and aggressive activities (Olla and Studholme 1975, Olla et al. 1978, Olla et al. 1980). Extended periods of high water temperatures may cause large adults to move to cooler water (Adams 1993).

Water temperature serves as the primary trigger for adult tautog seasonal migrations (Olla et al. 1980). At very low water temperatures, adult tautog become torpid (Cooper 1966, Olla et al. 1974). Some adults remain active throughout the year, particularly in the more southerly portion of the species range (Eklund and Targett 1991, Adams 1993, Hostetter and Munroe 1993).

1.4.2.3 Salinity

Although reported from brackish water, tautog have not been collected in freshwater (Bigelow and Schroeder 1953).

1.4.3 Present Condition of Habitats

Besides over exploitation, which primarily affects adult tautog, other sources of mortality can reduce abundance. Very little information is available on disease effects, although finrot has been reported in some locations (see Steimle and Shaheen, 1999). Tautog occur near areas immediately associated with human activity (shallow estuarine areas, rocky and artificial reefs, and submerged stormwater and sewage outfall pipes, etc.) which has resulted in past and current changes in habitat availability and quality. Development of nearshore areas through such activities as dredging of material for channel maintenance, marine construction and other shoreline development resulting in pollutant discharges will impact tautog populations at all life history stages. Shipwreck salvage or reduction in reef height and complexity (shelter sites) may reduce their value as adult tautog habitat. Use of “rock-hopper” roller trawling gear over wrecks, low profile reefs and mussel beds also threatens the quality of these habitats. Declining oyster beds is yet another threat to the estuarine habitat needs of juvenile tautog and other species with similar needs (Chesapeake Bay Program 1994).

Loss or destruction of vegetated bottom areas eliminates juvenile nursery areas. Increased turbidity and siltation due to dredging activities may inhibit feeding in larvae, degrade submerged aquatic vegetation beds used as nursery habitat, as well as damage adult spawning areas. Contaminants, disturbed in the dredging process, and brought into the water column could affect egg, larval and juvenile survival directly, or indirectly, through their food sources.

Entrainment of eggs and larvae in power plant intakes may result in physical damage to early life history stages and heated effluent from these and other industrial outfalls may also result in thermal stress. Discharge of treated sewage effluent and industrial wastes may have direct effects on fish as well as indirect effects on habitat and potential food sources through eutrophication. Results could include alterations of community composition (animal and vegetation) due to nutrient enrichment, and resulting anoxic and hypoxic environments.

Contaminants in the environment can affect tautog directly through contact and indirectly through ingestion of contaminated food. Reductions in growth and reproductive success, as well as direct mortality, are possible effects due to metals, oil, or other chemicals, which often remain in natural environments for long periods of time without degradation to less harmful forms. Biological sources of contamination could include direct contact with or ingestion of food associated with noxious or toxic phytoplankton blooms.

No information is available on direct pollution effects in tautog, however chromium, copper, and nickel levels in New Jersey coastal adult tautog liver tissue decreased significantly with increasing body length (Mears and Eisler 1977). Hall et al. (1978) found low to average levels of 15 metals in tautog muscle tissue (unknown collection site). Recently, the National Marine Fisheries Service (1995) found metal concentrations (silver, cadmium, chromium, copper, nickel, lead, zinc, arsenic and mercury), as well as PCB, PAH and pesticide concentrations below FDA action concentrations in adult tautog collected from Manasquan Inlet, New Jersey. In a laboratory study, Deacutis (1982) found that adult tautog showed little tendency to avoid oil contaminated feeding locations and would readily consume fuel oil contaminated bivalve meat.

Greater direct contaminant effects could occur with eggs and larvae, but because tautog feed on bottom-dwelling organisms, juveniles and adults could experience trophic transfer, resulting in indirect effects and long-term accumulation of contaminants in edible flesh.

Prevention of habitat loss through the species range should be a high priority for restoration of the tautog resource.

1.5 IMPACTS OF THE FISHERY MANAGEMENT PROGRAM

1.5.1 Biological and Environmental Impacts

The implementation of Amendment 1 should improve management of tautog. As proposed, the Amendment will create regional boundaries which allow the species to be managed according to localized population structures and harvesting patterns. The intent is to manage based on biology and behavior of the species including movement patterns. As indicated in tagging studies, tautog display strong site fidelity and limited north-to-south migration. If regional management is approved then the strategies to minimize overexploitation can be tailored to the unique circumstances of each region, thereby largely eliminating the problem of management generalization that can be associated with managing tautog as a coastwide stock. Any biological impacts resulting from this document are expected to be positive.

1.5.2 Social Impacts

1.5.2.1 Recreational Fishery

Tautog is a highly prize game fish targeted by anglers fishing at natural and manmade structures. The recreational fishery accounts for approximately 90 percent of the coastwide harvest. In a 2013 National Saltwater Angler Survey, conducted by NMFS, 591 east coast anglers identified tautog as a frequently targeted species (Lovell, 2015). When asked in the survey about attitudes toward broad-level management objectives, 93% of angler respondents prefer a minimum size to some degree, and 90% prefer a bag limit. Eight-one percent of respondents identified recovering fish stocks that have been depleted as an 'extremely important' fisheries management objective. The actions proposed in this Amendment overlap with desired management approaches identified in the survey, additional proposed actions are an outcome of stakeholder discussions.

1.5.2.2 Commercial Fishery

In recent years, commercial landings accounted for up to 40% of the catch in some states, largely due to the market for live fish. Steady demand has increased the price for live tautog and has further incentivized the black market for undersized, out-of-season, or illegal quantities of tautog. There is a preference for plate sized fish up to 12 inches, which is below the 15-16 inch size limits set by states.

The proposed management changes, such as the commercial harvest tagging program, were designed with input from the law enforcement community and feedback from commercial fishermen. The intent of the program is to minimize illegal, unreported and unregulated fishing that has perforated the fishery since the 1990s. It is an attempt to eliminate the backdoor practice of selling underpriced tautog by unlicensed fishermen in the black market. Desired outcomes from this management action are higher prices for those commercial fishermen that follow established regulations and greater accountability in the commercial fishing sector.

1.5.2.3 Subsistence Fishery

A subset of illegal activity occurs among individuals and small groups harvesting fish for personal consumption or subsistence. These individuals may not even be aware they are violating specific regulations. Additional information on the subsistence fishery is not available at this time.

1.5.3 Economic Impacts

As described elsewhere in Amendment 1, the recreational component of the fishery accounts for the majority of harvest compared to the commercial harvest. In order to evaluate how dividing the current single coast-wide stock into regional stocks would affect anglers and commercial fisherman, information on how this would affect their behavior or the amount of fish they catch is needed. For recreational anglers, the information needed would include how the number of fishing trips for tautog change, if they keep taking the same number of trips but make substitutions for target species and/or change fishing mode (private boat, shore, for-hire), and if they travel to different locations as a result. Changes in the number of fish, size of fish, and species composition would also be important aspects of how they might be impacted.

1.5.3.1 Recreational Fishery

There are no published or unpublished studies (as of 2016) that document the economic impacts or economic value of the recreational tautog fishery. Without specific information on how the proposed changes to the FMP would affect the number of recreational trips taken for tautog and/or the catch per angler, it is not possible to estimate any economic impacts or effects at this time.

However, there are a few recent socio-economic surveys and publications by the National Marine Fisheries Service, Office of Science and Technology, with limited data on anglers who fish for tautog. These may be useful to understand in general the socio-economic aspects of anglers who fish for tautog and may be useful in a future analysis of specific management options once those are better defined.

National Saltwater Angler Survey

The first of these is the 2013 National Saltwater Angler Survey that asked recreational anglers about their attitudes and preferences for recreational fishing trips, management strategies and management objectives. An analysis of the data shows that 226 anglers who responded to the survey from the North Atlantic region (Maine to Connecticut) and 365 from the Mid-Atlantic (New York to Virginia) replied they frequently targeted tautog (Lovell 2013). For this document, the data on these 591 anglers was analyzed to understand their preferences for trip characteristics and management options and objectives. In the survey, respondents were asked to rate the importance of each characteristic listed below using a five-point scale, ranging from “Extremely important” to “Not important at all” (Figure 23).

A. Catch fish
B. Catch as many fish as I can for consumption
C. Catch-and-release as many fish as possible
D. Catch a trophy-sized fish
E. Target a particular species
F. Catch the bag limit of a species I am targeting
G. Know that I will encounter abundant fish
H. Fish in an area that is not heavily congested
I. Be close to amenities such as parking, restrooms, cleaning stations, boat launches, etc.
J. See information concerning fishing regulations clearly posted
K. Have access to staff (park staff, marine operators, etc.) to answer questions or provide information
L. Have easy access to weather and tide information
M. Fish in a scenic area

N. Fish with family or friends
O. Teach others about fishing

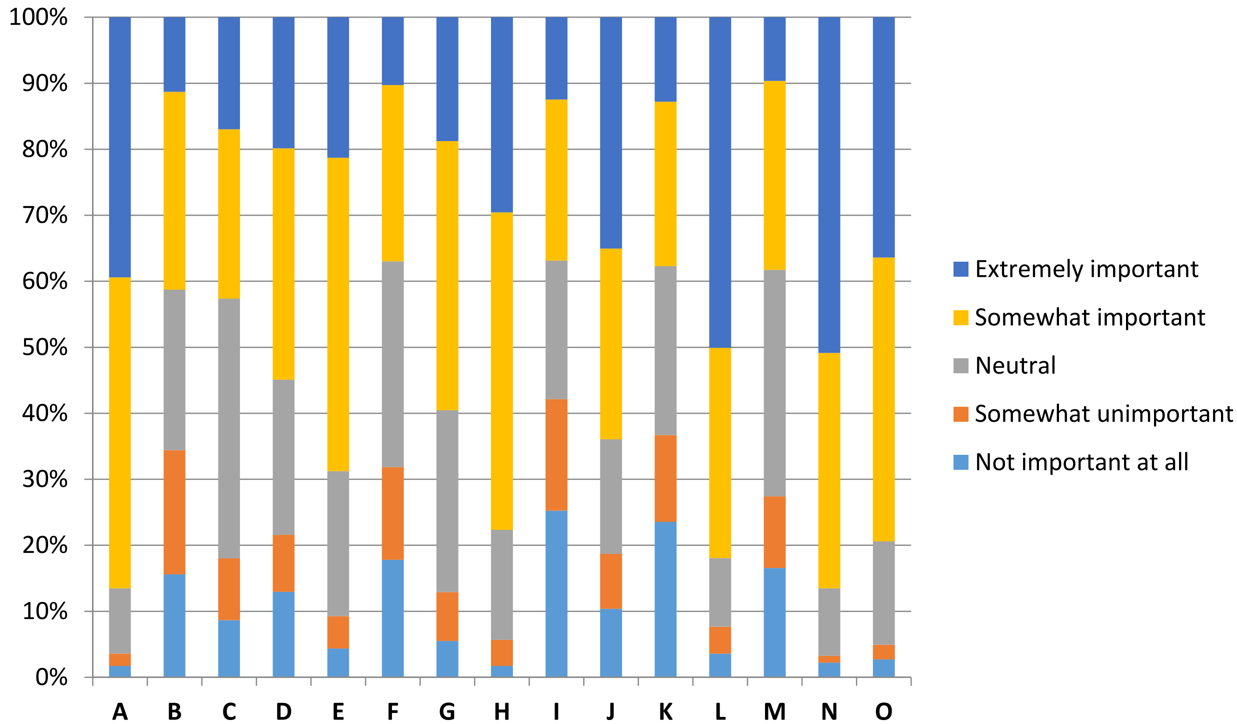


Figure 23. Fishing Trip Characteristics Important to Tautog Anglers (Maine to Virginia)

87% of the surveyed anglers fishing for tautog rated both “fishing with family or friends” and “catching fish” as important (defined as either somewhat or extremely important on the scale). Having easy access to weather and tide information was important to 82% of tautog anglers, and 78-79% rated “teach others about fishing” and “fish in an area that is not heavily congested” as important. Of concern to managers, the characteristics “catch the bag limit of a species I am targeting” was ranked as important by only 37% of anglers. In comparison to all anglers across the country as well as in the North Atlantic and Mid-Atlantic, these results are fairly consistent in terms of percentages ranking the various characteristics as important (Brinson and Wallmo 2013; Rubio et al 2014).

To help understand attitudes toward different types of management strategies, anglers were also asked to rate their preferences for a list of management strategies. Respondents rated each of a series of strategies using a five-point scale of “Strongly prefer,” “Somewhat prefer,” “Slightly prefer,” “Do not prefer at all,” and “I am unsure.” Results for a select group of management strategies relevant to the proposed changes in the tautog FMP are presented in Figure 24.

- Establish minimum size limits of the fish you can keep
- Limit the total number of fish you can keep
- Increase the recreational harvest limit by decreasing the commercial harvest limit

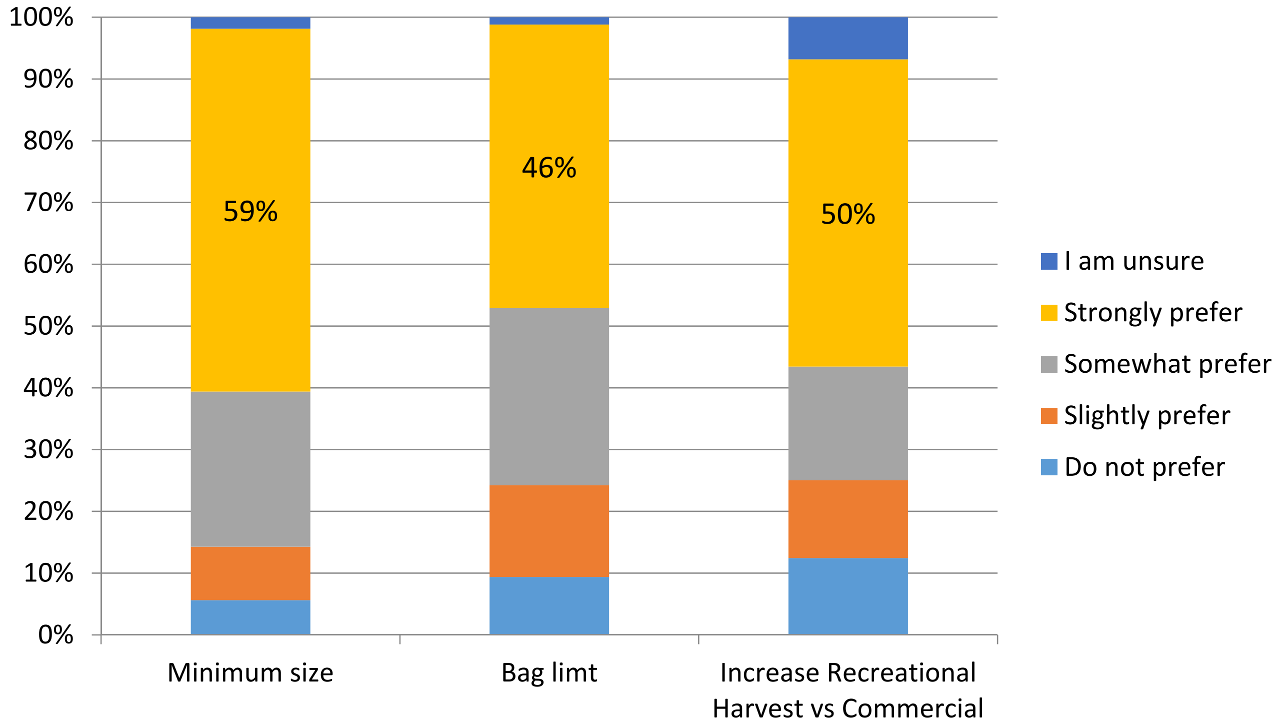


Figure 24. Management Preferences of Tautog Anglers (Maine to Virginia)

Another question the survey asked anglers included attitudes toward broad-level management objectives. Respondents were asked to rate each of several objectives using a six-point scale of "Extremely important," "Somewhat important," "Neutral," "Somewhat unimportant," "Not important at all," and "I am unsure." Results for some of the relevant objectives to the tautog FMP are presented in Figure 25.

a. Ensure that large quantities of fish are available to catch
b. Allocate some quota from commercial fisheries to recreational fisheries
c. Recover fish stocks that have been depleted

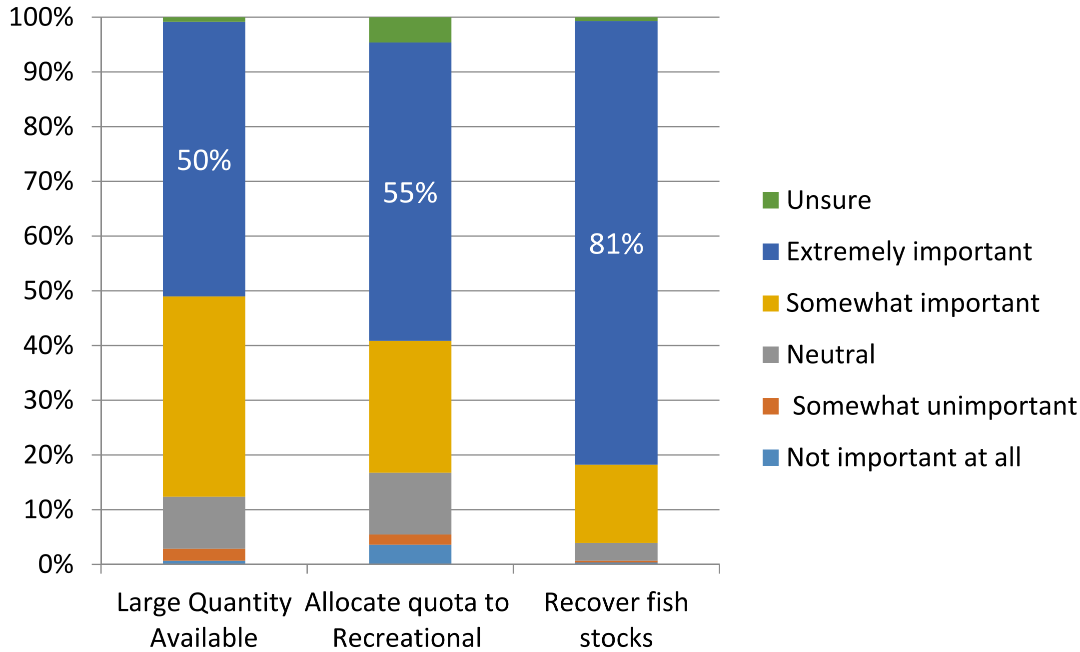


Figure 25. Preferences of Tautog Anglers (Maine to Virginia) For Different Management Objectives

Recovering fish stocks that have been depleted was extremely important to 81% of tautog anglers. Ensuring large numbers of fish to catch was ranked extremely important by 50% of tautog anglers. 55% said reallocating some of the quota from commercial to recreational anglers was extremely important, however, it is important to note the question did not ask about specific species in this context. The above responses to the survey can be useful in understanding what motivates recreational tautog anglers in general and how they may respond to changes in the tautog FMP.

Recreational Bait and Tackle Economic Survey

The most recent NMFS survey was conducted in 2014. The survey obtained information from independently owned bait and tackle stores and other independent stores selling marine recreational bait and tackle in coastal areas. Store owners were asked a series of questions on what type of bait and tackle they sold, their cost and earnings, and questions on the top species targeted by customers. The information collected was used to estimate the economic impacts of these stores to the regions.

For the North Atlantic Region, independent bait and tackle stores supported 958 jobs and contributed toward $140 million in regional economic output from sales of marine recreational bait and tackle (Hutt et al 2015). For the Mid-Atlantic region, bait and tackle stores supported 1,922 jobs and $293 million in output. In the Mid-Atlantic and New England, Bait and Tackle and Other Store owners indicated tautog (8.6%; 11.9%) was the sixth and fourth highest generators of sales for their business, respectively (Table 3). The information in this survey may be used to analyze economic impacts to bait and tackle shops in the management areas if a clear link between changes in the tautog FMP and changes in sales of bait and tackle can be made.

Table 3. Saltwater recreational fisheries that generated the greatest sales of bait and tackle for retail stores in the Mid-Atlantic and New England as identified by store owners and/or managers. Percentages exceed 100% as respondents were asked to select the top three fisheries (Hutt et al, 2015). N is the number of store owners that participated in the survey.

Fisheries Management Region: Mid-Atlantic						
	Total		Bait & Tackle Stores		Other Stores	
Fishery	**N**	**%**	**N**	**%**	**N**	**%**
Striped bass/Bluefish	118	72.4	58	76.3	60	69
Summer or Winter flounder	83	50.9	46	60.5	37	42.5
Atlantic croaker/Spot/Scup	49	30.1	19	25	30	34.5
Black seabass	16	9.8	9	11.8	7	8
Marlin/Tuna	9	5.5	9	11.8	0	0
Tautog/Triggerfish	**14**	**8.6**	**8**	**10.5**	**6**	**6.9**
Red or Black drum	10	6.1	5	6.6	5	5.7
Weakfish	10	6.1	4	5.3	6	6.9
Other	30	18.4	13	17.1	17	19.5

Fisheries Management Region: New England						
	Total		Bait & Tackle Stores		Other	
Fishery	**N**	**%**	**N**	**%**	**N**	**%**
Striped bass/Bluefish	80	67.8	52	78.8	28	53.8
Summer or Winter flounder	29	24.6	22	33.3	7	13.5
Scup	21	17.8	16	24.2	5	9.6
Tautog	**14**	**11.9**	**11**	**16.7**	**3**	**5.8**
Atlantic cod	14	11.9	8	12.1	6	11.5
Atlantic mackerel	20	16.9	7	10.6	13	25
Bluefin tuna	12	10.2	6	9.1	6	11.5
Bonito	1	0.8	1	1.5	0	0
Other	23	19.5	11	16.7	12	23.1

National Marine Recreational Fishing Expenditure Survey

The 2011 National Marine Recreational Fishing Expenditure Survey provides information on mean trip expenditures by state, fishing mode, and resident status (Lovell et al 2013). The number of directed trips for tautog by state and mode can be used together with mean trip expenditure to estimate the total expenditures on tautog trips and the resulting economic impacts to the coastal states from changes in the tautog FMP. This assumes such changes would affect the number and distribution of trips across the management area. Caution is noted however, because if anglers switch to fishing for other species with no or little change in the number, location, or type of trips taken, there will be no resulting impacts. Table 4 shows the 2014 mean expenditures by state, mode, and resident status using the 2011 estimates and inflating them to 2014 dollars using the Consumer Price Index. NMFS has developed state level economic impact models that can be used to estimate the economic impacts resulting from changes in fishing trips (Lovell et al 2013).

Aside from changes in economic impacts resulting from potential changes in the number of trips taken by anglers, data from the MRIP program on numbers of directed trip and catch of tautog could be used to develop a revealed preference model on the economic value of catching different numbers of tautog. The results can be used to show how changes in management measures would change the economic value, or benefits, anglers receive from fishing for and/or catching tautog. It would require some time to develop these models by an experienced economist.

Table 4. Mean Trip Expenditures by State, Mode, and Resident Status, 2014

State	Mode	Resident Status	Mean
Connecticut	For-Hire	Non-Resident	$151.80
Connecticut	For-Hire	Resident	$173.21
Connecticut	Private Boat	Non-Resident	$29.71
Connecticut	Private Boat	Resident	$32.03
Connecticut	Shore	Non-Resident	$13.33
Connecticut	Shore	Resident	$19.18
Delaware	For-Hire	Non-Resident	$199.34
Delaware	For-Hire	Resident	$124.56
Delaware	Private Boat	Non-Resident	$42.74
Delaware	Private Boat	Resident	$39.48
Delaware	Shore	Non-Resident	$72.52
Delaware	Shore	Resident	$30.82
Maryland	For-Hire	Non-Resident	$394.78
Maryland	For-Hire	Resident	$147.88
Maryland	Private Boat	Non-Resident	$37.12
Maryland	Private Boat	Resident	$46.55
Maryland	Shore	Non-Resident	$70.75
Maryland	Shore	Resident	$45.86
Massachusetts	For-Hire	Non-Resident	$473.54
Massachusetts	For-Hire	Resident	$178.38
Massachusetts	Private Boat	Non-Resident	$79.08
Massachusetts	Private Boat	Resident	$63.18
Massachusetts	Shore	Non-Resident	$152.17
Massachusetts	Shore	Resident	$42.20
New Jersey	For-Hire	Non-Resident	$138.41
New Jersey	For-Hire	Resident	$116.31
New Jersey	Private Boat	Non-Resident	$94.07
New Jersey	Private Boat	Resident	$58.44

State	Mode	Resident Status	Mean
New Jersey	Shore	Non-Resident	$53.49
New Jersey	Shore	Resident	$30.81
New York	For-Hire	Non-Resident	$122.19
New York	For-Hire	Resident	$165.72
New York	Private Boat	Non-Resident	$40.77
New York	Private Boat	Resident	$61.95
New York	Shore	Non-Resident	$46.92
New York	Shore	Resident	$20.90
Rhode Island	For-Hire	Non-Resident	$216.18
Rhode Island	For-Hire	Resident	$98.34
Rhode Island	Private Boat	Non-Resident	$38.50
Rhode Island	Private Boat	Resident	$42.97
Rhode Island	Shore	Non-Resident	$17.47
Rhode Island	Shore	Resident	$16.06
Virginia	For-Hire	Non-Resident	$189.54
Virginia	For-Hire	Resident	$113.05
Virginia	Private Boat	Non-Resident	$79.75
Virginia	Private Boat	Resident	$59.42
Virginia	Shore	Non-Resident	$104.20
Virginia	Shore	Resident	$27.77

1.5.3.2 Commercial Fishery

From 2009 to 2015, the states with the highest number of vessels and fisherman fishing for tautog on average are Rhode Island, Massachusetts, and New York. Table 5 shows the number of vessels, number of fishermen, total pounds, total revenue and average price per pound from 2009 to 2015 where data is available. For these vessels and fisherman, tautog is not the only species they catch. The top five species as measured in pounds for the vessels also reporting tautog were scup (#1), black sea bass (#3), longfin inshore squid (#4), and skates (#5). Tautog was second in terms of pounds. In terms of average pounds caught, the states with the highest catch are New York, Massachusetts, and Rhode Island.

Table 5. Commercial Tautog Effort by State. Confidential data has been excluded.

Year	State	Vessels	Fishermen	Landings (lbs)	Revenue	Price Per Pound
2009	MA	73	164	54,703	$137,062	$2.51
2010	MA	95	192	75,317	$210,114	$2.79
2011	MA	122	181	57,787	$179,683	$3.11
2012	MA	156	219	67,870	$212,688	$3.13
2013	MA	187	250	70,165	$236,224	$3.37
2014	MA	179	222	63,191	$230,697	$3.65
2015	MA	196	213	61,752	$268,529	$4.35

Year	State	Vessels	Fishermen	Landings (lbs)	Revenue	Price Per Pound
2009	RI	157	253	50,920	$98,854	$1.94
2010	RI	219	233	44,054	$101,427	$2.30
2011	RI	228	228	47,426	$124,862	$2.63
2012	RI	239	247	50,126	$151,008	$3.01
2013	RI	236	235	53,428	$168,471	$3.15
2014	RI	240	232	53,384	$182,347	$3.42
2015	RI	234	226	47,140	$172,694	$3.66
2009	CT	69	45	21,194	$44,178	$2.08
2010	CT	82	47	16,948	$41,842	$2.47
2011	CT	76	66	14,787	$38,693	$2.62
2012	CT	64	35	6,233	$18,501	$2.97
2013	CT	60	36	5,887	$15,950	$2.71
2014	CT	55	34	5,164	$14,647	$2.84
2015	CT	56	48	7,249	$22,774	$3.14
2009	NY	118	183	87,289	$276,169	$3.16
2010	NY	126	187	93,153	$299,080	$3.21
2011	NY	120	174	82,761	$261,467	$3.16
2012	NY	132	171	76,373	$254,907	$3.34
2013	NY	140	181	110,849	$359,138	$3.24
2014	NY	153	206	121,538	$375,909	$3.09
2015	NY	137	179	111,925	$401,668	$3.59
2009	NJ	17	16	14,591	$45,316	$3.11
2010	NJ	23	20	49,213	$122,781	$2.49
2011	NJ	24	20	45,865	$129,285	$2.82
2012	NJ	20	17	20,831	$66,577	$3.20
2013	NJ	19	17	21,999	$73,941	$3.36
2014	NJ	12	11	31,655	$101,049	$3.19
2015	NJ	15	16	17,538	$57,373	$3.27
2009	DE	8	5	2,116	$4,649	$2.20
2012	DE	5	4	1,444	$4,968	$3.44
2015	DE	4	5	2,107	$8,446	$4.01
2009	MD	13	9	1,638	$3,659	$2.23
2010	MD	11	11	1,285	$2,780	$2.16
2015	MD	7	8	1,181	$4,619	$3.91

Year	State	Vessels	Fishermen	Landings (lbs)	Revenue	Price Per Pound
2009	VA	35	15	11,132	$19,169	$1.72
2010	VA	35	10	6,081	$13,819	$2.27
2011	VA	34	9	14,590	$42,050	$2.88
2012	VA	36	10	13,870	$33,611	$2.42
2013	VA	24	8	11,776	$88,407	$7.51
2014	VA	26	9	7,545	$26,378	$3.50
2015	VA	27	23	6,937	$25,569	$3.69

1.5.3.3 Subsistence Fishery

No information exists on the subsistence fishery for tautog.

1.5.4 Other Resource Management Efforts

1.5.4.1 Artificial Reef Development/Management

Artificial reefs can enhance fish habitat, provide more access to quality fishing grounds, benefit fishermen, divers, and the economies of shore communities, and increase total biomass in a given area. Tautog rely on reef structures for protection, and reef-dependent species such as *Mytilus edulis* form a large portion of the diet of both juveniles and adults (Olla et al 1975).

Individual Atlantic states started deploying artificial habitat after the 1950s. Efforts became more formalized after the release of the 1985 National Artificial Reef Plan, which enhanced coordination and development of artificial reefs with state, interstate and federal agencies including ASMFC and the National Marine Fisheries Service. As shown in Table 6, the majority of states within tautog's distribution have state-administered artificial reef programs, and Rhode Island's artificial reef program is in development (McNamee, personal communication).

Table 6. Number of artificial reefs by state in 2016

State	# of artificial reefs inshore	# of artificial reefs offshore	Total # of artificial reefs built	Acres
Massachusetts	5	-	5	<160
Rhode Island	-	-	Artificial Reef Program in development	
Connecticut	1	-	1 no formal program	<6.4
New York	4	7	11	2,539
New Jersey	2	13	15	16,000
Delaware	8	4	12	7,080
Maryland	22	11	33	13,613
Virginia	18	5	23	487

Artificial reefs are built out of hard, durable structures such as rock, concrete, and steel, usually in the form of surplus or scrap materials (vessels, dredge rock, military vehicles, etc.). All harmful substances are removed from the material prior to deployment. Various design approaches are used for Atlantic artificial reefs. New Jersey has sunken old ships and barges to create 16,000 acres of artificial reefs. Delaware has used donated concrete for eight bay sites, and ballasted tire units and sunken ships for ocean sites. Most Maryland reefs are constructed from concrete materials of opportunity, including rubble from bridge and pier demolition projects, and reef balls built with the help of volunteers (Michael Malpezzi, MDNR, personal communication, 2016).

Some states are monitoring the impact of artificial reefs on fishery performance and biological diversity. In New Jersey, party boat fishing effort on artificial reefs increased from 3 percent in 1970 to 47 percent in 2000 in conjunction with an extensive increase in reef building efforts during that period (Figley 2001). In Maryland, volunteer angler surveys carried out on artificial and nearby natural reefs confirm that artificial reefs provide fishing experiences equivalent to the natural reefs (Michael Malpezzi, MDNR, personal communication, 2016). New and continued monitoring and research on the effects of existing artificial reef sites will be most informative for habitat-orientated species like tautog.

1.5.4.2 Bycatch

Tautog is often listed as a bycatch species in trap and pot fisheries targeting lobster and black sea bass (ASMFC 1997, Skrobe and Lee 2004, Hasbrouck et al. 2007, NEFMC et al. 2007, NEFMC et al. 2015). In the federally permitted Mid-Atlantic fish pot fishery, on average tautog accounted for 5% of harvest from 2000-2004 and 8% of harvest from 2007-2011 (Table 7). Tautog catch, as bycatch, is of value, and is often harvested and sold (Skrobe and Lee 2004). Many lobstermen target tautog when the inshore lobster fishery slows simply by using longer sets of traps without bait (ASMFC 1996, personal communication Peter Clarke, NJDEP). In a 1994 study, tautog was the second most abundant species (23% of finfish bycatch) after scup in New York's lobster pot fishery (ASMFC 1996).

Table 7. Average Landings in the Mid-Atlantic Fish Pot Fishery (Pounds)
Source: Northeast Region Standardized Bycatch Reporting Methodology (NEFMC 2007 & 2015)

Species	2000-2004	2007-2011
Tautog	49,000	56,000
Black Sea Bass	723,000	472,000
Lobster	17,000	37,000
Channeled Whelks	35,000	31,000
Eels	21,000	20,000
Other	60,000	116,000
Total	905,000	732,000

1.6 LOCATION OF TECHNICAL DOCUMENTATION FOR FMP

1.6.1 Review of Resource Life History and Biological Relationships
See Section 1.2.1

1.6.2 Stock Assessment Document
See Section 1.2.2

1.6.3 Habitat Background Document
See Section 1.4

2.0 GOALS AND OBJECTIVES

2.1 HISTORY OF PRIOR MANAGEMENT MEASURES

Prior to adoption of the Interstate FMP, tautog had been managed on a state-by-state basis. For the majority of states, tautog were largely unmanaged although some states had commercial and/or recreational regulations, such as minimum size limits, possession limits, and effort controls. An increase in fishing pressure in the mid-1980s through early 1990s, and a growing perception of the species' vulnerability to overfishing, stimulated the need for a coastwide FMP. Accordingly, in 1993 the ASMFC recommended a plan be developed as part of its Interstate Fisheries Management Program. The states of Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland Virginia, and North Carolina declared an interest in jointly managing this species through the ASMFC. The FMP was implemented in 1996, with the goals of conserving the resource along the Atlantic coast and maximizing long-term ecological benefits, while maintaining the social and economic benefits of recreational and commercial utilization.

Follwing is a brief history of tautog management activities to date:

Fishery Management Plan (FMP) (March 1996)
The FMP established a 14" minimum size limit and a target fishing mortality of F = M = 0.15. The target F was a significant decrease from the 1995 stock assessment terminal year fishing mortality rate in excess of F = 0.70, so a phased in approach to implementing these regulations was established. Northern states (Massachusetts through New Jersey) were to implement the minimum size and achieve an interim target of F = 0.24 by April 1997, while southern states (Delaware through North Carolina) had until April 1998 to do the same. All states were required to achieve the target F = 0.15 by April 1999.

Addendum I (May 1997)
In response to northern states' difficulty in achieving the interim F by their deadline, Addendum I delayed implementation of the interim F and target F for all states until April 1998 or April 2000 depending on the state. It also established *de minimis* specifications.

Addendum II (November 1999)
The 1999 stock assessment incorporated data through 1998, which included only nine months

of data under the Addendum I regulations. Given the life history of the species, the Board was concerned the assessment provided limited advice on the effects of Addendum I regulations. Addendum II further extended the deadline to achieve the F=0.15 target until April 2002. It also clarified the fishing mortality targets in the FMP with respect to individual state management program flexibility.

Addendum III (February 2002)
This addendum established a new target fishing mortality rate of $F_{target} = F_{40\%SSB} = 0.29$ and mandated states collect a minimum of 200 age samples per year.

Addendum IV (January 2007)
Addendum IV revised the target fishing mortality rate to F = 0.20, a 28.6% reduction in overall fishing mortality, and established biomass reference points for the first time. The biomass reference points were ad hoc, based on the average of the 1982-1991 SSB (target; 26,800 MT) and 75% of this value (threshold; 20,100 MT). It also required states to achieve the new target F by reductions in recreational harvest only.

Addendum V (April 2007)
Addendum V allowed state flexibility in achieving $F_{target} = 0.20$ through reductions in commercial harvest, recreational harvest, or some combination of both. A Massachusetts-Rhode Island model indicated regional F was lower than the coastwide target, therefore these two states were not required to implement management measures to reduce F.

Addendum VI (April 2011)
Addendum VI established a new F_{target} of F = M = 0.15 on the basis that stock biomass had not responded to previous F levels. The new F_{target} required states to take a 39% reduction in harvest. As in Addendum IV, a regional assessment of Massachusetts and Rhode Island demonstrated a lower regional F using ADAPT VPA model, and these states were not required to implement tighter regulations. To achieve the required harvest reduction, all other states adopted higher minimum size limits exceeding the FMP's minimum requirement of 14" in addition to other measures, such as possession limits, seasonal closures, and gear restrictions.

2.2 GOALS

If approved, Amendment 1 replaces the 1996 Tautog FMP and its addenda.

The Board is considering modifications to the goals that were enacted in 1996 to meet the current needs of the species and fishery.

Option A. Status Quo. Maintain the 1996 Goals

A. To perpetuate and enhance stocks of tautog through interstate fishery management so as to allow a recreational and commercial harvest consistent with the long-term maintenance of self-sustaining spawning stocks
B. To maintain recent (i.e. 1982-1991) utilization patterns and proportions of catch taken by commercial and recreational harvesters
C. To provide for the conservation, restoration, and enhancement of tautog critical habitat for all life history stages
D. To maintain a healthy age structure
E. To conserve the tautog resource along the Atlantic coast to preserve ecological benefits such as biodiversity and reef community stability, while maintaining the social and economic benefits of commercial and recreational utilization

Option B. Revised Goal Statement

The goal of Amendment 1 is to sustainably manage tautog over the long-term using regional differences in biology and fishery characteristics as the basis for management. Additionally, the Amendment seeks to promote the conservation and enhancement of structured habitat to meet the needs of all stages of tautog's life cycle.

2.3 OBJECTIVES

The following objectives are being considered by the Board to support the goals of this amendment:

Option A. Status Quo: Maintain the 1996 Objectives

A. To establish criteria, standards, and procedures for plan implementation as well as determination of state compliance with FMP provisions
B. To allow harvest that maintains spawning stock biomass (SSB) in a condition that provides for perpetuation of self-sustaining spawning stocks in each spawning area, SSB, size and age structure, or other measures of spawning success at or above historical levels as established in the plan
C. To achieve compatible and equitable management measures among jurisdictions throughout the fishery management unit
D. To enact management recommendations which apply to fish landed in each state, so that regulations apply to fish caught both inside and outside of state waters
E. To promote cooperative interstate biological, social, and economic research, monitoring and law enforcement
F. To encourage sufficient monitoring of the resource and collection of additional data, particularly in the southern portion of the species range, that are necessary for development of effective long-term management strategies and evaluation of the management program. Effective stock assessment and population dynamics modeling require more information on the status of the resource and the

biology/community/ecology of tautog than is currently available, in particular to facilitate calculation of F and stock trends

G. To identify critical habitats and environmental factors that support or limit long-term maintenance and productivity of sustainable tautog populations
H. To adopt and promote standards of environmental quality necessary to the long-term maintenance and productivity of tautog throughout their range
I. To develop strategies that reduce fishing mortality, restore stock size composition and the historical recreational/commercial split, consider ecological and socio-economic impacts.
J. To identify problems associated with the offshore fishery. Compatible regulations between the states and the EEZ are essential

Option B. Remove Objective A and B from Section 2.3 of the 1996 FMP

These objectives are inherent within the FMP or included in other objectives, and therefore redundant.

Option C. Modify Objective C in Section 2.3 of the 1996 FMP to the following:

- Adopt compatible management measures among states within a regional management unit

Option D. Combine Objectives D and J in Section 2.3 of the 1996 FMP to the following:

- Encourage compatible regulations between the states and the EEZ, which includes enacting management recommendations that apply to fish landed in each state (i.e., regulations apply to fish caught both inside and outside of state waters).

Option E. Combine Objectives G and H in Section 2.3 of the 1996 FMP to the following:

- Identify important habitat and environmental quality factors that support the long-term maintenance and productivity of sustainable tautog populations throughout their range.

Option F. Modify Objectives I in Section 2.3 of the 1996 FMP to the following:

- Develop and implement management strategies to rebuild tautog stocks to sustainable levels (reduce fishing mortality to the target and restore spawning stock biomass to the target), while considering ecological and socio-economic impacts.

Option G. Add the following objective to Section 2.3 of the 1996 FMP:

- Work with law enforcement to minimize factors contributing to illegal harvest.

Option H. Accept Options B through G into Section 2.3 of the 1996 FMP:

This option will insert all modifications identified under Options B through G into Section 2.3. If adopted, the objectives will be:

- Develop and implement management strategies to rebuild tautog stocks to sustainable levels (reduce fishing mortality to the target and restore spawning stock biomass to the target), while considering ecological and socio-economic impacts.
- Adopt compatible management measures among states within a regional management unit
- Encourage compatible regulations between the states and the EEZ, which includes enacting management recommendations that apply to fish landed in each state (i.e., regulations apply to fish caught both inside and outside of state waters).
- Identify important habitat and environmental quality factors that support the long-term maintenance and productivity of sustainable tautog populations throughout their range.
- Promote cooperative interstate biological, social, and economic research, monitoring and law enforcement
- Encourage sufficient monitoring of the resource and collection of additional data, particularly in the southern portion of the species range, that are necessary for development of effective long-term management strategies and evaluation of the management program.
- Work with law enforcement to minimize factors contributing to illegal harvest.

2.4 SPECIFICATION OF A MANAGEMENT UNIT

The management unit consists of all coastal states from Massachusetts through Virginia. The management unit is defined as all U.S. territorial waters of the northwest Atlantic Ocean, from the shoreline to the seaward boundary of the exclusive economic zone, and from US/Canadian border to the southern end of the species range. Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service have declared an interest in tautog.

2.5 BIOLOGICAL REFERENCE POINTS

Threshold reference points are the basis for determining stock status (i.e., whether overfishing is occurring or a stock is overfished). When the F exceeds the F-threshold, then overfishing is occurring; the rate of removal of fish by the fishery exceeds the ability of the stock to replenish itself. When the reproductive output (measured as spawning stock biomass or population fecundity) falls below the biomass-threshold, then the stock is overfished, meaning there is insufficient mature female biomass (SSB) or egg production (population fecundity) to replenish the stock.

Reference points are recalculated during an update and benchmark stock assessment, see the latest stock assessment for reference points and stock status determination (ASMFC 2016b).
In 2016, the Technical Committee recommended maximum sustainable yield based reference points and spawning potential ratio based reference points, depending on the region, based on data availability. The proposed biological reference tables are highlighted in Tables 8 and 9, and the two types of reference points are summarized below.

Maximum sustainable yield (MSY) based reference points

MSY-based reference points are estimated from ASAP, which uses a combination of spawning potential ratio, yield-per-recruit (YPR), and the stock-recruitment relationship to calculate the SSB_{MSY} and F_{MSY}. 75% F_{MSY} is calculated by projecting the population forward assuming the same stock-recruitment (S-R) relationship and finding the fishing mortality (F) that maintains the population at 75% SSB_{MSY}. SSB X% is calculated by projecting the population forward while fishing at F X%SPR with recruitment randomly drawn from the observed historical recruitment. MSY-based reference points are used in the LIS region because it has a longer time-series.

Spawning potential ratio (SPR) based reference points

SPR-based reference points estimate the reproductive potential of a fished stock relative to its unfished condition. SPR based reference points are used in the MARI, NJ-NYB and DelMarVa regions.

Table 8. Tautog Spawning Stock Biomass Status by Region When Compared to Proposed Reference Points. Source: ASMFC Stock Assessment Update, 2016

	Proposed SSB Reference Points			Status as of the 2016 Assessment	
Stock Region	MSY or SPR	SSB Target (mt)	SSB Threshold (mt)	SSB 2015 (mt)	Stock Status
Massachusetts – Rhode Island	SPR	2,684	2,004	2,196	Stock Not Overfished
Long Island Sound	MSY	2,865	2,148	1,603	Overfished
New Jersey – New York Bight	SPR	3,154	2,351	1,809	Overfished
Delaware – Maryland – Virginia	SPR	1,919	1,447	621	Overfished
Coastwide	MSY	14,944	11,208	6,014	Overfished
	SPR	9,448	7,091	6,014	Overfished

Table 9. Tautog Fishing Mortality Status by Region When Compared to Proposed Reference Points. Source: ASMFC Stock Assessment Update, 2016

	Proposed F Reference Points			Status as of the 2016 Assessment	
Stock Region	MSY or SPR	Fishing Mortality Target	Fishing Mortality Threshold	3-year Average (2013-15)	Stock Status
Massachusetts – Rhode Island	SPR	0.28	0.49	0.23	Overfishing Not Occurring
Long Island Sound	MSY	0.28	0.49	0.51	Overfishing
New Jersey – New York Bight	SPR	0.20	0.34	0.54	Overfishing
Delaware – Maryland – Virginia	SPR	0.16	0.24	0.16	Overfishing Not Occurring
Coastwide	MSY	0.17	0.24	0.38	Overfishing
	SPR	0.25	0.43	0.38	Overfishing Not Occurring

<u>Option A. Status Quo - Reference Points can be Modified via a Management Document</u>
The Tautog Technical Committee or Stock Assessment Subcommittee can recommend alternative reference points (i.e. other than MSY or SPR), as long as modifications to the status determination criteria, and their associated values, are the result of the most recent peer-reviewed stock assessments for tautog. In response, the Board may initiate a management document to incorporate the new, peer-reviewed stock status determination criteria.

<u>Option B. Reference Points can be Modified via Board Action (i.e., Management Document Not Required)</u>
The Tautog Technical Committee or Stock Assessment Subcommittee can recommend alternative reference points (i.e. other than MSY or SPR), as long as modifications to the status determination criteria, and their associated values, are the result of the most recent peer-reviewed stock assessments for tautog. In response, the Tautog Management Board may allow for the incorporation of new, peer-reviewed stock status determination criteria, when available, through Board action (at a Board Meeting).

Scientific advice, with respect to status determination criteria modifications, could follow three scenarios. First, the peer-review panel may reach consensus with respect to maintaining the current definitions of status determination criteria. There may be updates to the values associated with those same definitions based on the input of more recent (i.e., additional year's data) or updated information as well; however, the Board is not required to undertake any specific action when this occurs, as using the updated values is implied in this provision of the FMP. In this case the scientific advice can then move forward such that management advice can be developed.

Under the second potential scenario for scientific advice, the peer-review panel can recommend changes or different definitions of the status determination criteria. If the panelists reach consensus as to how these status determination criteria should be modified or changed then the scientific advice can move forward such that management advice can be developed. Under these first two potential scenarios, consensus has been reached and therefore the scientific advice moving forward to the Section's management advisory groups should be clear.

The third potential scenario is the peer review scientific advice with respect to the incorporation to status determination criteria are split (consensus is not reached) or uncertain recommendations are provided (weak consensus). The scientific advice provided by the reviewers may be particularly controversial. In addition, the scientific advice may not be specific enough to provide adequate guidance as to how the maximum fishing mortality threshold and/or minimum stock size threshold should be defined or what resulting management advice should be developed from these changes. Under these circumstances, the Board may engage their TC to review the information and recommendations provided by the peer-review group. Based on the terms of reference provided to the TC, they may prepare a consensus report clarifying the scientific advice for the Board as to what the status determination criteria should be (e.g., modify, change, or maintain the same definitions). At that point the scientific advice on how the status determination criteria should be defined will be clear, and can move forward such that management advice can be developed.

2.6 DEFINITION OF OVERFISHING AND OVERFISHED

Overfishing is defined relative to the rate of removals from the population as determined by the fishing mortality on the stock. The level of spawning stock biomass in a stock as the result of fishing mortality is the basis for determining if a stock has become overfished. A biomass target or threshold determines the condition of the stock whereas the mortality rate determines how fast the population is moving toward achieving the appropriate level of biomass.

2.7 MAINTENANCE OF STOCK STRUCTURE

2.7.1 Fishing Mortality (F) Target

Option A. Status quo

Coastwide fishing mortality cannot exceed F_{target}=0.15

Option B. Managing to the Regional Target F

The Management Board will evaluate the current estimates of F, as determined by the most recent stock assessment, with respect to its regional reference points (Section 2.5) before proposing any additional management measures. If the current F exceeds the regional threshold level (overfishing), the Board will take steps to reduce F to the regional target level; if current F exceeds the regional target, but is below the regional threshold, the Board should consider steps to reduce F to the regional target level. If current F is below the regional target F, then no action would be necessary to reduce F. At this time, the only way to assess the progress towards achieving the regional target F is through future stock assessments.

Sub-option B1. No time requirement
If the current F exceeds the regional threshold level (overfishing), the Board must take corrective action within a reasonable amount of time.

Sub-option B2. Board action within One Year
If the current F exceeds the regional threshold level (overfishing), the Board must take corrective action, via a management document, within one year of receiving the overfishing stock status. Alternative management measures must be implemented in the second year. Each region and/or state must identify specific measures (e.g., possession limit, minimum size and seasonal closures, quota, etc.) to achieve necessary harvest reductions (if applicable) in the management document.

Sub-option B3. Board Action within Two Years
If the current F exceeds the regional threshold level (overfishing), the Board must take corrective action, via a management document, within two years of receiving the overfishing stock status. Alternative management measures must be implemented by the third year. Each region and/or state must identify specific measures (e.g., possession limit, minimum size and seasonal closures, quota, etc.) to achieve necessary harvest reductions (if applicable) in the management document.

The Board determines a level of risk when developing management measures to achieve the reference points. For example, the Board can implement management measures associated with a 50% or 70% probability of achieving F target. The chosen probability impacts the percent reduction necessary. The Board can choose to hardwire the probability into the Amendment or select the probability when necessary.

Option A. Status Quo.
The Board will select the probability of achieving F Target when modified management measures are necessary.

Option B. 50% Probability of Achieving F Target
Management measures will be developed based on at least a 50% probability of achieving F Target.

Option C. 70% Probability of Achieving F Target
Management measures will be developed based on at least a 70% probability of achieving F Target.

2.7.2 F Reduction Schedule

If F exceeds the regional threshold level (overfishing), the Board will take corrective action, as described under *Section 2.7.1.* The Board will provide the Technical Committee with a timeframe in which F must be brought down to the regional target level using harvest reductions. The Technical Committee will then develop short-term projection scenarios to determine the constant harvest levels necessary to achieve the regional F target within X years.

The following management options refer to the harvest reduction timeframe:

Option A. Status Quo
Draft Amendment 1 does not specify a time frame to reduce fishing mortality to the regional target F level. The time frame will be established when the Board initiates a harvest reduction management response.

Option B. Three Years
Fishing mortality will be reduced to the regional target F level in a time frame that is no longer than 3 years.

Option C. Five Years
Fishing mortality will be reduced to the regional target F level in a time frame that is no longer than 5 years.

2.7.3 Stock Rebuilding Target

The Management Board will evaluate the current estimates of SSB with respect to its regional reference points (Section 2.5) before proposing any additional management measures. If the current SSB is below the regional threshold level, the Board may take steps to increase SSB to the regional target level (Section 2.7.4); if current SSB is below the regional target, but above the regional threshold, the Board may consider steps to increase SSB to the regional target level. If current SSB is above the regional target SSB, then no action would be necessary to increase SSB.

2.7.4 Stock Rebuilding Schedule

Option A. Status Quo (from Addendum IV)
No required management responses if SSB is below the threshold level.

Option B. A Stock Rebuilding Schedule can be Developed via an Addendum
The Management Board will evaluate the current estimates of SSB with respect to the regional reference points (Section 2.5). The Board can initiate a regional SSB rebuilding plan via an addendum (Section 4.12).

Option C. A Stock Rebuilding Schedule can be Developed via an Addendum, Not to Exceed 10 Years
The Management Board will evaluate the current estimates of SSB with respect to the regional reference points (Section 2.5). The Board can initiate a regional SSB rebuilding plan via an addendum (Section 4.12). The only limitation imposed under Amendment 1 is that the rebuilding schedule is not to exceed 10 years.

2.8 RESOURCE COMMUNITY ASPECTS
Tautog are an important recreational species for fishermen and a valuable resource in the live commercial market.

2.9 IMPLEMENTATION SCHEDULE
As part of the final approval of Amendment 1, the Management Board will establish an implementation schedule.

3.0 MONITORING PROGRAM SPECIFICATIONS/ELEMENTS

3.1 STOCK ASSESSMENT
A tautog stock assessment will be performed every five to seven years, or sooner if necessary. The technical committee will meet to review the stock assessment and all other relevant data sources. The stock assessment report shall follow the general outline as approved by the ISFMP Policy Board for all Commission-managed species. In addition to the general content of the report as specified in the outline, the stock assessment report will also address the specific topics detailed in the following sections.

3.1.1 Assessment of Annual Recruitment
Annual recruitment of tautog will be estimated by examination of a variety of data sources. The first is the estimate of recruitment from the model. Second will be the examination of various fishery-independent data sources, including the juvenile abundance indices that are integrated in to the statistical modeling process. Although many of these surveys are not designed to specifically target tautog, continued examination of these surveys in the future is worthwhile. In addition, surveys designed to specifically monitor tautog abundance along the coast are needed, including the use of gears that are more appropriate for structure oriented species.

3.1.2 Assessment of Spawning Stock Biomass
Spawning stock biomass (SSB) will be estimated from the model every five to seven years or sooner if necessary. Model estimates will be used for evaluating stock status versus the approved reference points.

3.1.3 Assessment of Fishing Mortality Target and Measurement

Fishing mortality (F) rates will be estimated by the model every five years or sooner, if necessary. Fishing mortality will be estimated for each age-class estimated by the model, but the metric used for comparison to the reference point values will be full F, or the comprehensive fishing mortality rate for all ages of the entire regional stock. Because of the inherent variability in some of the important data sources for the model (namely recreational catch estimates), a three-year running average of F should be developed and used as the reference estimate for the current state of the stock. Terminal year estimates for tautog generated by the model are subject to variability as additional data are added. Therefore, terminal year estimates may not accurately depict current conditions. The three-year running average is deemed to be more reflective of overall trends in fishing mortality and will reduce the risk of implementing management measures based on a false terminal year signal.

3.1.4 Assessment of Age Structure

Age structure will be estimated by the model every five to seven years or sooner, if necessary. Age structure will be estimated by the model, and is based off of the biological sampling done in each state, so is a good representation of the population structure in each region. Because of the inherent variability of age data it is important to use the model estimated age structure as the model synthesizes multiple sources of information to produce its estimates of numbers and weight at age, and therefore is accounting for some of this variability in its calculations. Additionally samples available for age analysis are affected by things such as the selectivity of the fisheries operating on the stock, which is another dynamic the model can account for in its estimates. As opposed to other population metrics, the population age structure can be used as an indicator of a healthy population if the age structure is robust and spans multiple ages including some of the oldest ages, and can also indicate when a population is becoming stressed as older ages are truncated or as there are multiple runs of low recruitment. Age structure may not immediately necessitate a management action, but can be viewed to preempt future problems in the population.

3.2 SUMMARY OF MONITORING PROGRAMS

In order to achieve the goals and objectives of Amendment 1, the collection and maintenance of quality data is necessary.

3.2.1 Catch and Landings Information

3.2.1.1 Recreational Catch and Effort Data Collection

Tautog is predominantly a recreationally caught species, with anglers accounting for about 90% of landings coastwide. The Marine Recreational Fisheries Statistics Survey (MRFSS) contains estimated tautog catches from 1981-2003 and the Marine Recreational Information Program (MRIP) contains estimated tautog catches from 2004 - present.

Recreational effort data is collected through phone surveys, but this will fully transition to mail surveys by 2018. Recreational catch data is collected through an access-site intercept survey. Interviewers routinely sample for biological data during angler intercepts by collecting length and weight measurements when possible. Sampling during night time and accounting for zero-catch trips are conducted to more accurately capture fishing behaviors. MRIP also leverages logbook reporting and tournament sampling to improve quality of data on the distinct for-hire fleet.

Tautog are not well-sampled by the MRFSS/MRIP program, resulting in higher percent standard errors (PSEs, approximately 20-25% in recent years at the regional level) and large year-to-year swings in catch estimates, often driven by small numbers of intercepts. When disaggregated by state, PSEs for the MRFSS/MRIP estimates of harvest and releases were generally high (>0.30), indicative of the low number of intercepts obtained by survey interviewers. Recreational catch information can be downloaded at: http://www.st.nmfs.noaa.gov/st1/recreational/queries/.

The recreational tautog fishery occurs throughout the year. The majority of the landings are captured through MRIP, which is administered by the National Marine Fisheries Service. However, MRIP does not sample landings during January and February (Wave 1). This amendment recommends the states initiate a sampling program to estimate the recreational harvest of tautog during January and February.

3.2.1.2 Commercial Catch and Effort Data Collection

The ASMFC, NMFS, U.S. Fish & Wildlife Service, the New England, Mid-Atlantic, and South Atlantic Fishery Management Councils, and all the Atlantic coastal states have developed a coastwide fisheries statistics program, known as the Atlantic Coastal Cooperative Statistics Program (ACCSP). All harvesters and dealers are required to report a minimum set of standard data elements by the 10th of the following month (refer to the ACCSP Program Design document for details, http://www.accsp.org/data-collectionstandards). Landings are reported to NMFS and available online at http://www.st.nmfs.noaa.gov/commercial-fisheries/index.

Harvesters are required to report all commercial trips regardless of catch. Trips that yield no catch are still considered trips. Therefore, all data elements for effort must be reported. Dealers are required to submit monthly negative, or no activity, reports in the states where they are licensed. A single negative report may be submitted in advance to cover multiple negative reporting periods. Harvesters with no reported commercial landings during the previous license period are required to certify that fact at the time of license renewal.

New Jersey has a limited access tautog commercial fishery. As of 2016, there are 40 directed fishery and 22 non-directed fishery permittees in New Jersey. All permittees are required to submit monthly reports identifying tautog landings by day, gear, and location, as well as any bycatch.

3.2.2 Biological Information

3.2.2.1 Fishery Dependent Information—Biological Sampling from the Recreational Fishery

Length and weight samples are collected from the recreational fishery through MRIP. As a less commonly encountered species, sample sizes are often low, and average approximately 350-500 intercepts per year depending on the region.

In addition, states have dedicated short term sampling programs for specific fisheries in New York (head boat mode), New Jersey (head boat and shore mode), and Virginia (a directed fishing mortality study) and in some states that have a significant head boat or shore mode component to their recreational tautog catch. Most state's age samples come from a combination of state-run recreational, commercial and fisheries independent surveys.

In 2004, MRIP implemented observers on headboats to collect lengths of released alive fish (Type 9 measurements). Prior to 2004, the only information on the size of released fish came from the American Littoral Society's (ALS') volunteer angler tagging program, which provides lengths of fish that anglers report they have released alive. These two data sources provide the length frequency information used to develop the catch-at-age for released fish.

Wave 1 Sampling

Historically, only about five percent of the annual recreational catch on the Atlantic and Gulf coasts is taken during Wave 1 (Jan/Feb). Costs to sample these months are very high due to low fishing activity. With a few exceptions the recreational statistics program (MRFSS/MRIP) has not collected data in Jan/Feb on the Atlantic coast north of Florida since 1980.

3.2.2.2 Fishery Independent Information—Biological Sampling Program

All states in the stock unit are required to collect a minimum of 200 age and length samples annually (five fish per centimeter), within the range of lengths commonly caught by the fisheries. Specific sources are not mandated, therefore most states fulfill their obligations through a combination of fishery-dependent and fishery-independent sampling. This intent of this requirement, imposed in 2002, was to collect data necessary to support regional assessments and/or regional approaches to management. A summary of data collection efforts should be included in the annual compliance report.

The state marine fisheries agencies from Massachusetts through New Jersey conduct fisheries independent surveys that encounter tautog to record biological information such as age, length, sex, weight, and some measures of maturity. As shown in Table 10, data availability varies by region; northern states have more data from the earlier parts of the time series, when older, larger fish were present in the samples. The more southern states lack data from fishery-independent sources and thus have limited numbers of samples of the youngest, smallest fish.

Table 10. Ongoing fishery independent surveys, as of 2016

State	Areas Surveyed	Survey Type	# of Survey Stations	Dates of Survey
MA	MA territorial waters	Trawl	1 station per 19 square nautical miles	May and September
RI	Narragansett Bay	Trawl	13 stations per month	June through October
	Narraganset Bay, Rhode Island Sound and Block Island Sound	Trawl	44 stations	Spring (April-May) Fall (Sept/October)
	Narragansett Bay Beach	Seine	18 stations per month	June through October
	Coastal Ponds	Seine	24 stations in 8 coastal ponds per month	May through October
	Narragansett Bay	Trap	10, 5 pot trawls set per month	April through October
CT	Long Island Sound (CT and NY waters)	Trawl	40 stations per month	Spring (April-June) Fall (Sept-Oct)
NY	Peconic Bay	Trawl	16 stations per week	May through October
	Western Long Island Sound (Little Neck, Manhasset Bay, Jamaica Bay)	Seine	5-10 sites, semimonthly	May through October
	Long Island Sound	Trap	35 stations per week	May through October
NJ	Nearshore ocean waters between Cape May and Sandy Hook	Trawl	30 tows in Jan; 39 tows per month in Apr, Jun, Aug & Oct	Jan, Apr, June, Aug & Oct
DE	Fisheries independent surveys do not collect tautog in quantities needed for monitoring purposes			
MD	Fisheries independent surveys do not collect tautog in quantities needed for monitoring purposes			
VA	Fisheries independent surveys do not collect tautog in quantities needed for monitoring purposes			

3.2.3 Social Information

No ongoing sociological data collection or monitoring is planned. Anecdotal information and insight on the fishery and regulatory changes are provided by the Tautog Advisory Panel, which maintains active participation. ACCSP is currently developing standards for collecting sociological data in all fishing sectors.

3.2.4 Economic Information

Currently there are no programs designed specifically to collect economic data pertaining to the tautog fishery. The ACCSP is currently developing standards for collecting economic data in all fishing sectors. See Section 1. 5.3 for a review of economic information that references tautog, but is not designed specifically for the tautog fishery.

3.2.5. Observer Program

As a condition of state and/or federal permitting, vessels are required to carry at-sea observers when requested. ACCSP currently has at-sea observer programs modeled after the NOAA Fisheries National Observer Program, adopting their standards and training protocols. A minimum set of standard data elements is defined through the ACCSP for biological or bycatch sampling data (refer to the ACCSP Program Design document for details: http://www/accsp.org/programdocument.htm#prog).

Observer data obtained from the Northeast Fisheries Observer Program for the years 1989-2012 indicates the overall sample size of observed trips that either retained or discarded tautog was low (Table 11 and Table 12). The data represents estimates of primarily incidental catch, not targeted tautog trips. Length sampling was also inconsistent and had a low sample size by year, but where available showed that discarded fish were smaller on average than retained fish (ASMFC 2015).

Table 11. Sample size of gear of observed commercial trips that caught tautog (1989-2012)

Gear	# of Trips
Gillnet	710
Otter Trawl	604
Scallop Dredge	23
Fish pot/trap	19
Longline	6
Lobster pot/trap	4
Scottish Seine	1
Troll Line	1

Table 12. Sample size by state of observed commercial trips that caught tautog (1989-2012)

State	# of Trips
ME	2
NH	9
MA	456
RI	620
CT	7
NY	59
NJ	113
DE	1
MD	43
VA	47
NC	11

Discarded-to-observed ratios from the observer data were supplemented with Vessel Trip Report (VTR) data for some gears and regulatory periods when sample size was less than ten observed trips. VTR data are self-reported by fishermen and are not considered as reliable as observer data. Overall there is high uncertainty in the estimates of commercial discards, and they are a small component of total removals of tautog. In addition, observer data is provided by vessels that hold federal permits, therefore the information presented is incomplete because it does not include data from fishermen with state permits only.

As an example of a program that could benefit our understanding of tautog and improve fishery dependent data collection for this species, in 2008, New Jersey began a collaboration with ACCSP personnel for an at-sea monitoring and sampling program targeting both the recreational party/charter boat and commercial fisheries for various species including tautog. Through 2014, data has been collected from this program on over 4,000 tautog (harvest and discard) sampled on nearly 200 trips targeting tautog. Programs such as these are an important source of valuable fisheries dependent data, and their continuation and expansion should be encouraged beyond New Jersey. In particular, a focus on observer information in recreational and commercial fisheries could provide robust estimates of discards (abundance, weights, and lengths) where there are currently gaps.

3.3 STATE TAGGING PROGRAMS

The Commission's Interstate Tagging Committee (ITC) was created in 1999 to improve the quality and utility of fish tagging data. A subcommittee of ITC members with expertise in tagging program design was established to review and certify interested tagging programs. In addition, it serves as a technical resource for jurisdictions other than the ASMFC, including private, non-profit tagging groups who plan to tag tautog. Protocols have been developed by the Committee as a source of information, advice and coordination for all Atlantic coast tagging programs; more information can be found at www.fishtag.info.

There are tautog tagging programs in the waters of Massachusetts, Maryland, and Virginia. The methods used to capture, tag, and track recaptures are described below.

Massachusetts
Massachusetts Division of Marine Fisheries tagged adult tautog using Floy internal anchor tags (model # FM-84). Tag anchors were implanted into the abdominal cavity, on the left side of fish just ventral and posterior to the pectoral fin apex. Tag number, total fish length in mm and sex was recorded for each fish, along with the latitude and longitude of the release point. Sex was determined by external examination of prominent morphological features. Subsequent recapture information on total length, recapture site, capture method, catch disposition (released, retained) was solicited from tag returnees.

Release and recapture sites were plotted on MapTech chart facsimiles for calculation of predicted straight line travel distance and travel vectors. Daily growth intervals were calculated using the difference between initial capture length and recapture length divided by the days at large, and compared to growth intervals of similar aged fish from the annual DMF Age and Growth Study.

Maryland
Tautog tagging in Maryland and adjacent federal waters is conducted by volunteer anglers for the American Littoral Society (ALS). A yellow dorsal loop tag with the serial number is applied to the fish behind the dorsal fin (Figure attached). Information on the area of capture and release, date and fish size is sent to the ALS. ALS tagging began in 1982 and continues today throughout a number of the Atlantic states, including Maryland. There are about 8,000 records available for tautog tagged in Maryland. There is no specific tagging design, tags are applied to fish on ad hoc basis. No tagging is conducted by the MD Department of Natural Resources.

Virginia
The Virginia Game Fish Tagging Program is a cooperative program of the Virginia Saltwater Fishing Tournament (Marine Resources Commission) and VIMS Marine Advisory Program. Initiated in 1995, it has been funded primarily by Saltwater Recreational Fishing License Funds and matching VIMS funds. This program provides annual training and enables a corps of ~200 experienced anglers to direct tagging effort on select target species important to VA's marine recreational fisheries. Through 2014, this program's database (used by researchers, fishery managers, anglers, etc.) includes over 240,000 records for fish tagged and over 25,900 fish recapture records (an overall >11% recapture rate). There are ten target species: black and red Tautog Stock Assessment Report 34 drum, black sea bass, cobia, flounder, gray triggerfish, sheepshead, spadefish, speckled trout, and tautog. There have been 17,705 tautog tagged since 1995 with 2,692 recaptures through 2013.

3.4 BYCATCH REDUCTION
The extent of bycatch in the tautog fishery is minimized through gear restrictions including pot and trap degradable fasteners to reduce the mortality of fish in lost or abandoned pots or traps, see Section 4.5. In addition, New York has prohibited the possession of tautog caught using fish pots or traps, unless there is one circular vent measuring 3 1/8 inch opening diameter.
States have implemented other gear restrictions and modifications to reduce overall bycatch in

pots and traps that indirectly benefit tautog. Escape vent provisions mandated to reduce the catch of undersized lobster, black sea bass and scup have likely allowed juvenile tautog to escape. However, as the minimum sizes for tautog are larger than those for the other species, some adult tautog may be too large to fit through these escape panels. Increasing the size of the escape panels to accommodate the larger size of the tautog may increase the rate of escapement for other species, rendering the utilization of such pots unfeasible for commercial fishing. Research into retention of tautog along with the other associated species harvested in lobster/fish pots using varying sizes of escape panels may be informative to determine a commercially feasible maximum.

Several bycatch reduction devices have been researched for trawl nets, a gear involved in the harvest of tautog in the more northern states along the Atlantic coast. These devices utilize escape panels of larger mesh, grills allowing escape of smaller fish, or the use of different color net material to increase the selectivity of the nets (Glass 2000). Investigations on the behavior of tautog to trawl gear may be informative toward the possible utilization of these devices in the trawl fishery.

3.5 HABITAT MONITORING PROGRAM

To enhance habitat for reef-associated fish and invertebrates, especially in the relatively featureless sand bottoms typical of ocean waters south of New England, artificial reefs have been created along the Atlantic coast, see Table 6. The construction of wide arrays of artificial reef sites reduce habitat fragmentation and act as networks supporting migratory movements of structure dependent species (Steimle and Zetlin 2000).

4.0 MANAGEMENT PROGRAM IMPLEMENTATION

4.1 REGIONAL BOUNDARIES

Option A. Status Quo – Coastwide Management

Currently, tautog are managed on a coastwide basis. If *Option A. Status Quo* is chosen then this section will be removed. The coastwide management unit is summarized under Section 2.4.

Option B. Regional Management

The Board reviewed multiple regional approaches and stock assessment analyses prior to proposing a four-region approach (Table 13). This option includes a sub-option to delineate the Long Island Sound boundary.

In the 1996 FMP, the document notes “there are apparent regional differences in the tautog fishery”, but did not specify regional boundaries due to limited biological data. In the 2015 Benchmark Stock Assessment, the TC identified a regional structure based on life history information, fishery characteristics, and data availability. Tagging data suggest strong site fidelity across years with limited north-south movement, although they undergo seasonal inshore-offshore migrations in the northern end of their range. Based on the analyses of biological and fisheries information, the TC determined the “coastwide” stock unit is inappropriate.

Draft Amendment 1 proposes delineating the stock into four regions due to differences in biology and fishery characteristics, as well as limited coastwide movement (Table 13 and Figures 26-30). Regional management is likely to reduce the risk of overfishing and acts upon prior research recommendations. The TC can recommend alternative regional boundaries as more data become available. In response, the Board may adjust the regional boundaries via *Adaptive Management, Section 4.12.*

Table 13. Four-Region Management Approach

1) Massachusetts – Rhode Island
2) Long Island Sound (CT and NY LIS)
3) New Jersey – New York Bight (NJ and NY South Shore
4) Delaware – Maryland – Virginia

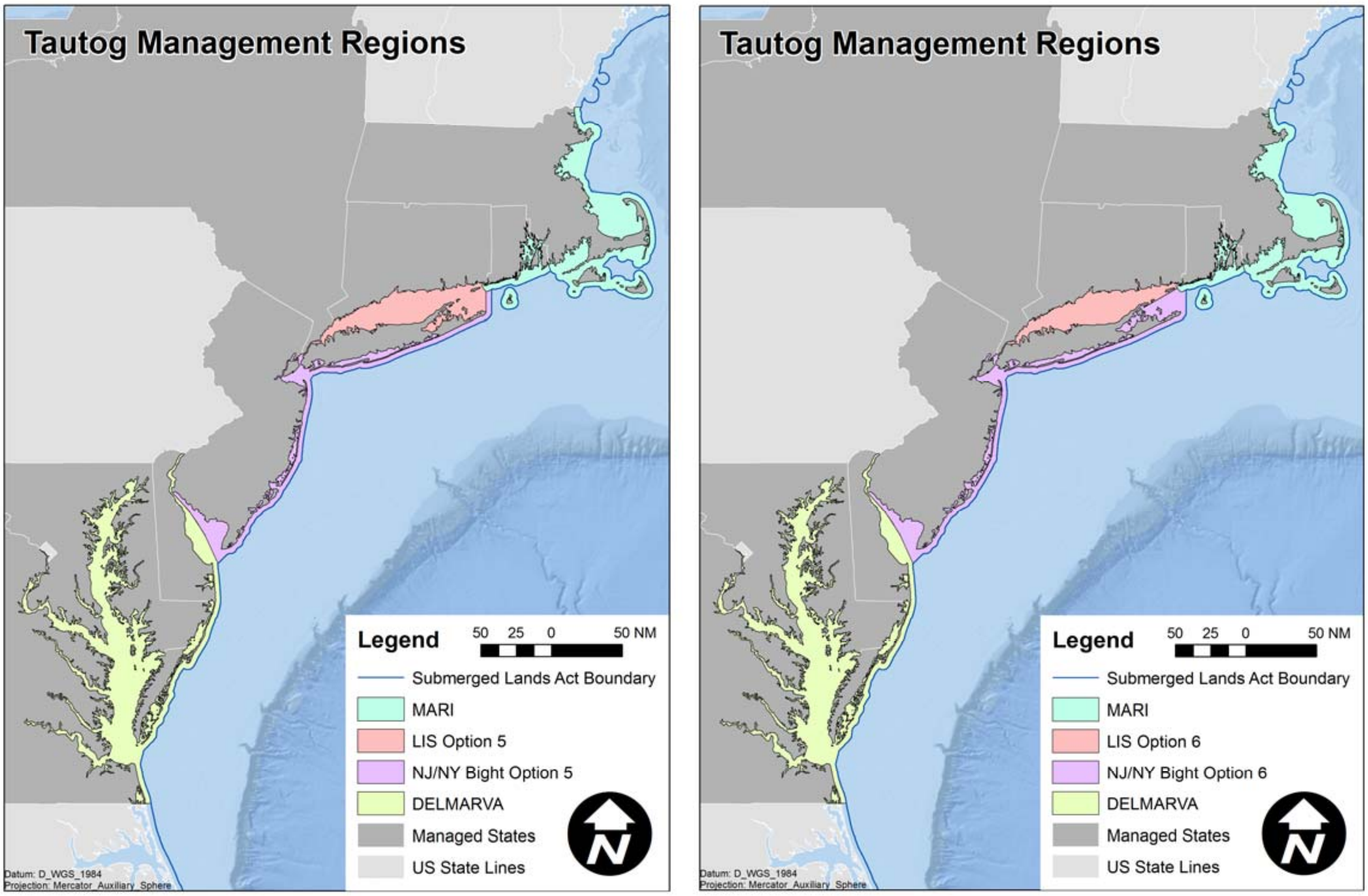


Figure 26. Proposed Tautog Management Regions; Showing Different LIS Boundaries

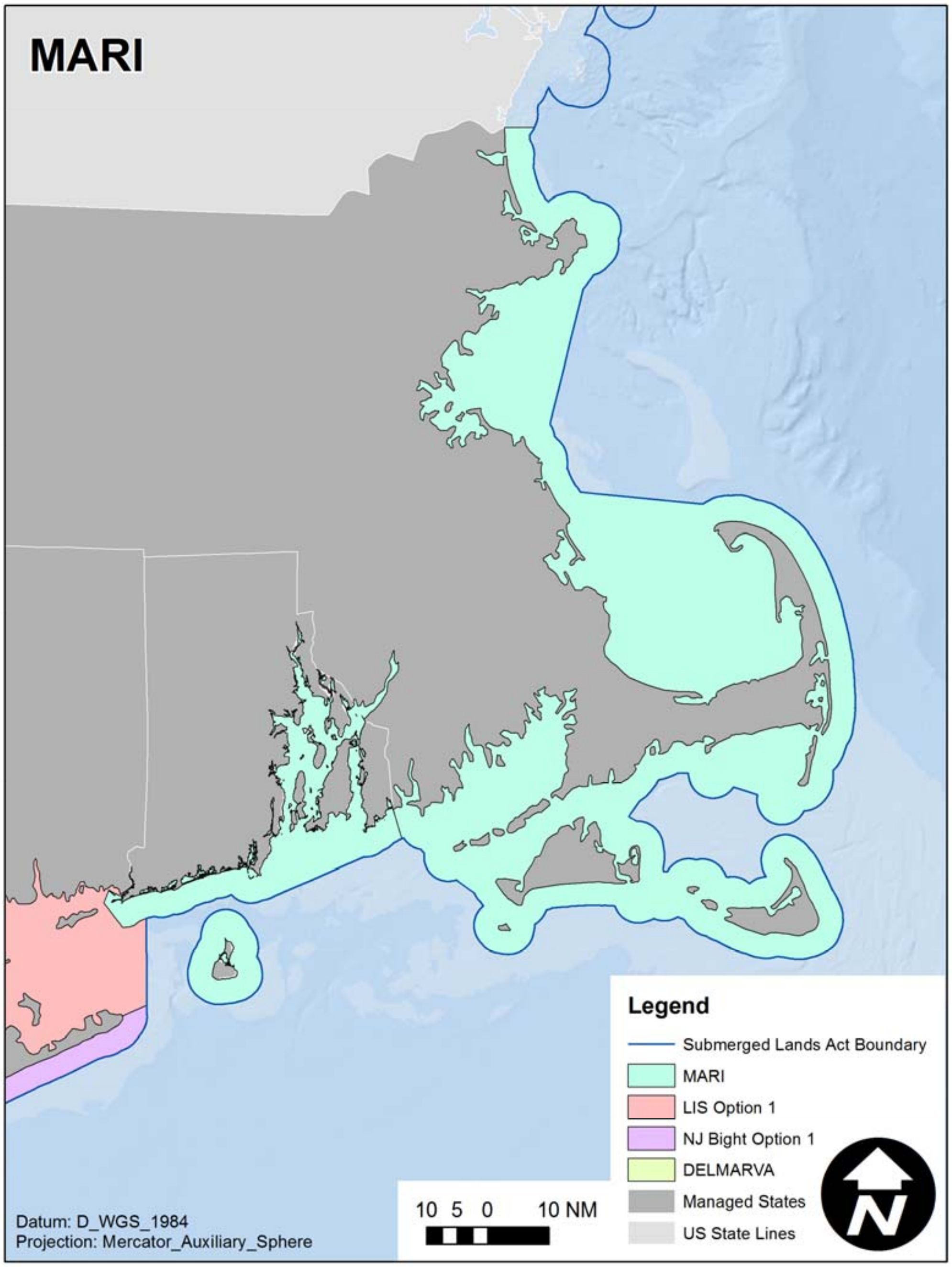


Figure 27. Proposed Massachusetts and Rhode Island Management Area

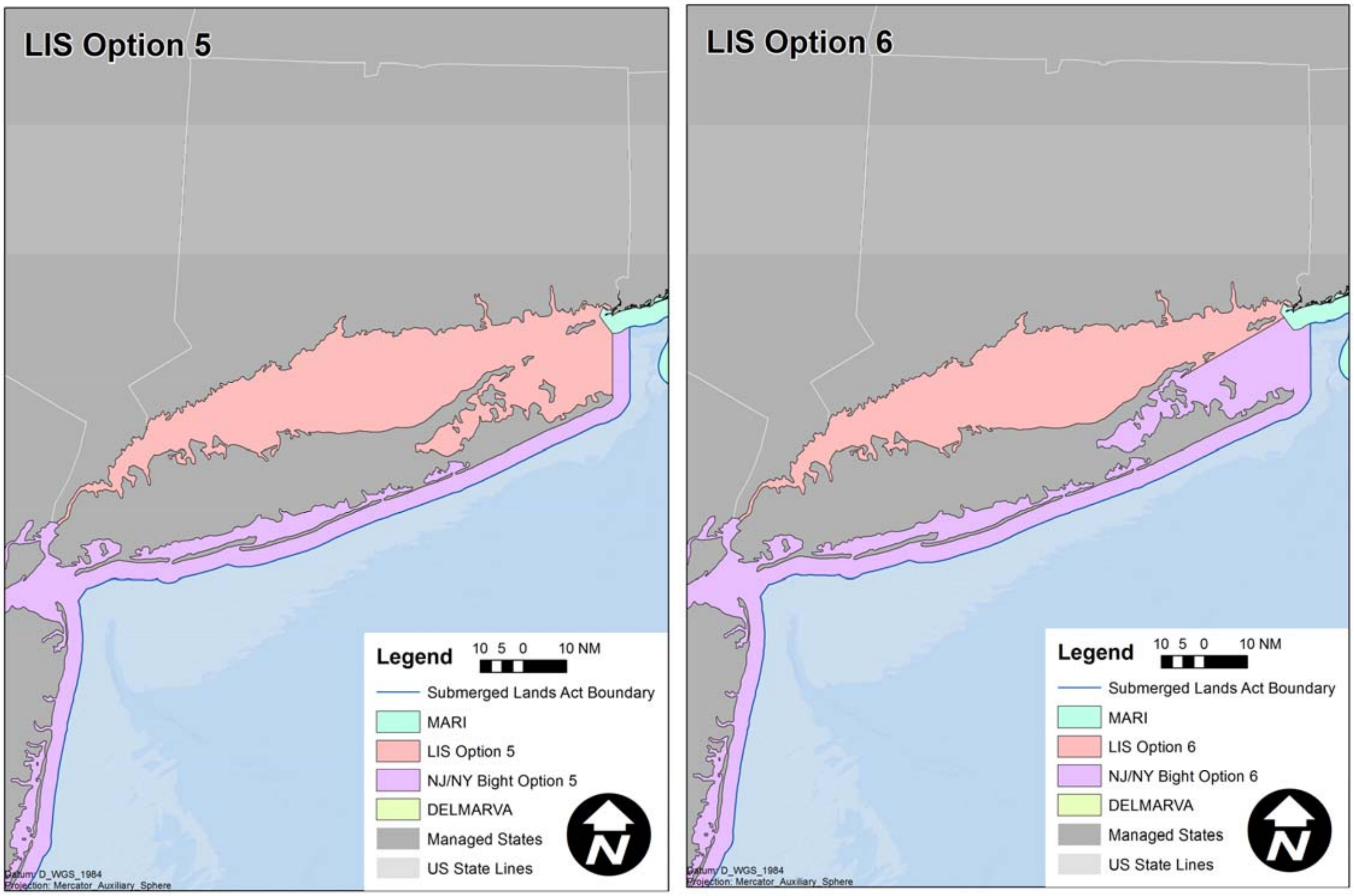


Figure 28. Proposed Long Island Sound Management Area

When Amendment 1 is finalized, the appropriate boundaries/maps will be included in the document.

Sub-Option B1 (map on the left): Long Island Sound is delineated by a line that runs from Montauk Point, New York to Watch Hill, Rhode Island. All waters west of the line will follow the Long Island Sound management measures. The MRIP data that was used to evaluate the LIS stock status is aligned with this option.

Sub-Option B2 (map on the right). Long Island Sound is delineated by a line that runs from Orient Point, New York to Watch Hill, Rhode Island. All waters west of the line will follow the Long Island Sound management measures.

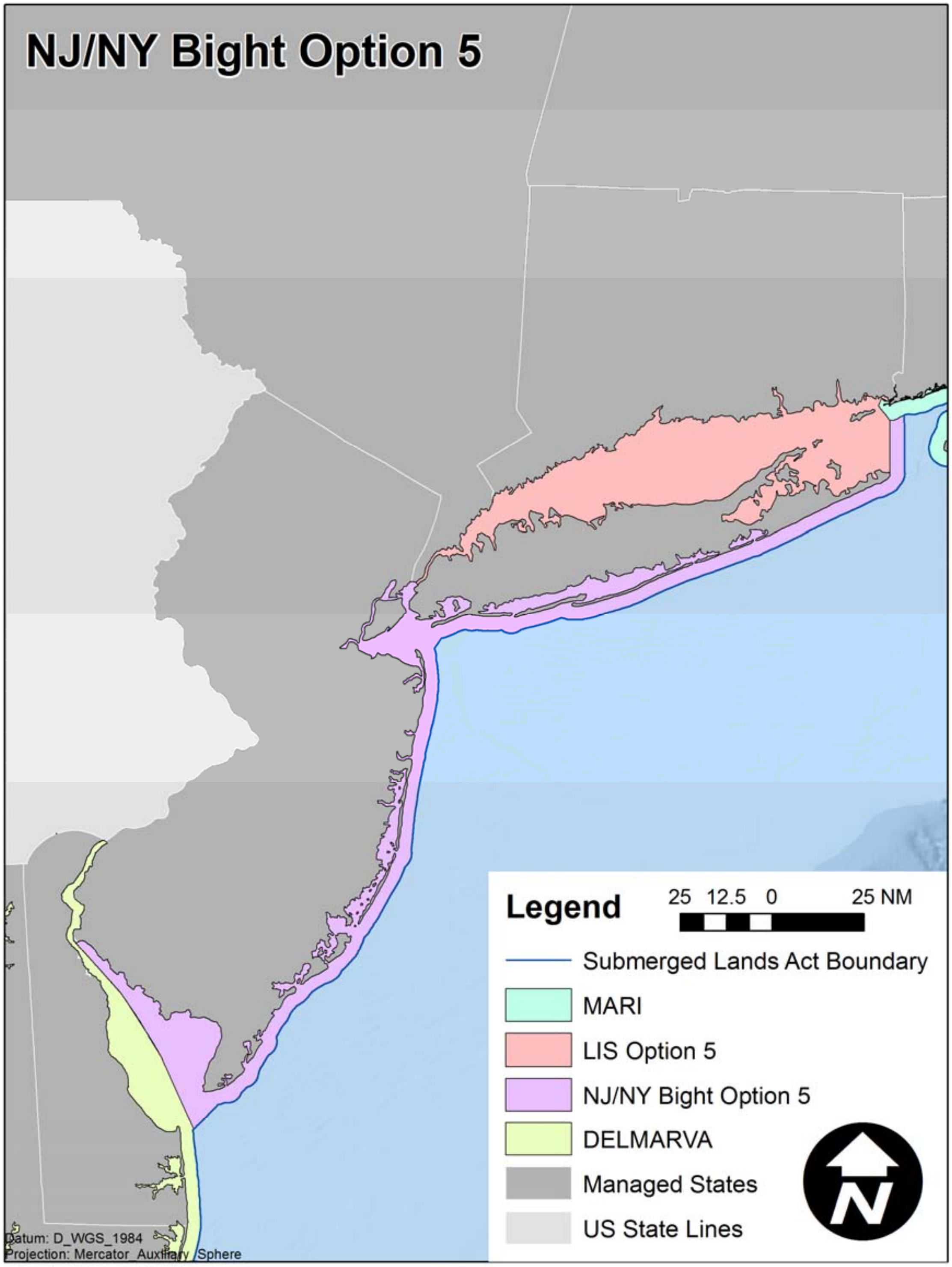


Figure 29. Proposed New Jersey-New York Bight Management Area

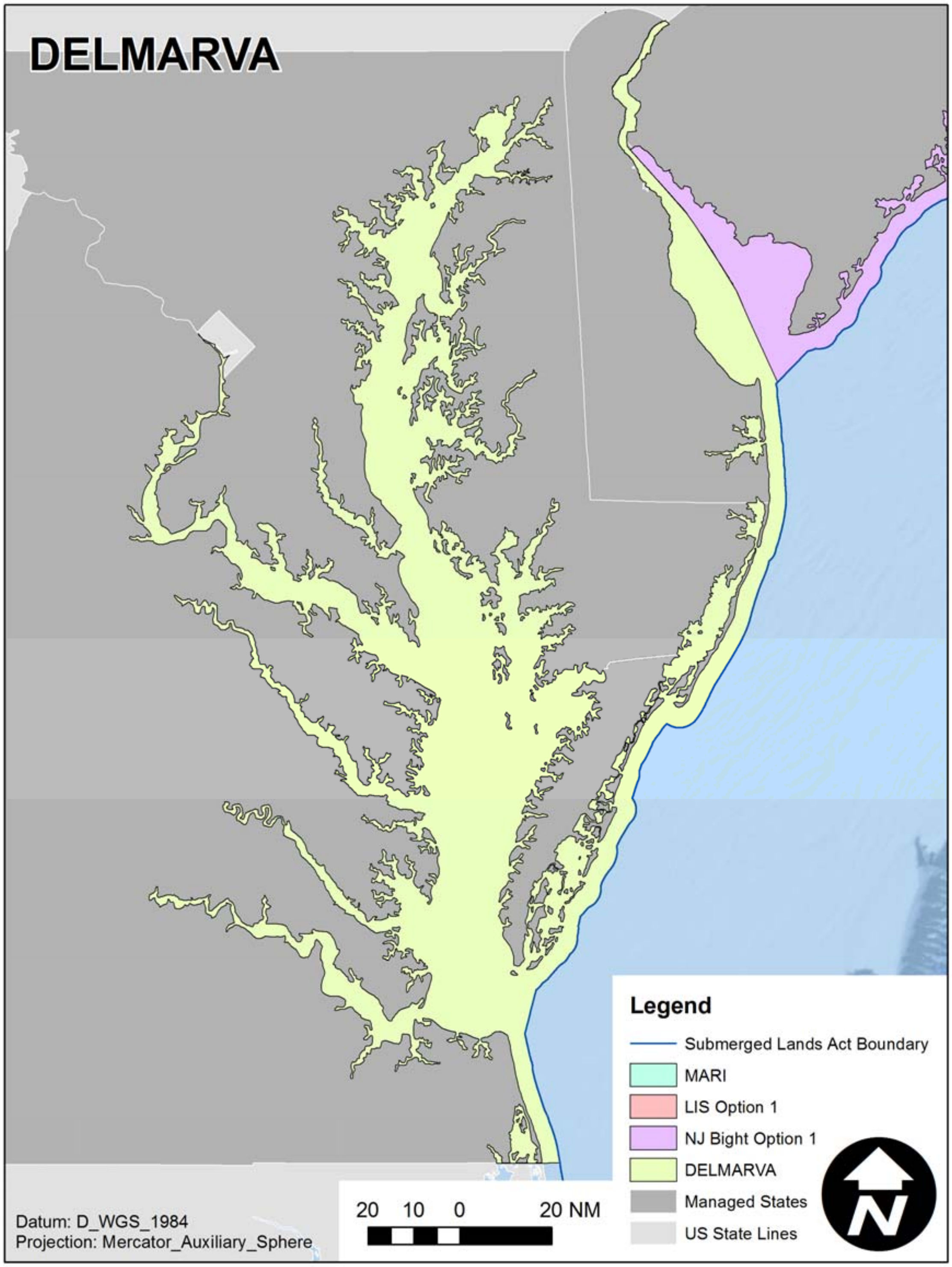


Figure 30. Proposed Delaware, Maryland, Virginia Management Area

4.2 REGIONAL MANAGEMENT MEASURES

Management options by region were developed by the TC in response to the 2016 stock assessment update. Two regions would be required to take harvest reductions to due to the regional stock status: LIS and NJ-NYB. Two regions would not have to take harvest reductions, but are proposing regional measures: MARI and DelMarVa.

The LIS and NJ-NYB regional reduction options are presented using two levels of management risk: 1) options that have a 50% probability of achieving F Target by 2021 and 2) options that have a 70% probability of achieving F Target in 2021 (Sections 4.2.3 and 4.2.4). Each region would be required to make reductions to the recreational and commercial sectors using the same level of risk. The PDT recommends selecting 3 recreational measures and 3 commercial measures (by region) for public comment.

The PDT recommends taking all commercial quota options out for public comment. If a commercial harvest tagging program is implemented then a state would not need to adopt the proposed commercial effort controls (e.g., changes to the size limit, season length, etc.) to achieve the necessary reductions, but would simply use a cap on the number of tags distributed. The cap could be derived from the proposed regional quota.

4.2.1 Procedure to Develop Regional Management Measures

Compatible regulations between adjacent states are desirable to prevent the shift of fishing effort to areas with more liberal regulations, or to an area with an open season. If a region is considering consistent measures across for all states within a region then a regional working group will be developed to discuss appropriate alternatives. A regional working group consists of representatives from each member state within the region. It is recommended that the regional working group decisions are made by consensus.

If a state within a region wants to implement different management measures than those within the region, the general procedure within *Section 4.11, Conservation Equivalency* will be followed. It is recommended that the state convene the regional working group to discuss and review the proposed management measures.

All modifications to management measures (e.g., bag limit, minimum size, seasonal closures, quota, etc.) will be reviewed by the TC and approved by the Management Board. Once approved by the Board, the management measures can be implemented.

4.2.2 Massachusetts-Rhode Island (MARI)

Historically, tautog management measures in MARI have been state-specific (Tables 14 and 15). In response to the 2016 stock assessment update, managers are proposing regional management options for the public to consider (Table 16). If the regional management measures are modified at a future date, all states will agree to the new regulations prior to regional implementation (See Section 4.2.1).

Table 14. 2017 MARI Recreational Regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/person/day)	OPEN SEASONS
Massachusetts	16”	3	Jan 1 – Dec 31
Rhode Island	16”	3 (up to 10/private vessel)	Apr 15 – May 31
		3 (up to 10/private vessel)	Aug 1 – Oct 14
		6 (up to 10/private vessel)	Oct 15- Dec 15

Table 15. 2017 MARI Commercial Regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/vessel/day)	OPEN SEASONS	2017 QUOTA (lbs.)
Massachusetts	16”	40	Sept 1 - Oct 31	64,643
Rhode Island	16”	10	Apr 15 - May 31	17,116
			Aug 1 - Sept 15	13,390
			Oct 15 - Dec 31	17,116

4.2.2.1 Massachusetts-Rhode Island Proposed Recreational Management Measures

The following tools were used by MARI to calculate harvest reductions to achieve similar regulations between the two states. The methods described below all use MRIP recreational data for the years of 2013 – 2015, only waves 2 – 6 are available for analysis in these states during these years.

Four methods of estimating future recreational tautog harvest were employed. These included; 1) seasonal reductions calculated from daily harvest rates based on MA and RI harvest from 2013 - 2015 waves 2 – 6 according to MRIP data; 2) bag limit reduction calculations based on MA and RI harvest from 2013 - 2015 waves 2 – 6 according to MRIP data; 3) reductions achieved from increasing the minimum size based on MRIP size distribution data from 2013 - 2015 waves 2 – 6, and 4) a methodology for combining size, bag, and season harvest reduction calculations based on MA and RI harvest from 2013 - 2015 waves 2 – 6 according to MRIP data.

Table 16. Proposed MARI Recreational Regional Management Measures

Option	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A. Status Quo	16”	See Table 14		NA
B. All Measures Consistent	16”	3	March 1 - May 31; Aug 1 - Oct 14	9%
		4	Oct 15 - Dec 31	
C. All measures consistent	16”	3	March 1 - May 31; Aug 1 – Dec 31	19%

4.2.2.2 Massachusetts-Rhode Island Proposed Commercial Management Measures

There are no proposals to adjust the commercial regulations for MA-RI. The regulations in Table 15 would continue to be enforced unless a state or region adjusts the measures following the procedures set forth in *Section 4.2.1 or 4.3.*

4.2.3 Long Island Sound

Based on the 2016 stock assessment update and the level of risk approved by the Board, LIS harvest will be reduced by 47.2% (50% risk) or 52.6% (70% risk) to achieve the biological reference points by 2021. The current management measures (Table 17 & 18) will be adjusted to meet the required reductions.

Table 17. 2017 LIS Recreational Regulations

STATE	**SIZE LIMIT (inches)**	**POSSESSION LIMITS** (number of fish/person/day)	**OPEN SEASONS**
Connecticut	16”	2	Apr 1-Apr 30
		2	July 1 – Aug 31
		4	Oct 10 – Dec 6
New York	16”	4	Oct 5 – Dec 14

Table 18. 2017 LIS Commercial Regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/vessel/day)	OPEN SEASONS	2017 QUOTA (lbs.)
Connecticut	16”	10	Apr 1- Apr 30 Jul 1 - Aug 31 Oct 8 - Dec 24	-
New York	15”	25 (except, 10 per vessel when fishing lobster pot gear and more than six lobsters are in possession)	Jan 1 – Feb 28 Apr 8 – Dec 31	-

The TC developed multiple regional management scenarios for the recreational and commercial fisheries to achieve the following harvest reductions:

- If harvest is reduced by 47.2% then there is a 50% probability of achieving F target by 2021 (Recreational: Tables 19 & 20; Commercial Tables 23 & 24; Slot Limit for Recreational and Commercial: Table 27)
- If harvest is reduced by 52.6% then there is a 70% probability of achieving F target by 2021 (Recreational: Tables 21 & 22; Commercial Tables 25 & 26)

4.2.3.1 Long Island Sound Proposed Recreational Management Measures

Recreational options were developed by adjusting season, size and possession limit regulations using MRIP data from 2013 to 2015. Length analysis included data from MRIP, the CT Volunteer Angler Survey (> 16”) and the NY Headboat Survey (> 16”). Alterations in season length were evaluated by converting percent of annual harvest by wave to percent of annual harvest by day in each wave. Due to limited data (driven by minimal harvest) from the CT spring fishery (Waves 2 and 4), analysis focused on projected harvest reductions in response to changes in bag limit and minimum size at current season length for Wave 4.

The following LIS options were developed using a 50% probability of achieving F target, which is associated with a minimum harvest reduction of 47.2%.

Table 19. LIS recreational harvest reduction (of 47.2% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A1. Status Quo	CT	17”	1	Apr. 1-30, Aug. 1-31	48.1%
			2	Oct 10-Nov 30	
	NY	16”	1	Oct. 5-Dec. 14	49.5%

Table 20. LIS recreational regional harvest reduction (of 47.2% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
B1. Consistent Minimum Size & Possession Limit	CT	16”	1	Apr. 1-30, Oct. 6-Dec. 6	47%
	NY			Oct. 1-Dec. 14	
B2. Consistent Minimum Size & Possession Limit	CT	17”	2	Apr 1-30, Aug 1-31, Oct. 10-Nov. 30	48.9%
	NY			Oct. 10-Nov. 30	
B3. All measures consistent	Regional	16”	1	Oct. 1-Nov. 9	47.1%

The following LIS options were developed using a 70% probability of achieving F target, which is associated with a minimum harvest reduction of 52.6%.

Table 21. LIS recreational harvest reduction (of 52.6% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A2. Status Quo	CT	16”	1	Apr 1-30, Aug 1-31, Oct. 10-Dec. 6	53%
	NY	16.5”	1	Oct. 5-Dec. 14	53.1%

Table 22. LIS recreational regional harvest reduction (of 52.6% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
B4. Consistent Minimum Size & Possession Limit	CT	16”	1	Apr. 1-30, Oct. 10-Dec. 6	53%
	NY			Oct. 5-Dec. 14	
B5. Consistent Minimum Size & Possession Limit	CT	17”	3	Apr. 1-30, Oct. 15-31	52.8%
			1	Nov. 1-Dec. 3	
	NY		3	Oct. 10-31	
			1	Nov. 1-Dec. 11	
B6. All measures consistent	Regional	16.5”	1	Oct. 1-Nov. 9	53%

4.2.3.2 Long Island Sound Proposed Commercial Management Measures

Commercial options were developed based on seasonal closures. Connecticut's current commercial fishery has three open seasons and New York's commercial fishery has two open seasons. Total reported harvest from trip level reporting in 2013-2015 was calculated for each open season and converted to percent of total annual harvest. This was divided by the number of days in the season to provide an average daily percent of total annual harvest. It was then possible to look at seasonal closures that would reduce cumulative harvest by the required amount.

The following LIS option was developed using a 50% probability of achieving F target, which is associated with a minimum harvest reduction of 47.2%.

Table 23. LIS commercial harvest reduction (of 47.2% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A1. Status Quo	CT	16”	10	Apr. 1-30, Aug. 1-31, Oct. 21-Dec. 4	47.3%
	NY	15”	25 (except, 10 per vessel when fishing lobster pot gear and more than six lobsters are in possession)	Jan. 1-Feb. 28, Apr. 1-30, Aug. 1-Dec. 31	51.3%

Table 24. LIS commercial regional harvest reduction (of 47.2% or more) option

Regional Option	State	Minimum Size	Possession Limit	Open Season	Quota (lbs)	% Harvest Reduction
B1. Quotas	CT	16”	-	Jan.1 – Apr 30, Aug. 1-Dec.31	2,489	47.2%
	NY				34,883	

The following LIS options were developed using a 70% probability of achieving F target, which is associated with a minimum harvest reduction of 52.6%.

Table 25. LIS commercial harvest reduction (of 52.6% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A2. Status Quo	CT	16”	10	Apr. 1-30, Aug. 1-31, Oct. 21-Nov. 18	52.8%
	NY	15”	25 (except, 10 per vessel when fishing lobster pot gear and more than six lobsters are in possession)	Jan. 1-Feb. 28, Aug. 1-Dec. 31	52.9%

Table 26. LIS commercial regional harvest reduction (of 52.6% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	Quota (lbs)	% Harvest Reduction
B2. Consistent Minimum Size	CT	16”	10	Apr. 1-30, Aug. 1-31, Oct. 21-Nov. 18	-	52.8%
	NY		25 (except, 10 per vessel when fishing lobster pot gear and more than six lobsters are in possession)	Jan. 1-Feb. 28, Apr. 1-30, Aug. 1-Dec. 31	-	60.6%
B3. Quotas	CT	16”	-	Jan.1 – Apr 30, Aug. 1-Dec.31	2,774	52.6%
	NY				38,873	

4.2.3.3 Long Island Sound Proposed Slot Limit for the Commercial and Recreational Fisheries

Harvest slot scenarios were calculated for Long Island Sound for recreational and commercial fisheries, combined. These calculations were based on the same catch and harvest length distributions used in the Long Island Sound stock assessment update for the years 2013-2015. Catch and harvest lengths were scaled by the mean number of fish caught and harvested in LIS in the given years. The proportion of catch in a size class (P_L) was calculated (catch in length/total catch). As the proportion harvested in legal size classes was nearly 1, the proportion harvested was set to 1 for all subsequent calculations. Given that, the yield (Y_L) in a size class was calculated:

$$Y_L = C \times P_L$$

The sum of Y_L for all the lengths of interest in a slot results in the yield (Y, number of fish harvested).

$$Y = \sum_{i=slot\ min}^{n=slot\ max} Y_i + Y_{i+1} + \cdots + Y_n$$

The number of dead discards was estimated by the product of the discard mortality (2.5%) and the sum of all Y_L outside of the harvest slot and was included in the percent reduction. Y_L was also calculated based on the biomass by converting length to mean weight.

$$Y_L = C \times P_L \times W_L$$

Yield in biomass (Yb) was calculated as above.

All harvest reductions for slot limits include spawning season closures from May to July.

Harvest slots provide the opportunity to protect the large female spawners which produce exponentially more eggs (which are potentially of higher quality) than smaller females (LaPlante and Schultz, 2007). As Tautog have a relatively low discard mortality rate (2.5%) harvest slots provide an opportunity for implementing harvest reductions without increasing the minimum size.

There are no viable harvest reduction options for slot limit for recreation and commercial fishery, with a size range of 14”- X” using status quo bag and seasonal closures. This is largely because of a high proportion of fish under 16” in the current size structure of the population. Reducing bag size and additional seasonal closures would be required to achieve these harvest reductions with such a slot limit.

A harvest slot between 16” and 18” is possible with no reductions in bag size (Table 27). This option includes a spawning closure for May, June and July. It would have no significant impact on these harvest reductions if bonus fish (recreational sector) within one inch of the state record (34” for CT and 32” for NY) were allowed. Reductions are shown in number of individuals and biomass (Table 27).

Table 27. LIS regional management harvest reduction scenarios with harvest slot limits for commercial and recreational fisheries.

Slot Limit Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
C. 16”-18” harvest slot	CT	16-18”	Status quo – state specific commercial and recreational limits	Apr. 1-30, Aug. 1-31, Oct. 10-Dec 6	51.3%
	NY			Oct. 5-Dec. 14	

4.2.4 New Jersey-New York Bight

Based on the 2016 stock assessment update and the level of risk approved by the Board, NJ-NYB harvest should be reduced by 2% (50% risk) or 11% (70% risk) to achieve the biological reference points by 2021. The current management measures (Tables 28 & 29) will be adjusted to meet the required reductions.

Table 28. 2017 NJ-NYB recreational regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/person/day)	OPEN SEASONS
New York	16”	4	Oct 5 – Dec 14
New Jersey	15”	4 4 1 6	Jan 1 – Feb 28 Apr 1 – Apr 30 Jul 17 – Nov 15 Nov 16 – Dec 31

Table 29. 2017 NJ-NYB commercial regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/vessel/day)	OPEN SEASONS	2017 QUOTA (lbs.)
New York	15”	25 (except, 10 per vessel when fishing lobster pot gear and more than six lobsters are in possession)	Jan 1 – Feb 28 Apr 8 – Dec 31	-
New Jersey	15”	> 100 lbs requires directed fishery permit	Jan 1 - 15 June 11 - 30 Nov 9 - Dec 31	103,000

The TC developed multiple regional management scenarios for the recreational and commercial fisheries to achieve the following harvest reductions:

- If harvest is reduced by 2% then there is a 50% probability of achieving F target by 2021 (Recreational: Tables 30 & 31; Commercial: Tables 34 & 35)
- If harvest is reduced by 11% then there is a 70% probability of achieving F target by 2021 (Recreational: Tables 32 & 33; Commercial: Tables 36, & 37)

4.2.4.1 New Jersey-New York Bight Proposed Recreational Management Measures

Data for this analysis were obtained from MRIP raw length and catch frequency data by wave from 2013 through 2015 using only records showing legal size, bag and season harvests (data excludes Long Island Sound harvests). Percent savings estimates by wave for size and bag limit options were calculated through an R code program. Wave (season) savings were estimated by calculating the percent harvest by wave of the total annual harvest for the sum of the years 2013 through 2015.

NJ-NYB region chose a 15-18 inch slot limit proposal as a way for fishermen to keep a good percentage of current harvests (between 73 – 80%) while allowing the largest fish (those equal to or greater than 18.5 inches) to remain in the population since research has shown larger tautog are the greatest contributors to the reproductive potential of the stock. The percent reductions for this slot limit were calculated by taking the proportion of total harvest of the fish legally landed in the recreational fishery in New Jersey and New York's south shore which exceeded 18 inches. The resulting reduction percentages were 19.6% and 26.9% for New Jersey and New York Bight respectively. These percentage savings were applied to both the recreational and commercial sectors due to the lack of length frequency data for commercial catches. The data were obtained from the MRIP length frequency and Type 9 information, New Jersey Volunteer Angler Survey, and the south shore component of New York's DEC Headboat Survey.

The following NJ-NYB options were developed using a 50% probability of achieving F target, which is associated with a minimum harvest reduction of 2%.

Table 30. NJ-NYB recreational harvest reduction (of 2% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A1. Status Quo	NYB	16"	4	Oct 6 - Dec 13	2%
	NJ	15"	4	Jan 1 – Feb 28	
			4	Apr 1 - 18	
			1	Aug 21 – Nov 15	
			6	Nov 16 – Dec 31	

Table 31. NJ-NYB recreational regional harvest reduction (of 2% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
B1. Consistent Minimum Size & Possession Limit	NYB	15"	4	Oct 10 - Dec 12	2%
	NJ			Sep 17 - Dec 31	
B2. Consistent Minimum Size	NYB	16"	4	Oct 6 - Dec 14	4%
	NJ		4	Jan 1 – May 31	
			6	Aug 31-Dec 31	
C1. Slot Limit with Consistent Possession Limits	NYB	15-18"	4	Oct 2 - Dec 26	2%
	NJ			Jan 1 - Mar 31; Aug 20 - Dec 31	

The following NJ-NYB options were developed using a 70% probability of achieving F target, which is associated with a minimum harvest reduction of 11%.

Table 32. NJ-NYB recreational harvest reduction (of 11% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A2. Status Quo	NYB	16"	4	Oct 16 - Dec 14	11%
	NJ	15"	4	Jan 1 – Feb 28	
			1	Oct 2 – Nov 15	
			6	Nov 16 – Dec 31	

Table 33. NJ-NYB recreational regional harvest reduction (of 11% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
B3. Consistent Minimum Size & Possession Limit	NYB	15"	3	Oct 9 - Dec 13	11%
	NJ			Sep 17 - Dec 31	
B4. Consistent Minimum Size & Possession Limit	NYB	16"	4	Oct 8 - Dec 9	11%
	NJ		4	Jan 1 - May 25; Aug 11 - Dec 31	
B5. All measures consistent	Regional	15"	4	Oct 12 – Dec 14	21%
C2. Slot Limit with Consistent Possession Limits	NYB	15-18"	4	Sep 10 - Dec 31	11%
	NB			Oct 2 - Dec 19	
C3. Slot Limit with all measures consistent	Regional	15 – 18"	4	Oct 1 – Dec 27	13%

4.2.4.2 New Jersey-New York Bight Proposed Commercial Management Measures

Length frequencies from the recreational sector were used for both the commercial and recreational sectors due to the lack of commercial length frequencies and to reflect the predominance of the recreational harvest (~90%) in the tautog fisheries for both New Jersey (NJ) and the south shore of New York (NYB). For NJ, the data were pulled from the MRIP NJ harvest expanded length frequencies, the state's Volunteer Angler Survey's kept length frequencies, and the Type 9 MRIP records. For NYB, the raw MRIP length frequency data were used due to the necessity of pulling out the records obtained from Long Island Sound. These data were supplemented by the New York State DEC Headboat Survey length frequencies and MRIP Type 9 data from the non-Long Island Sound records.

The following NJ-NYB options were developed using a 50% probability of achieving F target, which is associated with a minimum harvest reduction of 2%.

Table 34. NJ-NYB commercial harvest reduction (of 2% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A1. Status Quo	NYB	15”	25	Jan 1 - Feb 28; Apr 14 - Dec 31	2%
	NJ		-	Jan 1 - 15; Jun 11 - 30; Nov 12 - Dec 31	

Table 35. NJ-NYB commercial regional harvest reduction (of 2% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	Quota (lbs)	% Harvest Reduction
B1. Consistent Minimum Size	NYB	15”	28	Jan 1 - May 31; Aug 1 - Dec 31	-	2%
	NJ		-	Jan 1 - May 1; Sep 19 - Dec 31	-	
B2. Consistent Minimum Size	NYB	16”	31	Jan 1 - May 31; Aug 1 - Dec 31	-	2%
	NJ		-	Jan 1 - May 11; Aug 1 - Dec 31	-	
B3. Quotas	NYB	15”	-	-	65,486	2%
	NJ				23,259	
C4. 15”- 18” harvest slot	NYB	15-18”	34	Jan 1 - May 31; Aug 1 - Dec 31	-	2%
	NJ			Jan 1 - Apr 21; Aug 11 - Dec 31	-	

The following NJ-NYB options were developed using a 70% probability of achieving F target, which is associated with a minimum harvest reduction of 11%.

Table 36. NJ-NYB commercial harvest reduction (of 11% or more) options to the status quo state-by-state measures

Status Quo Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction
A2. Status Quo	NYB	15”	25	Jan 1 - Feb 28; May 10 - Dec 31	11%
	NJ		-	Jan 9 -15; June 13 - 30; Nov 15 - Dec 31	

Table 37. NJ-NYB commercial regional harvest reduction (of 11% or more) options

Regional Options	State	Minimum Size	Possession Limit	Open Season	Quota (lbs)	% Harvest Reduction
B4. Consistent Minimum Size	NYB	15”	26	Jan 1 - May 31; Aug 1 - Dec 31	-	11%
	NJ		-	Jan 1 - Mar 31; Sep 11 - Dec 31	-	
B5. Consistent Minimum Size	NYB	16”	29	Jan 1 - May 31; Aug 1 - Dec 31	-	11%
	NJ		-	Jan 1 - May 16; Aug 15 - Dec 31	-	
B6. Quotas	NYB	15”	-	-	59,472	11%
	NJ				21,123	
C5. 15”- 18” harvest slot	NYB	15-18”	31	Jan 1 - May 31; Aug 1 - Dec 31	-	11%
	NJ		-	Jan 1 - April 15; Aug 11 - Dec 31	-	

4.2.5 Delaware – Maryland - Virginia

Historically, tautog management measures in DelMarVa have been state-specific (Tables 38 and 39). In response to the 2016 stock assessment update, managers are proposing regional management options for the public to consider (Table 40). If the regional management measures are modified at a future date, all states will agree to the new regulations prior to regional implementation (See Section 4.2.1).

Table 38. 2017 DelMarVa recreational regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/person/day)	OPEN SEASONS
Delaware	15”	5 3 5 5	Jan 1 – Mar 31 Apr 1 – May 11 July 17 – Aug 31 Sept 29 – Dec 31
Maryland	16”	4 2 4	Jan 1- May 15 May 16 – Oct 31 Nov 1 – 26
Virginia	16"	3	Jan 1 – April 30 Sept 20 – Dec 31

Table 39. 2017 DelMarVa commercial regulations

STATE	SIZE LIMIT (inches)	POSSESSION LIMITS (number of fish/vessel/day)	OPEN SEASONS	2017 QUOTA (lbs.)
Delaware	15”	5 3 5 5	Jan 1 - Mar 31 Apr 1 - May 11 July 17 - Aug 31 Sept 29 - Dec 31	-
Maryland	16”	4 2 4	Jan 1- May 15 May 16 - Oct 31 Nov 1 - 26	-
Virginia	15”	-	Jan 1 – Jan 21 Mar 1 – Apr 30 Nov 1 – Dec 31	-

4.2.5.1 Delaware-Maryland-Virginia Proposed Recreational Management Measures

Table 40. Proposed DelMarVa Recreational Regional Management Measures

Option	State	Minimum Size	Possession Limit	Open Season	% Harvest Reduction/ Liberalization
A. Status Quo		See Table 38			NA
B. Consistent Possession Limit & Seasons	DE	15"	4	Jan 1 – Apr 30; July 1 – Dec 31	8.5% Liberalization
	MD	16"			
	VA				
C. Consistent Minimum Size	DE	16"	5	Jan – Mar 31	11.9% Reduction
			3	Apr 1 – May 31	
			5	Aug 1 – Dec 31	
	MD		4	Jan 1 – May 31 Aug 1 – Nov 26	
	VA		3	Jan 1 – Apr 30 Sept 20 – Dec 31	
D. All measures consistent	Regional	16"	4	Jan 1 – May 31; Aug 1 – Dec 31	11.6% Reduction

4.2.5.2 Delaware-Maryland-Virginia Proposed Commercial Management Measures

There are no proposals to adjust the commercial regulations for DelMarVa. However, Delaware and Maryland have traditionally adopted the recreational measures as the commercial measures; and could continue to do this if the recreational measures are changed (Option B). If the region would like to make this decision at a later date then it can do so following the procedures set forth in *Section 4.2.1 or 4.3.*

Option A. Status Quo measures, as shown in Table 39

Option B. The modified recreational measures for Delaware and Maryland will be implemented as commercial measures (Section 4.2.5.1); Virginia commercial measures will remain status quo.

4.3. COMMERCIAL QUOTA
Option A. Status Quo. No specific commercial quota procedures.

Option B. Commercial Quota Procedures (Option B includes Sections 4.3.1 – 4.3.5)
A state or region may implement an annual commercial quota if the following procedures are met and Board approval is granted.

For the purposes of this section, a regional working group consists of representatives from each member state within the region. Regional working group decisions related to commercial quotas should be made by consensus.

Quota proposals will be reviewed by the TC according to *Sections 4.3.1* or *4.3.2*.; and develop a recommendation for the Board. The Board will meet to review and consider approval of the quota. Once approved by the Board, the regional quota can be implemented.

4.3.1 Commercial Quota within a Region
A regional working group will be developed to discuss the parameters of a regional quota across one or more states and develop rationale to justify the proposed quota. The proposal must include an agreed upon allocation method (by all member states within the region) and data to justify the quota must include the most recent 10 years of data. For example, a 2017 quota can include any combination of data from 2006-2016.

4.3.2 State-Specific Quota within a Region
If a state within a region wants to implement a quota and some or none of the other states have a quota then the proposed quota will need to be brought to the regional working group. Data to justify the quota must include the most recent 10 years of data. For example, a 2017 quota can include any combination of data from 2006-2016.

4.3.3 Quota Rollover
Due to the current stock condition, the PDT does not recommend the use of quota rollovers. If stock condition changes this management tool can be re-evaluated. Unused quota may not be rolled over from one fishing year to the next.

4.3.4 Quota Transfer
States can transfer quota to another state within the same region. The quota transfer must be finalized within the current fishing year. Quota cannot be transferred outside of a region.

States have the responsibility to close the tautog commercial fishery in their state once the quota has been reached. The Executive Director or designated ASMFC staff will review and approve all transfer requests before the quota transfer is finalized.

Once quota has been transferred to a state, the state receiving quota is responsible for any overages of transferred quota. That is, the amount over the final quota (that state's quota plus any quota transferred to that state) for a state will be deducted from the corresponding state's quota the following fishing season.

4.3.5 Quota Overage

If a region or state exceeds the quota in a fishing season, the overage will be deducted from the corresponding region or state in the subsequent fishing year.

4.4 COMMERCIAL HARVEST TAGGING PROGRAM

Option A. Status Quo.

No commercial harvest tagging program.

Option B. Implement a Commercial Harvest Tagging Program

(Includes a sub-option under Section 4.4.3)

If a commercial harvest tagging program is implemented then a state would not need to adopt the proposed commercial effort controls (e.g., changes to the size limit, season length, etc.) to achieve the necessary reductions, but would simply use a cap on the number of tags distributed. The cap could be derived from the proposed regional quota.

Law enforcement officials have evidence that indicates there is a significant illegal harvest of tautog, primarily in the live market. Reports of illegally harvested fish have been documented in cases against fishermen, fish houses and at retail markets and restaurants. In Massachusetts there have been a number of large cases made against licensed commercial fishermen, whereas in Delaware, New Jersey and New York illegal harvest seems mostly concentrated in the recreational fishery. Regardless of the source, most undersized, out-of-season or illegal quantities of live tautog are associated with the demand for tautog at ethnic food markets or restaurants. These markets are often found in large cities such as New York City and Philadelphia. To a lesser degree, illegal activity does occur among individuals and small groups harvesting fish for personal consumption or subsistence. This latter group may not even be aware they are violating specific regulations.

A commercial harvest tagging program was recommended to increase accountability in the fishery and curb illegal harvest. The tagging program would accommodate both the live and dead commercial markets. To evaluate the merits of such a program a Law Enforcement Subcommittee (Subcommittee), comprised of Tautog Board members and law enforcement representatives, was developed in 2015. As agreed upon by the Subcommittee, the tag should be easy to attach, secure and have minimal to no impact on the appearance or condition of live fish for the amount of time that live, tagged fish are maintained until consumption. The Subcommittee evaluated multiple tag types and fishermen were interviewed to describe the handling process from catch to market. A tautog tag trial was conducted to investigate the efficacy of a commercial tag that serves as a tool for law enforcement, while minimizing impact to the resource. The 30-day trial concluded with no mortality or degradation to fish health (Dumais et al 2016).

4.4.1 Objectives
The intent of the Commercial Harvest Tagging Program is to provide accountability in the commercial fishery and minimize illegal, unreported and unregulated (IUU) fishing, while utilizing methods that are easy for fishermen to use and do not detract from fish quality or marketability, and serve as a tool for law enforcement to evaluate compliance. To achieve these goals, the Subcommittee developed the following objectives:

Objective 1: Implement a verifiable tagging system that can aid enforcement and help identify IUU fish from reaching markets.

Objective 2: Use tags of a consistent type and style among all states that include standardized identifiers of year, state, and tag number.

Objective 3: Employ tags that are single-use only. Tags must be difficult to replicate. All unused tags will be returned or otherwise accounted for annually.

Objective 4: Implement a tagging program that will accommodate both the live and dead commercial fish markets. The tags used must be easy to attach, secure and have minimal to no impact on the appearance or condition of live fish for the amount of time that live, tagged fish are maintained until consumption.

4.4.2 Commercial Tagging
All states within a regional management unit are required to participate in the commercial harvest tagging program. *De minimis* status does not preclude a state from the requirements of the commercial harvest tagging program.

All states will use the same single-use tag. The tag will be inscribed with the year of issue, state of issue and a unique number. The **unique number will be linked back to the permit holder**. States will distribute tags to participants. It is unlawful to sell or purchase commercially caught tautog (alive or dead) without a commercial tag. The cost of the tag will be financed by states or fishermen at the discretion of each state or jurisdiction.

4.4.3 Tag Application

<u>Option A. Harvester Application at Harvest or Upon Landing</u>
All commercially caught tautog will be tagged by the commercially-permitted harvester at the time of harvest or at the time of landing. Tautog must be landed in the state that is identified on the tag.

Option B. Application by Dealer

All commercially caught tautog will be tagged by a licensed dealer. The location (state) of the sale must correspond to the state identified on the tag. The tag will be applied to the fish immediately after the dealer buys the fish from the harvester.

4.4.4 Tag Allowance (Biological Metric)

States are required to allocate commercial tags to the recipients described in Section 4.4.3 based on a biological metric, which will be described in the Annual Commercial Tag Report (Section 4.4.7). This metric is an estimate to determine the number of fish tags that will be required per year; the goal is to avoid surplus tags. For example, the majority of states in the striped bass commercial tagging program use the average commercial weight per fish from the previous year, or some variation thereof as the biological metric.

4.4.5 Tag Accounting

All states will require the recipients described in Section 4.4.3 to return unused tags from the previous fishing year no later than **February 15**.The return method will be further described by each state. The number of unused tags will be included in the Annual Commercial Tag Report (Section 4.4.7), along with the disposition of other returned tags (e.g., used, broken, lost, etc). Tag recipients who do not comply with this section may be subject to penalties set forth in Section 4.4.6.

4.4.6 Penalties

It is recommended that states strengthen their penalties for tautog violations and include counterfeit tag operations, in order to deter illegal harvest of tautog. License revocation or suspension is supported as a primary penalty for state or federal violations. Civil and/or criminal penalties can be also effective deterrents. It is recommended that cases of undocumented "lost" tags should result in a 1-year suspension from the commercial tautog fishery (for the subsequent fishing year).

4.4.7 Annual Commercial Tag Report

The existing compliance report will be modified to include a Commercial Tag section that must be completed by each state. The report must include the following information. The Board may modify the sections of the report via Board action.

- Describe the biological metric
- Number of tag violations.
- Complete the following table:

State	MA	RI	CT	NY (LIS)	NY (south shore)	NJ	DE	MD	VA
Quota (if applicable)									
Maximum Commercial Harvest per Region									
Avg. Commercial Weight									
Number of Participants									
Number of Tags Issued									
Number of Tags Returned									

4.5 Gear Restrictions

Tautog pots and traps are required to have hinges and fasteners on one panel or door made of one of the following degradable materials:

1) Untreated hemp or jute string of 3/16 inch (4.8mm) in diameter or smaller;
2) Magnesium alloy fasteners, timed float releases (pop-up devices) or similar magnesium alloy fasteners;
3) Ungalvanized or uncoated iron wire of 0.094-inch (2.39mm) diameter or smaller.

4.6 SPAWNING CLOSURES

Option A. Status Quo; state specific spawning closures

Option B. Regional Spawning Closures

Spawning closures are often used in fisheries management as a tool to protect spawning fish and enhance reproduction. Each region supports the need to protect tautog spawning aggregations. The spawning closures are intended to reduce disruption on tautog pairing and protect spawning females in perpetuity. This measure is not subject to conservation equivalency.

Each region reviewed the Estuarine Living Marine Resources Database https://products.coastalscience.noaa.gov/elmr/ to determine peak spawning as well as scientific articles that are summarized in *Section 1.2.1 Species Life History*. Spawning closures apply to both commercial and recreational fisheries. Any vessel is prohibited to fish for, take, land, or possess tautog from or within an area closed for spawning.

- The Massachusetts-Rhode Island and New Jersey-New York Bight tautog fisheries are closed from June through July.
- The Long Island Sound is closed from May-July (See Appendix 1 for more biological information).
- The Delaware-Maryland-Virginia tautog fisheries are closed from May through June.

4.7 POSSESSION LIMIT REGULATORY LANAGUAGE

Concern has been raised that the absence of tautog regulations in federal waters allows for loopholes that potentially contribute to overfishing. Possession restrictions have been used successfully to control federal waters fisheries for other species. While landing restrictions are enforceable, prohibiting possession allows for a larger area where marine enforcement can intercept vessels carrying tautog in amounts or sizes that violate state regulations. This Amendment requires that all state tautog regulations to prohibit *possession*. **In federal waters, a vessels' possession limit is respective to the home port.**

4.8 FISHERY REGULATION ENFORCEMENT

The tautog fishery has many unique harvest, transportation, and marketing characteristics, which increase demand for small live fish. This Amendment emphasizes the need for state and federal enforcement agencies to place a high priority on the enforcement of tautog regulations. In addition, the public may also play an important role by reporting information on illegal harvest and sale of tautog to their state's marine fishery enforcement agency.

4.9 DATA COLLECTION

The recreational fishery occurs throughout the year. The majority of the landings are captured through the Marine Recreational Information Program (MRIP) administered by the National Marine Fisheries Service. However, the MRIP does not sample landings during January and February (wave 1). This Amendment recommends states initiate a sampling program to estimate the recreational harvest of tautog during January and February.

4.10 HABITAT CONSERVATION AND RESTORATION RECOMMENDATIONS

4.10.1 Preservation of Existing Habitat

Management of existing habitat on a sustainable basis requires a thorough knowledge of essential habitat types, their distribution, and their use by all life history stages of tautog. Currently, additional research is needed to determine the extent and condition of essential tautog habitats on a coastwide basis. Once the locations and abundance of essential tautog habitats are determined, refuges and special fishery management zones (SMZ) that limit fishing access and gear types are one potential method of habitat management.

4.10.2 Habitat Restoration, Improvement, and Enhancement

Restoration should be considered where well-known, historically "productive" tautog habitat has been degraded or lost.

Restoration could be directed specifically toward tautog habitat or it could occur as a component of other efforts. South of Cape Cod, restoration of lobster habitat should also consider the needs of tautog because habitat usage by the two species overlaps. Response plans for accidental toxic spills in coastal waters should focus on tautog as well as shellfish resources, because tautog are localized and depend on specific habitats and associated food sources that are susceptible to chemical contamination. Point source contamination and hypoxia near nursery grounds can be improved by minimizing sewage discharges and increasing wastewater treatment levels. Non-point source toxic contamination of groundwater and nearshore coastal habitats can be reduced by redirecting storm water runoff into catch basins.

Habitat enhancement requires the creation or expansion of essential habitat where little or none presently exists. Creation of artificial reef habitats (see *Section 1.5.4.1*) and breakwaters could mitigate habitat losses. Both intentional reef construction and accidental creation through shipwrecks may be expanding tautog habitat in open, sandy coastal areas where tautog would not normally be found.

4.10.3 Avoidance of Incompatible Activities

Each state should establish windows of compatibility for activities known, to adversely affect tautog habitat, including projects involving water withdrawal, entrainment of eggs and larvae in cooling water systems and mortality from thermal effects, dredging, bulk-heading and channel construction. As a preventative measure, buffer zones could be established around important nursery areas.

4.10.4 Fishery Practices

Certain gear types may disrupt tautog habitat, however, insufficient information is available to quantify effects at this time. Derelict lobster traps are known to entrap tautog, resulting in unquantified mortality. Any fishing gear having an unacceptable impact on tautog habitat should be prohibited within essential habitats.

4.11 ALTERNATIVE STATE/REGION MANAGEMENT REGIMES/MANAGEMENT PROGRAM EQUIVALENCY

Once approved by the Tautog Management Board, states are required to obtain prior approval from the Board of any changes to their management program for which a compliance requirement is in effect. Other measures must be reported to the Board but may be implemented without prior Board approval. A state can request permission to implement an alternative to any mandatory compliance measure only if that state can show to the Board's satisfaction that its alternative proposal will have the same conservation value as the measure contained in this amendment or any addenda prepared under *Adaptive Management (Section 4.12*). States submitting alternative proposals must demonstrate that the proposed action will not contribute to overfishing of the resource. States may submit alternative region/state proposals under this section following the procedures outlined in the Commission's Conservation Equivalency Policy and Technical Guidance Document.

Option A: States can submit an alternative management program for any measures contained in Section 4 of the Amendment.

Option B. States can submit an alternative management program for any measures contained in Section 4 of the Amendment, except for the measures included in *Section 4.6 Spawning Closures*. If implemented, a state cannot open their fishery during the spawning closure.

4.11.3 *De Minimis* Fishery Guidelines

4.11.3.1 Criteria for De Minimis Consideration
To be eligible for *de minimis* consideration, a state must prove that its commercial landings in the most recent year for which data are available did not exceed *the greater of* 10,000 pounds or 1% of the regional landings.

4.11.3.2 Plan Requirements if De Minimis is Granted
If *de minimis* status is granted, the *de minimis* state is required to implement the minimum size provisions, the pot and trap degradable fastener provisions, and regulations consistent with those in the recreational fishery (including possession limits and seasonal closures). The state must monitor its landings on at least an annual basis and provide a compliance report as outlined in *Section 5.1.2* of the Tautog FMP. If the FMP is altered through adaptive management as specified in *Section 4.12* of the Tautog FMP the Management Board will specify by motion which measures *de minimis* states must adopt.

4.11.3.3 Procedure to Apply for De Minimis Status
States must specifically request *de minimis* status each year. Requests for *de minimis* status will be reviewed by the Tautog Plan Review Team (PRT) as part of the annual FMP review process. Requests for *de minimis* must be submitted to the ASMFC Tautog FMP Coordinator as a part of the state's yearly compliance report. The request must contain the following information: commercial landings for the most recent year, commercial regulations for the current year, and the proposed management measures the state plans to implement for the year *de minimis* status is requested. The FMP Coordinator will then forward the information to the PRT and, if necessary, the Tautog Technical Committee and Stock Assessment Subcommittee.

In determining whether or not a state meets the *de minimis* criteria, the PRT will consider the information provided with the request, the most recent available coastwide landings data, any information provided by the Technical Committee and Stock Assessment Subcommittee, and projections of future landings. The PRT will make a recommendation to the Board to either accept or deny the *de minimis* request. The Board will then review the PRT recommendation and either grant or deny the *de minimis* classification.

The Board must make a specific motion to grant a state *de minimis* status. By deeming a given state *de minimis*, the Board is recognizing that: the state has a minimal tautog fishery; there is little risk to the health of the tautog stock if the state does not implement the full suite of management measures; and the overall burden of implementing the complete management and monitoring requirements of the FMP outweigh the conservation benefits of implementing those measures in the particular state.

If commercial landings in a *de minimis* state exceed the *de minimis* threshold, the state will lose its *de minimis* classification, will be ineligible for *de minimis* in the following year, and will be required to implement all requirements of the FMP. If the Board denies a state's *de minimis* request, the state will be required to implement all the requirements of the FMP. When a state rescinds or loses its *de minimis* status the Board will set a compliance date by which the state must implement the required regulations.

4.12 ADAPTIVE MANAEGMENT

The Tautog Management Board may vary the requirements specified in this amendment as a part of adaptive management in order to conserve the tautog resource. The elements that can be modified by adaptive management are listed in *Section 4.12.2*. The process under which adaptive management can occur is provided below.

4.12.1 General Procedures

The Plan Review Team (PRT) will monitor the status of the fishery and the resource and report on that status to the Tautog Management Board annually, or when directed to do so by the Section. The Plan Review Team may consult with the Technical Committee, the Stock Assessment Committee or the Advisory Panel, if any. The report may contain recommendations concerning proposed adaptive management revisions to the management program. If the PRT makes a recommendation, the Tautog Management Board will review the report and may consult further with Technical Committee, the Stock Assessment Committee or the Advisory Panel.

If an addendum is initiated, then the Board will provide guidance on the specific issues that the Plan Development Team (PDT) should address. The PDT will be convened after members are nominated and approved by the Board.

A public hearing will be held in any state that requests one. The PDT will also request comment from federal agencies and the public at large. The PDT will summarize the comments and prepare a final version of the addendum for the Board. The Board will consider the public comments received and the recommendations of the Technical Committee, the Stock Assessment Committee or the Advisory Panel. The Section shall then decide whether to adopt, or revise and then adopt, the addendum. The addendum shall contain a schedule for the states to implement its provisions.

Upon adoption of an addendum implementing adaptive management by the Board, states shall prepare plans to carry out the addendum, and submit them to the Board for approval according to the schedule contained in the addendum.

4.12.2 Measures Subject to Change

The following measures are subject to change under adaptive management upon approval by the Tautog Management Board:

1. Rebuilding targets and schedules
2. Fishing season including seasonal closures
3. Trip limits/bag limits
4. Minimum size

5. Commercial harvest tagging program
6. Reporting requirements
7. Gear restrictions
8. Management areas/regions
9. Recommendations to the Secretary for complimentary actions in federal jurisdictions
10. Research or monitoring requirements
11. Or any other management action

4.13 EMERGENCY PROCEDURES
Emergency procedures may be used by the Tautog Management Board to require any emergency action that is not covered by or is an exception or change to any provision in Amendment 1. Procedures for implementation are addressed in the ASMFC Interstate Fisheries Management Program Charter, Section Six (c)(11) (ASMFC 2016).

4.14 MANAGEMENT INSTITUTIONS
The management institutions for tautog shall be subject to the provisions of the ISFMP Charter (ASMFC, 2016). The following is not intended to replace any or all of the provisions of the ISFMP Charter. All committee roles and responsibilities are included in detail in the ISFMP Charter and are only summarized here.

4.14.1 Atlantic States Marine Fisheries Commission and ISFMP Policy Board
The ASMFC (Commission) and the ISFMP Policy Board are generally responsible for the oversight and management of the Commission's fisheries management activities. The Commission must approve all fishery management plans, and amendments, including this Amendment 1, and must also make all final determinations concerning state compliance or noncompliance.

4.14.2 Tautog Management Board
The Tautog Management Board Section is generally responsible for carrying out all activities under this Amendment. It establishes and oversees the activities of the Plan Development or Plan Review Team, the Technical Committee and the Stock Assessment Subcommittee and requests the establishment of the Commission's Tautog Advisory Panel. Among other things, the Board makes changes to the management program under adaptive management and approves state programs implementing the amendment and alternative state programs under Sections 4.12.

4.14.3 Tautog Plan Development Team / Plan Review Team
The Tautog Plan Development Team (PDT) and the Tautog Plan Review Team (PRT) will be composed of a small group of scientists and/or managers whose responsibility is to provide all of the technical support necessary to carry out and document the decisions of the Tautog Management Board. The ASMFC FMP Coordinator chairs both. The PDT/PRT is directly responsible to the Section for providing information and documentation concerning the

implementation, review, monitoring and enforcement of Amendment 1. The PDT/PRT shall be comprised of personnel from state and federal agencies who have scientific and management ability and knowledge of tautog. The PDT will be responsible for preparing all documentation necessary for the development of Amendment 1, using the best scientific information available and the most current stock assessment information. The PDT will either disband or assume inactive status upon completion of Amendment 1. Alternatively, the Board may elect to retain PDT members as members of the PRT or appoint new members. The PRT will provide annual advice concerning the implementation, review, monitoring, and enforcement of Amendment 1 once the Commission has adopted it.

4.14.4 Tautog Technical Committee
The Tautog Technical Committee will consist of representatives from state or federal agencies, Regional Fishery Management Councils, Commission, university or other specialized personnel with scientific and technical expertise and knowledge of the tautog fishery. The Board will appoint the members of the Technical Committee and may authorize additional seats as it sees fit. Its role is to act as a liaison to the individual state and federal agencies, provide information to the management process, and review and develop options concerning the management program. The Technical Committee will provide scientific and technical advice to the Management Board, PDT, and PRT in the development and monitoring of a fishery management plan or amendment.

4.14.5 Tautog Stock Assessment Subcommittee
The Tautog Stock Assessment Subcommittee shall be appointed by the Technical Committee at the request of the Management Board, and will consist of scientists with expertise in the assessment of the tautog population. Its role is to assess the tautog population and provide scientific advice concerning the implications of proposed or potential management alternatives, or to respond to other scientific questions from the Board, Technical Committee, PDT or PRT. The Stock Assessment Subcommittee will report to the Technical Committee.

4.14.6 Tautog Advisory Panel
The Advisory Panel is established according to the Commission’s Advisory Committee Charter. Members of the Advisory Panel are citizens who represent a cross-section of commercial and recreational fishing interests and others who are concerned about tautog conservation and management. The Advisory Panel provides the Board with advice directly concerning the Commission’s tautog management program.

4.14.7 Federal Agencies

4.14.7.1 Management in the Exclusive Economic Zone (EEZ)
Management of tautog in the EEZ is within the jurisdiction of the Regional Fishery Management Councils under the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.). In the absence of a Council Fishery Management Plan, management is the responsibility of the NMFS as mandated by the Atlantic Coastal Fishery Conservation and Management Act (16 U.S.C. 5105 et seq.)

4.14.7.2 Federal Agency Participation in the Management Process

The Commission has accorded the United States Fish and Wildlife Service (USFWS) and the NMFS voting status on the ISFMP Policy Board and the Tautog Management Board in accordance with the Commission's ISFMP Charter. The NMFS also participates on the Tautog Plan Development Team, Plan Review Team, Technical Committee and Stock Assessment Subcommittee.

4.14.7.3 Consultation with Fishery Management Councils

At the time of adoption of Amendment 1, none of the Regional Fishery Management Councils had implemented a management plan for tautog nor have they indicated an intention to develop a plan.

4.15 RECOMMENDATIONS TO THE SECRETARY FOR COMPLIMENTARY ACTIONS IN FEDERAL JURISDICTIONS

The ASMFC recommends the federal government promulgate all necessary regulations to implement compatible measures in the exclusive economic zone (EEZ). Specifically, the ASMFC recommends that the Secretary of Commerce fully implement regulations for tautog in the EEZ that are in accordance with state minimum sizes, possession limits, closed seasons, as well as other possession requirements for both the commercial and recreational fishery (Section 4.2).

4.16 COOPERATION WITH OTHER MANAGEMENT INSTITUTIONS

The Board will cooperate, if necessary, with other management institutions during the implementation of this amendment, including the National Marine Fisheries Service and the New England, Mid-Atlantic, and South Atlantic Fishery Management Council.

5.0 COMPLIANCE

Full implementation of the provisions of this amendment is necessary for the management program to be equitable, efficient and effective. States are expected to implement these measures faithfully under state laws. Although ASMFC does not have authority to directly compel states to implement these measures, it will continually monitor the effectiveness of state implementation and determine whether states are in compliance with the provisions of this fishery management plan. The Board sets forth specific elements that the Commission will consider in determining state compliance with this fishery management plan, and the procedures that will govern the evaluation of compliance. Additional details of the procedures are found in the ASMFC Interstate Fishery Management Program Charter (ASMFC 2016).

5.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES

A state will be determined to be out of compliance with the provision of this fishery management plan according to the terms of Section Seven of the ISFMP Charter if:

- It fails to meet any schedule required by Section 5.1.2, or any addendum prepared under adaptive management (Section 4.12); or
- It has failed to implement a change to its program when determined necessary by the Tautog Management Board; or
- It makes a change to its regulations required under Section 4 or any addendum prepared under adaptive management (Section 4.12), without prior approval of the Tautog Management Board.

5.1.1 MANDATORY ELEMENTS OF STATE PROGRAMS

To be considered in compliance with this amendment, all state programs must include management measures for tautog fisheries consistent with the requirements listed throughout *Section 4.0 and Section 3.2.2.2 Fishery Independent Information—Biological Sampling Program*, except that a state may propose an alternative management program under Section 4.12, which, if approved by the Management Board, may be implemented as an alternative regulatory requirement for compliance.

5.1.1.1 Regulatory Requirements

States shall begin to implement Amendment 1 after final approval of the state's implementation proposal by the Commission. Each state must submit its required tautog regulatory program to the Commission through the ASMFC staff for approval by the Atlantic Tautog Management Board. During the period from submission and until the Management Board makes a decision on a state's program, a state may not adopt a less protective management program than contained in this amendment or contained in current state law.

Once approved by the Tautog Management Board, states are required to obtain approval from the Board prior to making any changes to their management program for which a compliance requirement is in effect. Other measures must be reported to the Board, but may be implemented without prior Board approval. A state can request permission to implement an alternative to any mandatory compliance measure only if that state can show to the Board's satisfaction that its alternative proposal will have the same conservation value as the measure contained in this management plan or any addenda prepared under Adaptive Management (Section 4.12). States submitting alternative proposals must demonstrate that the proposed action will not contribute to overfishing of the resource. All changes in state plans must be submitted in writing to the Board and to the Commission either as part of the annual FMP Review process or the Annual Compliance Reports.

5.1.1.2 Monitoring Requirements

All state programs must include the mandatory monitoring requirements contained in Sections 3.1, 3.2, and 3.3 and 4.4.7. States must submit proposals for all intended changes to required monitoring programs, which may affect the quality of the data or the ability of the program to fulfill the needs of the fishery management plan. State proposals for making changes to required monitoring programs will be submitted to the Technical Committee at least two weeks prior to its spring or fall meeting. Proposals must be on a calendar year basis. The Technical Committee will make recommendations to the Management Board concerning whether the proposals are consistent with Amendment 1.

In the event that a state realizes it will not be able to fulfill its fishery independent monitoring requirements, it should immediately notify the Commission in writing. The Commission will work with the state to develop a plan to secure funding or plan an alternative program to satisfy the needs outlined in Amendment 6. If the plan is not implemented 90 days after it has been adopted, the state will be found out of compliance with Amendment 1.

5.1.1.3 Research Requirements
A prioritized list of research needs for tautog was created during the development of this FMP and can be found in Section 6.0. The PDT and Technical Committee will re-prioritize the research needs for tautog as part of the FMP Review or Stock Assessment process. Appropriate programs for meeting these needs may be implemented under *Section 4.12 (Adaptive Management)* through the Commission's addendum process including the opportunity for public comment.

5.1.1.4 Law Enforcement Requirements
All state programs must include law enforcement capabilities adequate for successfully implementing a state's tautog regulations. The adequacy of a state's enforcement activity will be monitored annually by reports of the ASMFC Law Enforcement Committee to the Tautog Plan Review Team.

5.1.2 Compliance Schedule
To be determined by the Tautog Management Board.

5.1.3 Compliance Report Content
Each state must submit an annual report concerning its tautog fisheries and management program for the previous fishing year. Reports should follow the tautog report outline as sent by the PRT chair each year. The report shall cover:

- the previous fishing year's fishery and management program including activity and results of monitoring (including the results of 200 age and length samples), a copy of regulations that were in effect and harvest broken down between recreational and commercial, including estimates of non-harvest losses; and
- commercial harvest tagging program requirements as described in Section 4.4.7
- the planned management program for the current fishing year summarizing regulations that will be in effect and monitoring programs that will be performed, highlighting any changes from the previous year.

5.2 PROCEDURES FOR DETERMINING NON-COMPLIANCE

Detailed procedures regarding compliance determinations are contained in the ISFMP Charter, Section 7 (ASMFC 2016). The following summary is not intended to replace the language found in the ISFMP Charter.

The Plan Review Team will continually review the status of state implementation, and advise the Management Board at any time that a question arises concerning state compliance. The PRT will review state reports submitted under Section 5.1.3 and prepare a report by May 1 for the Management Board summarizing the status of the resource and the fishery and the status of state compliance on a state-bystate basis.

Upon review of a report from the Plan Review Team, or at any time by request from a member of the Management Board, the Management Board will review the status of an individual state's compliance. If the Management Board finds that a state's approved regulatory management program fails to meet the requirements of this section, it may be recommended that the state be found out of compliance. The recommendation must include a specific list of the state's deficiencies in implementing and enforcing this Amendment and the actions that the state must take in order to come back into compliance.

If the Management Board recommends that a state be found out of compliance, as referred to in the preceding paragraph, it shall report that recommendation to the ISFMP Policy Board for further review according to the Commission's Charter for the Interstate Fisheries Management Program. The state that is out of compliance or subject to a recommendation by the Management Board under the preceding paragraph may request at any time that the Management Board reevaluate its program. The state shall provide a written statement concerning actions which justify a reevaluation. The Management Board shall promptly conduct such reevaluation, and if it agrees with the state, shall recommend to the ISFMP Policy Board that the noncompliance finding be withdrawn. The ISFMP Policy Board and Commission shall deal with the Management Board's recommendation according to the Commission's Charter for the Interstate Fisheries Management Program.

5.3 ANALYSIS OF ENFORCEABILITY OF MANAGEMENT MEASURES

The Law Enforcement Committee will, during the implementation of this amendment, analyze the enforceability of conservation and management measures as they are proposed.

6.0 MANAGEMENT AND RESEARCH NEEDS

The Technical Committee identified the following research recommendations in the 2015 benchmark stock assessment to improve future stock assessments and our understanding of tautog population and fishery dynamics. Research recommendations are organized by topic and level of priority. Research recommendations that should be completed before the next benchmark assessment are underlined.

6.1 FISHERY-DEPENDENT PRIORITIES

High

- Expand biological sampling of the commercial catch for each gear type over the entire range of the stock (including weight, lengths, age, sex, and discards).
- Continue collecting operculum from the tautog catch as the standard for biological sampling in addition to collecting paired sub-samples of otoliths and operculum.
- Increase catch and discard length sampling from the commercial and recreational fishery for all states from Massachusetts through Virginia.
- Increase collection of effort data for determining commercial and recreational CPUE.
- Increase MRIP sampling levels to improve recreational catch estimates by state and mode. Current sampling levels are high during times of the year when more abundant and popular species are abundant in catches, but much lower in early spring and late fall when tautog catches are more likely.

6.2 FISHERY-INDEPENDENT PRIORITIES

High

- Conduct workshop and pilot studies to design a standardized, multi-state fishery independent survey for tautog along the lines of MARMAP and the lobster ventless trap survey.
- Establish standardized multi-state long-term fisheries-independent surveys to monitor tautog abundance and length-frequency distributions, and to develop YOY indices.
- Enhance collection of age information for smaller fish (<20 cm) to better fill in age-length keys.

Low

- Investigate a nonlethal method for age determination based on pelvic-fin spines based on the Elzey and Trull, 2016 article.

6.3 LIFE HISTORY, BIOLOGICAL AND HABITAT PRIORITIES

Moderate

- Define local and regional movement patterns and site fidelity in the southern part of the species range. This information may provide insight into questions of aggregation versus recruitment to artificial reef locations, and to clarify the need for local and regional assessment.
- Assemble regional reference collections of paired operculum and otolith samples and schedule regular exchanges to maintain and improve the precision of age readings between states that will be pooled in the regional age-length keys.
- Calibrate age readings every year by re-reading a subset of samples from previous years before ageing new samples. States that do not currently assess the precision of their age readings over time should do so by re-ageing a subset of their historical samples.

Low

- Evaluate the potential impacts of climate change on tautog range, life history, and productivity.
- Conduct a tag retention study to improve return rates, particularly in the northern region.
- Define the status (condition and extent) of optimum or suitable juvenile habitats and trends in specific areas important to the species. It is critical to protect these habitats or to stimulate restoration or enhancement, if required.
- Define the specific spawning and pre-spawning aggregating areas and wintering areas of juveniles and adults used by all major local populations, as well as the migration routes used by tautog to get to and from spawning and wintering areas and the criteria or times of use. This information is required to protect these areas from damage and overuse or excessive exploitation.
- Define larval diets and prey availability requirements. This information can be used as determinants of recruitment success and habitat function status. Information can also be used to support aquaculture ventures with this species.
- Define the role of prey type and availability in local juvenile/adult population dynamics over the species range. This information can explain differences in local abundance, movements, growth, fecundity, etc. Conduct studies in areas where the availability of primary prey, such as blue mussels or crabs, is dependent on annual recruitment, the effect of prey recruitment variability as a factor in tautog movements (to find better prey fields), mortality (greater predation exposure when leaving shelter to forage open bottom), and relationship between reef prey availability/quality on tautog condition/fecundity.
- Define the susceptibility of juveniles to coastal/anthropogenic contamination and resulting effects. This information can explain differences in local abundance, movements, growth, fecundity, and serve to support continued or increased regulation of the inputs of these contaminants and to assess potential damage. Since oil spills seem to be a too frequent coastal impact problem where juvenile tautog live, it may be helpful to conduct specific studies on effects of various fuel oils and typical exposure concentrations, at various seasonal temperatures and salinities. Studies should also be conducted to evaluate the effect of common piling treatment leachates and common antifouling paints on YOY tautog. The synergistic effects of leaked fuel, bilge water, treated pilings, and antifouling paints on tautog health should also be studied.
- Define the source of offshore eggs and larvae (in situ or washed out coastal spawning).
- Confirm that tautog, like cunner, hibernate in the winter, and in what areas and temperature thresholds, for how long, and if there are special habitat requirements during these times that should be protected or conserved from damage or disturbance. This information will aid in understanding behavior variability and harvest availability.

6.4 MANAGEMENT, LAW ENFORCEMENT AND SOCIOECONOMIC PRIORITIES

Moderate

- Collect data to assess the magnitude of illegal harvest of tautog.

Low

- Collect basic sociocultural data on tautog user groups including demographics, location, and aspects of fishing practices such as seasonality.

6.5 RESEARCH RECOMMENDATIONS THAT HAVE BEEN MET

- ✓ Sample hard parts for annual ageing from the catches of recreational and commercial fisheries and fishery-independent surveys throughout the range of the stock. *Being conducted by all participating states.*

- ✓ Conduct hard part exchange and ageing workshop to standardize techniques and assess consistency across states. Conducted May 2012, report available at http://www.asmfc.org//uploads/file/2012_Tautog_Ageing_Workshop_Report.pdf

7.0 PROTECTED RESOURCES

In the fall of 1995, Commission member states, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) began discussing ways to improve implementation and enforcement of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) in state waters. In November 1995, the Commission, through its Interstate Fisheries Management Program (ISFMP) Policy Board, approved an amendment of its ISFMP Charter (section 6(b)(2)) so that protected species and their interactions with ASMFC managed fisheries are addressed in the Commission's fisheries management planning process. Specifically, the Commission's fishery management plans (FMP) will describe impacts of state fisheries on certain marine mammals and endangered species (collectively termed "protected species"), and recommend ways to minimize these impacts. The following section outlines: (1) the federal legislation that guides protection of marine mammals and sea turtles, (2) the protected species with potential fishery interactions; and (3) the specific type(s) of fishery interaction.

7.1 MARINE MAMMAL PROTECTION ACT (MMPA) REQUIREMENTS

The 1994 amendments to the MMPA established both short- and long-term goals for reducing mortality and serious injury, or bycatch, of marine mammals incidental to commercial fisheries. The amendments also established take reduction plans (TRPs) and stakeholder-based take reduction teams (TRTs) as the mechanisms for achieving these goals. The MMPA requires NMFS to convene TRTs to develop TRPs for each strategic stock that interacts with a Category I or II fishery, fisheries with "frequent" or "occasional" marine mammal bycatch, respectively. (Fisheries that have a remote likelihood of or no known bycatch of marine mammals are classified in Category III.) A strategic stock is defined as a stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal (PBR)[1] level; (2) which is declining and is likely to be listed under the ESA in the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA. In the short-term (within six months of implementation), TRPs must reduce marine mammal bycatch to levels below a marine mammals stock's potential biological removal level. In the long-term (within five years of implementation), TRPs must reduce marine mammal bycatch to insignificant levels approaching a zero mortality and serious injury rate taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans.

The 1994 amendments also required fishermen in Category I and II fisheries to register under the Marine Mammal Authorization Program (MMAP), the purpose of which is to provide an exception for commercial fishermen from the general taking prohibitions of the MMPA; to take on board an observer if requested to do so by the Secretary of Commerce; and to comply with any applicable TRP or emergency regulations. All commercial fishermen, regardless of the category of the fishery in which they participate, must report all marine mammal bycatch.

7.2 ENDANGERED SPECIES ACT REQUIREMENTS

The taking of endangered sea turtles and marine mammals is prohibited under section 9 of the ESA. NMFS may issue section 4(d) protective regulations necessary and advisable to provide for the conservation of threatened species. There are several mechanisms established in the ESA that exempt take prohibitions set forth in section 9. First, a 4(d) regulation may include less stringent requirements intended to reduce incidental take and thus allow for the exemption from the taking prohibition. Section 10(a)(1)(B) of the ESA authorizes NMFS to permit, under prescribed terms and conditions, any taking otherwise prohibited by section 9 of the ESA, if the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Finally, section 7(a)(2) requires NMFS to consult with each federal agency to ensure that any action that is authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species. Pursuant to Section 7(b), formal consultation will be completed on any action that may adversely affect and/or result in the destruction or adverse modification of critical habitat. Formal consultation will conclude with NMFS issuing a Biological Opinion which will include an incidental take statement containing reasonable and prudent measures and terms and conditions that minimize take and must be complied for otherwise prohibited take to be authorized.

---

[1] PBR is the number of human-caused deaths per year each stock can withstand and still reach an optimum population level. This is calculated by multiplying "the minimum population estimate" by "½ stock's net productivity rate" by "a recovery factor ranging from 0.1 for endangered species to 1.0 for healthy stocks."

7.3 PROTECTED RESOURCES IN THE MANAGEMENT UNIT

Numerous protected species inhabit the environment within the tautog management unit (Table 41). These species are under NMFS jurisdiction and are afforded protection under the Endangered Species Act (ESA) of 1973 and/or the Marine Mammal Protection Act (MMPA) of 1972.

Table 41. Species protected under the ESA and/or MMPA that may occur in the affected environment of the tautog fishery. Marine mammal species (cetaceans and pinnipeds) italicized and in bold are considered MMPA strategic stocks.[1]

Species	Status[2]	Potentially affected by this action?
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***Yes***
Humpback whale, West Indies DPS (Megaptera novaeangliae)	***Protected (MMPA)***	***Yes***
Fin whale (Balaenoptera physalus)	***Endangered***	***Yes***
Sei whale (Balaenoptera borealis)	***Endangered***	***Yes***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	Yes
Pilot whale (*Globicephala spp.*)[3]	Protected (MMPA)	Yes
Risso's dolphin (*Grampus griseus*)	Protected (MMPA)	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected (MMPA)	Yes
Short Beaked Common dolphin (*Delphinus delphis*)[4]	Protected (MMPA)	Yes
Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[5]	***Protected (MMPA)***	***Yes***
Harbor porpoise (Phocoena phocoena)	*Protected (MMPA)*	*No*
Sea Turtles		
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Yes
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Yes
Green sea turtle, North Atlantic DPS (*Chelonia mydas*)	Threatened	Yes
Loggerhead sea turtle (*Caretta caretta*), Northwest Atlantic Ocean DPS	Threatened	Yes
Hawksbill sea turtle (*Eretmochelys imbricate*)	Endangered	No

Fish		
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered	No
Atlantic salmon (*Salmo salar*)	Endangered	Yes
Atlantic sturgeon *(Acipenser oxyrinchus)*		
Gulf of Maine DPS	Threatened	Yes
New York Bight DPS, Chesapeake Bay DPS, Carolina DPS & South Atlantic DPS	Endangered	Yes
Cusk	Candidate	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected (MMPA)	Yes
Gray seal (*Halichoerus grypus*)	Protected (MMPA)	Yes
Harp seal (*Phoca groenlandicus*)	Protected (MMPA)	Yes
Hooded seal (*Cystophora cristata*)	Protected (MMPA)	Yes
Critical Habitat		
North Atlantic Right Whale[6]	ESA (Protected)	No

Notes:
[1] A strategic stock is defined under the MMPA as a marine mammal stock for which: (1) the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; and/or (3) is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA (Section 3 of the MMPA of 1972).
[2] The status of the species is defined by whether the species is listed under the ESA as endangered (species are at risk of extinction) or threatened (species at risk of endangerment), or protected under the MMPA. Note, marine mammals listed under the ESA are also protected under the MMPA. Candidate species are those species in which ESA listing may be warranted.
3 There are two species of pilot whales: short finned (G. melas melas) and long finned (G. macrorhynchus). Due to the difficulties in identifying the species at sea, they are often just referred to as Globicephala spp.
4 Prior to 2008, this species was called "common dolphin."
5 This includes the following Stocks of Bottlenose Dolphins: Western North Atlantic Offshore, Northern Migratory Coastal (strategic stock), and Southern Migratory Coastal (strategic stock).
[6] Originally designated June 3, 1994 (59 FR 28805); Expanded on January 27, 2016 (81 FR 4837).

Cusk are a NMFS "candidate species" under the ESA. Candidate species are those petitioned species for which NMFS has determined that listing may be warranted under the ESA and those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register. If a species is proposed for listing, the conference provisions under Section 7 of the ESA apply (see 50 CFR 402.10); however, candidate species receive no substantive or procedural protection under the ESA. As a result, this species will not be discussed further in this and the following sections; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on cusk from any

proposed action. Additional information on cusk can be found at
http://www.nmfs.noaa.gov/pr/species/esa/candidate.htm

7.4 SPECIES AND CRITICAL HABITAT NOT LIKELY AFFECTED BY THE FMP

Based on available information, it has been determined that the FMP is not likely to affect multiple ESA listed and/or marine mammal protected species or any designated critical habitat (see Table 41). This determination has been made because either the occurrence of the species is not known to overlap with the area primarily affected by the action and/or there have never been documented interactions between the species and the primary gear type (i.e., hook and line and pot/trap) used to prosecute the tautog fishery (see Waring *et al*. 2014, 2015, 2016; NMFS NEFSC FSB 2015, 2016; http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html). In the case of critical habitat, this determination has been made because the action will not affect the essential physical and biological features of North Atlantic right whale critical habitat and therefore, will not result in the destruction or adverse modification of this species critical habitat (NMFS 2015a,b).

7.5 SPECIES POTENTIALLY AFFECTED BY THE FMP

Table 41 provides a list of sea turtle, marine mammal, and fish species present in the affected environment of the tautog fishery, and that may also be affected by the operation of this fishery. Of primary concern is the potential for the fishery to interact (e.g., bycatch, entanglement) with these species. To understand the potential risk of an interaction, it is necessary to consider (1) species occurrence in the affected environment of the fishery and how the fishery will overlap in time and space with this occurrence; and (2) data and observed records of protected species interaction with particular fishing gear types. Information on species occurrence in the affected environment of the tautog fishery is provided in this section, while information on protected species interactions with specific fishery gear is provided in Section 7.6.

7.5.1 Sea Turtles

Green (North Atlantic DPS), Kemp's ridley, leatherback, and loggerhead (Northwest Atlantic Ocean DPS) sea turtle are the four ESA listed species of sea turtles that occur in the area of operation for the 13 GAR fisheries (see Table 41). Three of the four species are considered hard-shelled turtles (i.e., green, loggerhead, and Kemp's ridley). Additional background information on the range-wide status of the other four species, as well as a description and life history of the species, can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant *et al*. 2009; NMFS and USFWS 2007a,b, 2013, 2015; Seminoff *et al*. 2015), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992), Kemp's ridley sea turtle (NMFS *et al.* 2011), and green sea turtle (NMFS and USFWS 1991).

Hard-shelled Sea Turtles

Distribution

In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida (FL) to Cape Cod, Massachusetts (MA), although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Mitchell *et al.* 2003; Braun-McNeill *et al.* 2008; TEWG 2009). While hard-shelled turtles are most common south of Cape Cod, MA, they are known to occur in the Gulf of Maine (GOM). Loggerheads, the most common hard-shelled sea turtle in the GAR, feed as far north as southern Canada. Loggerheads have been observed in waters with surface temperatures of 7 °C to 30 °C, but water temperatures ≥11 °C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). Sea turtle presence in U.S. Atlantic waters is also influenced by water depth. While hard-shelled turtles occur in waters from the beach to beyond the continental shelf, they are most commonly found in neritic waters of the inner continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Seasonality

Hard-shelled sea turtles occur year-round in waters off Cape Hatteras, North Carolina (NC) and south. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic Coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Griffin *et al.* 2013), occurring in Virginia (VA) foraging areas as early as late April and on the most northern foraging grounds in the GOM in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the GOM by September, but some remain in Mid-Atlantic and Northeast areas until late fall. By December, sea turtles have migrated south to waters offshore of NC, particularly south of Cape Hatteras, and further south (Shoop and Kenney 1992; Epperly *et al.* 1995b; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Leatherback Sea Turtles (Non-Hard Shelled Sea Turtles)

Leatherbacks, a pelagic species, are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (James *et al.* 2005; Eckert *et al.* 2006; Murphy *et al.* 2006; NMFS and USFWS 2013; Dodge *et al.* 2014). Leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992; James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014). They are found in more northern waters (i.e., Gulf of Maine) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014).

7.5.2 Marine Mammals

7.5.2.1 Large Whales

As provided in Table 42, as North Atlantic right, humpback, fin, sei, and minke whales are found throughout the waters of the Northwest Atlantic Ocean, these species will occur in the affected environment of the tautog fishery. In general, these species follow an annual pattern of migration between low latitude (south of 35°N) wintering/calving grounds and high latitude spring/summer foraging grounds (primarily north of 41°N; Waring *et al*. 2014; Waring *et al*. 2015; Waring *et al*. 2016; NMFS 1991, 2005, 2010, 2011a, 2012). This, however, is a simplification of whale movements, particularly as it relates to winter movements. It remains unknown if all individuals of a population migrate to low latitudes in the winter, although, increasing evidence suggests that for some species (e.g., right and humpback whales), some portion of the population remains in higher latitudes throughout the winter (Waring *et al*. 2014; Waring *et al*. 2015; Waring *et al*. 2016; Khan *et al*. 2009, 2010, 2011, 2012; Brown *et al*. 2002; NOAA 2008; Cole *et al*. 2013; Clapham *et al*. 1993; Swingle *et al*. 1993; Vu *et al*. 2012). Although further research is needed to provide a clearer understanding of large whale movements and distribution in the winter, the distribution and movements of large whales to foraging grounds in the spring/summer is well understood. Movements of whales into higher latitudes coincide with peak productivity in these waters. As a result, the distribution of large whales in higher latitudes is strongly governed by prey availability and distribution, with large numbers of whales coinciding with dense patches of preferred forage (Mayo and Marx 1990; Kenney *et al*. 1986, 1995; Baumgartner *et al*. 2003; Baumgartner and Mate 2003; Payne *et al*.1986, 1990; Brown *et al.* 2002; Kenney and Hartley 2001; Schilling *et al.* 1992). For additional information on the biology, status, and range wide distribution of each whale species please refer to: Waring *et al*. 2014; Waring *et al*. 2015; Waring *et al*. 2016; NMFS 1991, 2005, 2010, 2011a, 2012.

To further assist in understanding how the tautog fishery may overlaps in time and space with the occurrence of large whales, a general overview on species occurrence and distribution in the area of operation for the tautog fishery is provided in the following table (Table 42).

Table 42. Large whale occurrence in the area of operation for the tautog fishery

Species	Prevalence and Approximate Months of Occurrence
North Atlantic Right Whale	• Distributed throughout all continental shelf waters from the GOM to the South Atlantic Bight (SAB) throughout the year; however, increasing evidence of year round presence in the GOM. • New England waters (GOM and GB regions) = **Foraging Grounds** (January through October)). Seasonally important foraging grounds include, but not limited to: › Cape Cod Bay (January-April);

Species	Prevalence and Approximate Months of Occurrence
	› Great South Channel (April-June); › western Gulf of Maine (April-May, and July-October); › Jordan Basin (August-October); › Wilkinson Basin (April-July); and › northern edge of GB (May-July); • Mid-Atlantic waters: Migratory pathway to/from northern (high latitude) foraging and southern calving grounds. • Increasing evidence of wintering areas (approximately November – January) in: › Cape Cod Bay; › Jeffreys and Cashes Ledges; › Jordan Basin; and › Massachusetts Bay (e.g., Stellwagen Bank).
Humpback	• Distributed throughout all continental shelf waters of the Mid-Atlantic (SNE included), GOM, and GB throughout the year. • New England waters (GOM and GB regions) = **Foraging Grounds** (March-November). • Mid-Atlantic waters: Migratory pathway to/from northern (high latitude) foraging and southern (West Indies) calving grounds. • Increasing evidence of whales remaining in mid- and high- latitudes throughout the winter. Specifically, increasing evidence of wintering areas (for juveniles) in Mid-Atlantic (e.g., waters in the vicinity of Chesapeake and Delaware Bays; peak presence approximately January through March) and Southeastern coastal waters.
Fin	• Distributed throughout all continental shelf waters of the Mid-Atlantic (SNE included), GOM, and GB throughout the year. • Mid-Atlantic waters: › Migratory pathway to/from northern (high latitude) foraging and southern (low latitude) calving grounds; and › Possible offshore calving area (October-January). • New England(GOM and GB)/SNE waters = **Foraging Grounds** (greatest densities March-August; lower densities September-November).Important foraging grounds include: > Massachusetts Bay (esp. Stellwagen Bank);

Species	Prevalence and Approximate Months of Occurrence
	> Great South Channel; > Waters off Cape Cod (~40-50 meter contour); > GOM; > Perimeter (primarily eastern) of GB; and > Mid-shelf area off the east end of Long Island. • Evidence of wintering areas in mid-shelf areas east of New Jersey (NJ), Stellwagen Bank; and eastern perimeter of GB.
Sei	• Uncommon in shallow, inshore waters of the Mid-Atlantic (SNE included), GB, and GOM; however, occasional incursions during peak prey availability and abundance. • Primarily found in deep waters along the shelf edge, shelf break, and ocean basins between banks. • Spring through summer, found in greatest densities in offshore waters of the GOM and GB; sightings concentrated along the northern, eastern (into Northeast Channel) and southwestern (in the area of Hydrographer Canyon) edge of GB.
Minke	• Widely distributed throughout continental shelf waters (<100m deep) of the Mid-Atlantic (SNE included), GOM, and GB. • Most common in the EEZ from spring through fall, with greatest abundance found in New England waters.
Sources: NMFS 1991, 2005, 2010, 2011a, 2012; Hain *et al.* 1992; Payne *et al*. 1984; Good 2008; Pace and Merrick 2008; McLellan *et al*. 2004; Hamilton and Mayo 1990; Schevill *et al*. 1986; Watkins and Schevill 1982; Payne *et al*.1990; Winn *et al.* 1986; Kenney et al. 1986, 1995; Khan *et al*. 2009, 2010, 2011, 2012; Brown *et al*. 2002; NOAA 2008; 50 CFR 224.105; CETAP 1982; Clapham *et al*. 1993; Swingle *et al*. 1993; Vu *et al*. 2012; Baumgartner *et al*. 2011; Cole *et al*. 2013; Risch *et al*. 2013; Waring *et al*. 2014; Waring *et al*. 2015; Waring *et al*. 2016; 81 FR 4837(January 27, 2016); NMFS 2015b; Bort et al. 2015.	

7.5.3 Small Cetacean

As provided in Table 43, as Atlantic white sided dolphins, short and long finned pilot whales, Risso's dolphins, short beaked common dolphins, harbor porpoise, and several stocks of bottlenose dolphins are found throughout the year in the Northwest Atlantic Ocean, these species will occur in the affected environment of the tautog fishery (Waring *et al*. 2014; Waring *et al*. 2015; Waring *et al*. 2016). Within this range; however, there are seasonal shifts in species distribution and abundance. To further assist in understanding how fisheries may overlap in time and space with the occurrence of small cetaceans, a general overview of species occurrence and distribution in the area of operation for the tautog fishery is provided in the following table (Table 43). For additional information on the biology, status, and range wide distribution of each species please refer to Waring *et al*. (2014), Waring *et al.* (2015), and Waring *et al*. (2016).

Table 43. Small cetacean occurrence in the area of operation of the tautog fishery.

Species	Prevalence and Approximate Months of Occurrence
Atlantic White Sided Dolphin	• Distributed throughout the continental shelf waters (primarily to 100 meter isobath) of the Mid-Atlantic (north of 35°N), SNE, GB, and GOM ; however, most common in continental shelf waters from Hudson Canyon (~ 39°N) to GB, and into the GOM. • **January-May**: low densities found from GB to Jeffreys Ledge. • **June-September**: Large densities found from GB, through the GOM. • **October-December**: intermediate densities found from southern GB to southern GOM. • South of GB (SNE and Mid-Atlantic), low densities found year round, with waters off Virginia (VA) and NC representing southern extent of species range during winter months.
Short Beaked Common Dolphin	• Regularly found throughout the continental shelf-edge-slope waters (primarily between the 100-2,000 meter isobaths) of the Mid-Atlantic, SNE, and GB (esp. in Oceanographer, Hydrographer, Block, and Hudson Canyons). • Less common south of Cape Hatteras, NC, although schools have been reported as far south as the Georgia (GA)/South Carolina (SC) border. • **January-May**: occur from waters off Cape Hatteras, NC, to GB (35° to 42°N). • **Mid-summer-autumn**: Occur primarily on GB with small numbers present in the GOM; *Peak abundance* found on GB in the autumn.
Risso's Dolphin	• **Spring through fall**: Distributed along the continental shelf edge from Cape Hatteras, NC, to GB. • **Winter**: distributed in the Mid-Atlantic Bight, extending into oceanic waters. • Rarely seen in the GOM; primarily a Mid-Atlantic continental shelf edge species (can be found year round).

Species	Prevalence and Approximate Months of Occurrence
Harbor Porpoise	• Distributed throughout the continental shelf waters of the Mid-Atlantic (north of 35^{o}N), SNE, GB, and GOM. • **July-September**: Concentrated in the northern GOM (waters < 150 meters); low numbers can be found on GB. • **October-December**: widely dispersed in waters from NJ to Maine (ME); seen from the coastline to deep waters (>1,800 meters). • **January-March**: intermediate densities in waters off NJ to NC; low densities found in waters off New York (NY) to GOM. • **April-June**: widely dispersed from NJ to ME; seen from the coastline to deep waters (>1,800 meters).
Bottlenose Dolphin	**<u>Western North Atlantic Offshore Stock</u>** • Distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic from GB to FL. • Depths of occurrence: ≥40 meters **<u>Western North Atlantic Northern Migratory Coastal Stock</u>** • Warm water months (e.g., July-August): distributed from the coastal waters from the shoreline to approximately the 25-meter isobaths between the Chesapeake Bay mouth and Long Island, NY. • Cold water months (e.g., January-March): stock occupies coastal waters from Cape Lookout, NC, to the NC/VA border. **<u>Western North Atlantic Southern Migratory Coastal Stock</u>** • **October-December**: stock occupies waters of southern NC (south of Cape Lookout) • **January-March**: stock moves as far south as northern FL. • **April-June**: stock moves north to waters of NC. • **July-August**: stock is presumed to occupy coastal waters north of Cape Lookout, NC, to the eastern shore of VA.

Species	Prevalence and Approximate Months of Occurrence
Pilot Whales: *Short- and Long-Finned*	**Short- Finned Pilot Whales** • Except for area of overlap (see below), primarily occur south of 40°N (Mid-Atl and SNE waters); although low numbers have been found along the southern flank of GB, but no further than 41°N. • May through December (approximately): distributed primarily near the continental shelf break of the Mid-Atlantic and SNE; individuals begin shifting to southern waters (i.e., 35°N and south) beginning in the fall. **Long-Finned Pilot Whales** • Except for area of overlap (see below), primarily occur north of 42°N. • Winter to early spring (November through April): primarily distributed along the continental shelf edge-slope of the Mid-Atlantic, SNE, and GB. • Late spring through fall (May through October): movements and distribution shift onto/within GB, the Great South Channel, and the GOM. **Area of Species Overlap:** between approximately 38°N and 41°N.

Notes : [1] Information presented in table is representative of small cetacean occurrence in the Northwest Atlantic continental shelf waters out to the 2,000 meter isobath.

***Sources*:** Waring *et al*. 1992, 2007**,** 2014, 2015, 2016**;** Payne and Heinemann 1993; Payne *et al.* 1984; Jefferson *et al*. 2009.

7.5.4 Pinnipeds

As provided in Table 44, harbor, gray, harp, and hooded seals will occur in the affected environment of the tautog fishery. Specifically, pinnipeds are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. They are primarily found throughout the year or seasonally from New Jersey to Maine; however, increasing evidence indicates that some species (e.g., harbor seals) may be extending their range seasonally into waters as far south as Cape Hatteras, North Carolina (35°N) (Waring *et al*. 2007, 2014, 2015, 2016). To further assist in understanding how the tautog fishery may overlap in time and space with the occurrence of pinnipeds, a general overview of species occurrence and distribution in the area of operation of the tautog fishery is provided in the following table (Table Z4). For additional information on the biology, status, and range wide distribution of each species of pinniped please refer to Waring *et al*. (2007), Waring *et al*. (2014), Waring *et al*. (2015), Waring *et al*. (2016).

Table 44. Pinniped occurrence in the area of operation of the tautog fishery.

Species	Prevalence
Harbor Seal	• Primarily distributed in waters from NJ to ME; however, increasing evidence indicates that their range is extending into waters as far south as Cape Hatteras, NC (35°N). • **Year Round**: Waters of ME • **September-May**: Waters from New England to NJ.
Gray Seal	• Distributed in waters from NJ to ME. • **Year Round**: Waters from ME to MA. • **September-May**: Waters from Rhode Island to NJ.
Harp Seal	• Winter-Spring (approximately January-May): Waters from ME to NJ.
Hooded Seal	• Winter-Spring (approximately January-May): Waters of New England.
Sources: Waring *et al*. 2007 (for hooded seals); Waring *et al*. 2014; Waring *et al*. 2015;Waring *et al*. 2016.	

7.5.5 Atlantic Sturgeon

Table 45 lists the 5 DPSs of Atlantic sturgeon that occur in the affected environment of the tautog fishery and that may be affected by the operation of this fishery. The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. All five DPSs of Atlantic sturgeon have the potential to be located anywhere in this marine range; in fact, results from genetic studies show that, regardless of location, multiple DPSs can be found at any one location along the Northwest Atlantic coast (ASSRT 2007; Dovel and Berggren 1983; Dadswell *et al*. 1984; Kynard *et al*. 2000; Stein *et al*. 2004a; Dadswell 2006; Laney *et al*. 2007; Dunton *et al*. 2010; Dunton *et al*. 2012; Dunton *et al*. 2015; Erickson *et al*. 2011; Wirgin *et al*. 2012; O'Leary *et al*. 2014; Waldman *et al.* 2013; Wirgin *et al*. 2015a,b).

Table 45. Atlantic Sturgeon DPSs that occur in the area of operation for the tautog fishery

Species	Listed Under the ESA
Gulf of Maine (GOM) DPS	threatened
New York Bight (NYB) DPS	endangered
Chesapeake Bay (CB) DPS	endangered
Carolina DPS	endangered
South Atlantic (SA) DPS	endangered

Based on fishery- independent and dependent data, as well as data collected from tracking and tagging studies, in the marine environment, Atlantic sturgeon appear to primarily occur inshore of the 50 meter depth contour (Stein *et al*. 2004 a,b; Erickson *et al*. 2011; Dunton *et al*. 2010); however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Timoshkin 1968; Collins and Smith 1997; Stein *et al*. 2004a,b; Dunton *et al*. 2010; Erickson *et al*. 2011). Data from fishery-independent surveys and tagging and tracking studies also indicate that some Atlantic sturgeon may undertake seasonal movements along the coast (Erickson *et al.* 2011; Dunton *et al*. 2010; Wipplehauser 2012). For instance, tagging and tracking studies found that satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight, at depths greater than 20 meters, during winter and spring, while in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 20 meters (Erickson *et al.* 2011).

Within the marine range of Atlantic sturgeon, several marine aggregation areas have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina, Chesapeake Bay, and Delaware Bay; New York Bight; Massachusetts Bay; Long Island Sound; and Connecticut and Kennebec River Estuaries); depths in these areas are generally no greater than 25 meters (Bain *et al.* 2000; Savoy and Pacileo 2003; Stein *et al*. 2004a; Laney *et al*. 2007; Dunton *et al*. 2010; Erickson *et al*. 2011; Oliver *et al*. 2013; Waldman *et al.* 2013; O'Leary *et al*. 2014; Wipplehauser 2012; Whipplehauser and Squiers 2015). Although additional studies are still needed to clarify why these particular sites are chosen by Atlantic sturgeon, there is some indication that they may serve as thermal refuge, wintering sites, or marine foraging areas (Stein *et al*. 2004a; Dunton *et al*. 2010; Erickson *et al*. 2011).

7.5.6 Atlantic Salmon (Gulf of Maine DPS)

The wild populations of Atlantic salmon are listed as endangered under the ESA. Their freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, while the marine range of the GOM DPS extends from the GOM (primarily northern portion of the GOM), to the coast of Greenland (Fay *et al*. 2006; NMFS

& USFWS 2005, 2016). In general, smolts, post-smolts, and adult Atlantic salmon may be present in the GOM and coastal waters of Maine in the spring (beginning in April), and adults may be present throughout the summer and fall months (Baum 1997; Fay *et al*. 2006; Hyvarinen *et al*. 2006; Lacroix & Knox 2005; Lacroix & McCurdy 1996; Lacroix *et al*. 2004; NMFS & USFWS 2005, 2016; Reddin 1985; Reddin & Friedland 1993; Reddin & Short 1991). For additional information on the on the biology, status, and range wide distribution of the GOM DPS of Atlantic salmon, refer to NMFS and USFWS (2005, 2016); Fay *et al*. (2006).

7.6 INTERACTIONS BETWEEN GEAR AND PROTECTED RESOURCES

Protected species in Table 41 are all known to be vulnerable to interactions with various types of fishing gear. Available information on gear interactions with a given species (or species group) is provided in the sections below. These sections are not a comprehensive review of all fishing gear types known to interact with a given species; emphasis is only being placed on the primary gear types used to prosecute the tautog fishery (i.e., hook and line and pot/trap gear).

7.6.1 Marine Mammals

Pursuant to the MMPA, NMFS publishes a List of Fisheries (LOF) annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injuries and/or mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions; 82 FR 3655 (January 12, 2017)). In the Northwest Atlantic, the 2017 MMPA LOF (82 FR 3655 (January 12, 2017) categorizes commercial Northeast and Mid-Atlantic bottom trawl, and Atlantic mixed species trap/pot fisheries as Category II fisheries.2 General hook and line gear associated with rod and reel fishing has not been categorized as it is primarily prosecuted by recreational fisheries.

7.6.2 Large Whales

7.6.2.1 Hook and Line Gear

Large whales are known to interact with hook and line gear; however, in the most recent (2010-2014) mortality and serious injury determinations for baleen whales, the majority of cases identified with confirmed hook and line or monofilament entanglement did not result in the serious injury or mortality to the whale (89.5% observed/reported whales had a serious injury value of 0; 10.5% had a serious injury value of 0.75; none of the cases resulted in mortality; Henry *et al*. 2016).[3] In fact, 85.0% of the whales observed or reported with a hook/line or monofilament entanglement were resighted gear free and healthy; confirmation of the health of the other remaining whales remain unknown as no resightings had been made over the timeframe of the assessment (Henry *et al*. 2016). Based on this information, while large whale

---

2 Atlantic mixed species trap/pot fisheries include, but are not limited to: crab (red, Jonah, and rock), hagfish, finfish (black sea bass, scup, tautog, cod, haddock, pollock, redfish (ocean perch), and white hake), conch/whelk, and shrimp

3 Any injury leading to a significant health decline (e.g., skin discoloration, lesions near the nares, fat loss, increased cyamid loads) is classified as a serious injury (SI) and will result in a SI value set at 1 (Henry *et al*. 2016).

interactions with hook and line gear are possible, there is a low probability that an interaction will result in serious injury or mortality to any large whale species.

7.6.2.2 Bottom Trawl Gear

With the exception of minke whales, there have been no observed interactions with large whales and bottom trawl gear. To date, bottom trawl interactions with minke whales have only been observed in the MMPA LOF Category II Northeast bottom trawl fisheries. From the period of 2008-2012, the estimated annual mortality attributed to this fishery was 7.8 minke whales for 2008, and zero minke whales from 2009-2012; no serious injuries were reported during this time (Waring *et al*. 2015). Based on this information, from 2008-2012, the estimated annual average minke whale mortality and serious injury attributed to the northeast bottom trawl fishery was 1.6 (CV=0.69) whales (Waring *et al*. 2015). Lyssikatos (2015) estimated that from 2008-2013, mean annual serious injuries and mortalities from the northeast bottom trawl fishery were 1.40 (CV=0.58) minke whales. Based on above information, bottom trawl gear is likely to pose a low interaction risk to any large whale species. Should an interaction occur, serious injury or mortality to any large whale is possible; however, relative to other gear types discussed below (i.e., fixed gear (pot/trap)), bottom trawl gear represents a low source serious injury or mortality to any large whale.

7.6.2.3 Pot/Trap Gear

The greatest entanglement risk to large whales is posed by fixed fishing gear (e.g., sink gillnet and trap/pot gear) comprised of lines (vertical or ground) that rise into the water column. Any line can become entangled in the mouth (baleen), flippers, and/or tail of the whale when the animal is transiting or foraging through the water column (Johnson *et al*. 2005; NMFS 2014; Kenney and Hartley 2001; Hartley *et al*. 2003; Whittingham *et al*. 2005a,b). For instance, in a study of right and humpback whale entanglements, Johnson *et al*. (2005) attributed: (1) 89% of entanglement cases, where gear could be identified, to fixed gear consisting of pot and gillnets and (2) entanglement of one or more body parts of large whales (e.g., mouth and/or tail regions) to four different types of line associated with fixed gear (the buoy line, groundline, floatline, and surface system lines).[4] Although available data (e.g., Johnson *et al*. (2005), Waring *et al*. (2016); Henry *et al*. (2016))provides insight into large whale entanglement risks with fixed fishing gear, determining which part of fixed gear creates the most entanglement risk for large whales is difficult (Johnson *et al.* 2005). The difficulties arise from uncertainties surrounding the nature of the entanglement event, as well as unknown biases associated with reporting effort and the lack of information about the types and amounts of gear being used (Johnson *et al.* 2005). As a result, any type or part of fixed gear is considered to create an entanglement risk to large whales and should be considered potentially dangerous to large whale species (Johnson *et al.* 2005).

4 Buoy line connects the gear at the bottom to the surface system. Groundline in trap/pot gear connects traps/pots to each other to form trawls; in gillnet gear, groundline connects a gillnet, or gillnet bridle to an anchor or buoy line. Floatline is the portion of gillnet gear from which the mesh portion of the net is hung. The surface system includes buoys and high-flyers, as well as the lines that connect these components to the buoy line.

Table 46 summarizes confirmed human-caused injury and mortality to humpback, fin, sei, minke, and North Atlantic right whales along the Gulf of Mexico Coast, U.S. East Coast, and Atlantic Canadian Provinces from 2010 to 2014 (Henry *et al.* 2016); the data provided in Table Z5 is specific to confirmed injury or mortality to whales from entanglement in fishing gear. As many entanglement events go unobserved, and because the gear type, fishery, and/or country of origin for reported entanglement events are often not traceable, it is important to recognize that the information presented in Table Z5 likely underestimates the rate of large whale serious injury and mortality due to entanglement. Further studies looking at scar rates for right whales and humpbacks suggests that entanglements may be occurring more frequently than the observed incidences indicate (NMFS 2014; Robbins 2009; Knowlton *et al.* 2012).

Table 46. Summary of confirmed human-caused injury or mortality to fin, minke, humpback, sei, and North Atlantic right whales from 2010-2014 due to entanglement in fishing gear.[1]

Species	Total Confirmed Entanglement: Serious Injury[2]	Total Confirmed Entanglement: Non-Serious Injury	Total Confirmed Entanglement: Mortality	Entanglement Events: Total Average Annual Injury and Mortality Rate (US waters/Canadian waters/unassigned waters)
North Atlantic Right Whale	16	31	8	4.65 (0.4/0/4.25)
Humpback Whale	30	53	8	6.85 (1.55/0/5.3)
Fin Whale	6	1	4	1.8 (0.2/0.8/0.8)
Sei Whale	0	0	0	0
Minke Whale	20	11	16	6.4 (1.7/2.45/2.25)

Notes:
[1]Information presented in Table Z5 is based on confirmed human-caused injury and mortality events along the Gulf of Mexico Coast, US East Coast, and Atlantic Canadian Provinces; it is not specific to US waters only.
[2] NMFS defines a serious injury as an injury that is more likely than not to result in mortality (for additional details see: http://www.nmfs.noaa.gov/pr/pdfs/serious_injury_procedure.pdf)

Source: Henry *et al.* 2016

Pursuant to the MMPA, NMFS publishes a LOF annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injurious and mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions). Large whales, in particular, humpback, fin, minke, and North Atlantic right whales, are known to interact with Category I and II fisheries in the (Northwest) Atlantic Ocean. In addition, as provided in Table

46, humpback, fin, and North Atlantic right whales are considered strategic stocks under the MMPA. Section 118(f)(1) of the MMPA requires the preparation and implementation of a Take Reduction Plan (TRP) for any strategic marine mammal stock that interacts with Category I or II fisheries. In response to its obligations under the MMPA, in 1996, NMFS established the Atlantic Large Whale Take Reduction Team (ALWTRT) to develop a plan (Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan)) to reduce serious injury to, or mortality of large whales, specifically, humpback, fin, and North Atlantic right whales, due to incidental entanglement in U.S. commercial fishing gear.[5] In 1997, the ALWTRP was implemented; however, since 1997, the Plan has been modified; recent adjustments include the Sinking Groundline Rule and Vertical Line Rules (72 FR 57104, October 5, 2007; 79 FR 36586, June 27, 2014; 79 FR 73848, December 12, 2014; 80 FR 14345, March 19, 2015; 80 FR 30367, May 28, 2015).

The TRP consists of regulatory (e.g., universal gear requirements, modifications, and requirements; area-and season- specific gear modification requirements and restrictions; time/area closures) and non-regulatory measures (e.g., gear research and development, disentanglement, education and outreach) that, in combination, seek to assist in the recovery of North Atlantic right, humpback, and fin whales by addressing and mitigating the risk of entanglement in gear employed by commercial fisheries, specifically trap/pot and gillnet fisheries (http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/; 73 FR 51228; 79 FR 36586; 79 FR 73848; 80 FR 14345; 80 FR 30367). The TRP recognizes trap/pot and gillnet Management Areas in Northeast, Mid-Atlantic, and Southeast regions of the U.S, and identifies gear modification requirements and restrictions for Category I and II gillnet and trap/pot fisheries in these regions; these Category I and II fisheries must comply with all regulations of the Plan.[6] For further details on the ALWTRP please see: http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/

7.6.3 Small Cetacean and Pinnipeds

7.6.3.1 Hook and Line and Pot/Trap Gear

Over the past several years, observer coverage has been limited for fisheries prosecuted with hook and line or trap/pot gear. In the absence of extensive observer data for these fisheries, stranding data provides the next best source of information on species interactions with hook and line or trap/pot gear. It is important to note, however, stranding data underestimates the extent of human-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in human interactions are discovered, reported, or show signs of entanglement. Additionally, if gear is present, it is often difficult to definitively attribute the animal's death to the gear interaction, or if pieces of gear are absent, attribute the death or serious injury to a specific fishery or fishing gear type. As a result, the conclusions below should

5 The measures identified in the ALWTRP are also beneficial to the survival of the minke whale, which are also known to be incidentally taken in commercial fishing gear.

6 The fisheries currently regulated under the ALWTRP include: Northeast/Mid-Atlantic American lobster trap/pot; Atlantic blue crab trap/pot; Atlantic mixed species trap/pot; Northeast sink gillnet; Northeast anchored float gillnet; Northeast drift gillnet; Mid-Atlantic gillnet; Southeastern U.S. Atlantic shark gillnet; and Southeast Atlantic gillnet (NMFS 2014c).

be taken with these considerations in mind, and with an understanding that interactions may occur more frequently than what we are able to detect at this time.

Table 41 provides a list of small cetacean and pinniped species that may be affected by the tautog fishery. Of these species, only several bottlenose dolphin stocks have been identified as species at risk of becoming seriously injured or killed by hook and line or trap/pot gear. For each dolphin stock identified, stranding data provides the best source of information on species interaction history with pot/trap and hook and line gear types. Specifically, based on stranding data from 2007-2013, estimated mean annual mortality for each stock due to interactions with trap/pot gear was approximately one animal;, interactions with hook and line gear also caused approximately one annual mortality for each stock (Waring *et al*. 2014; Waring *et al*. 2016).[7] Based on this and the best available information, hook and line or trap/pot gear is not expected to pose an interaction risk to pinniped species. Interaction risks to small cetaceans (specifically bottlenose dolphins) are expected to be low. Should an interaction with a small cetacean occur, serious injury or mortality to the animal is possible; however, relative to other gear types discussed below (i.e., trawl or gillnet gear), hook and line or trap/pot gear represents a low source serious injury or mortality to any small cetacean.

7.6.3.2 Bottom Trawl Gear

Small cetaceans and pinnipeds are vulnerable to interactions with bottom trawl gear. Species that have been observed incidentally injured and/or killed by MMPA LOF Category II (occasional interactions) Northeast bottom or Mid-Atlantic trawl fisheries are provided in Table 47 (Waring *et al*. 2014; Waring *et al*. 2015; Waring *et al*. 2016; 82 FR 3655 (January 12, 2017)). Of the species provided in Table Y, short-beaked common dolphins and Atlantic white-sided dolphins are the most frequently observed bycaught marine mammal species in Northeast bottom trawl gear, followed by gray seals, long-finned pilot whales, and risso's dolphins (Lyssikatos 2015). In the Mid-Atlantic, the most frequently observed bycaught marine mammal species in Mid-Atlantic bottom trawl gear was common dolphins, followed by Risso's dolphins, gray seals, offshore bottlenose dolphins, and harbor seals (Lyssikatos 2015).

---

7 Stranding data provided in Waring *et al*. (2015) was not considered in estimating mean annual mortality as not all bottlenose dolphin stocks are addressed in this stock assessment report. As all bottlenose dolphin stocks are considered in Waring *et al.* (2014) and Waring *et al*. (2016), these stock assessment reports were used to estimate mean annual mortality. Estimates of mean annual mortality were calculated based on the total number of animals that stranded between 2007-2013, and that were determined to have incurred serious injuries or mortality as result of interacting with hook and line or trap/pot gear. Please note, for bottlenose dolphin stocks, Waring *et al*. (2014) and Waring *et al*. (2016) provides two categories for trap/pot gear: (Atlantic Blue) Crab Pot, and Other Pot gear. We combined the two to get an overall number of interactions associated with trap/pot gear in general. In addition, any animals released alive with no serious injuries were not included in the estimate. Also, if maximum or minimum number of animals stranded were provided, to be conservative, we considered the maximum estimated number in calculating our mean annual estimate of mortality.

Table 47. Small cetacean and pinniped species observed seriously injured and/or killed by Category II bottom trawl fisheries in the affected environment of the tautog fishery.

Fishery	Category	Species Observed or reported Injured/Killed
Northeast Bottom Trawl	II	Harp seal
		Harbor seal
		Gray seal
		Long-finned pilot whales
		Short-beaked common dolphin
		White-sided dolphin
		Harbor porpoise
		Bottlenose dolphin (offshore)
		Risso's dolphin
Mid-Atlantic Bottom Trawl	II	White-sided dolphin
		Pilot whales (spp)
		Short-beaked common dolphin
		Risso's dolphin
		Bottlenose dolphin (offshore)
		Gray seal
		Harbor seal
Sources: Waring *et al*. 2016; MMPA LOF 82 FR 3655 (January 12, 2017).		

7.6.4 Sea Turtles

7.6.4.1 Hook and Line Gear

ESA-listed species of sea turtles are known to interact with hook and line gear and are more commonly reported in nearshore, southern waters (Sea Turtle Disentanglement Network; NMFS 2013). Hook and line gear can cause injury and mortality to sea turtles, and therefore, can pose a risk to these species. However, the extent to which these interactions impact sea turtle populations is still under investigation and, therefore, no conclusions can currently be made on the impact of hook and line gear on the continued survival of sea turtle populations.

7.6.4.2 Bottom Trawl Gear

Sea turtle interactions bottom trawl gear have been observed in the Gulf of Maine, Georges Bank, and the Mid-Atlantic; however, most of the observed interactions have occurred in the Mid-Atlantic (see Murray 2011; Murray 2013; Murray 2015; Warden 2011a, b). As few sea turtle interactions have been observed in the Gulf of Maine and Georges Bank regions of the Northwest Atlantic, there is insufficient data available to conduct a robust model-based analysis on sea turtle interactions with bottom trawl gear in these regions or produce a bycatch estimate for these regions. As a result, the bycatch estimates and discussion below are based on observed sea turtle interactions bottom trawl gear in the Mid-Atlantic.

Bottom trawl gear poses an injury and mortality risk to sea turtles, specifically due to forced submergence (Sasso and Epperly 2006). Green, Kemp's ridley, leatherback, loggerhead, and unidentified sea turtles have been documented interacting (e.g.., bycaught) with bottom trawl gear. However, estimates are available only for loggerhead sea turtles. Warden (2011a,b) estimated that from 2005-2008, the average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic8 was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls, but released through a Turtle Excluder Device.[9] The 292 average annual observable loggerhead interactions equates to approximately 44 adult equivalents (Warden 2011a,b). Most recently, Murray (2015) estimated that from 2009-2013, the total average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic10 was 231 (CV=0.13, 95% CI=182-298); this equates to approximately 33 adult equivalents (Murray 2015b). Bycatch estimates provided in Warden (2011a) and Murray (2015) are a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, which Murray (2008) estimated at 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890). This decrease is likely due to decreased fishing effort in high-interaction areas (Warden 2011a, b).

7.6.4.3 Pot/Trap Gear

Leatherback, loggerhead, green, and Kemp's ridley sea turtles are known to interact with trap/pot gear, with interactions primarily associated with entanglement in vertical lines, although sea turtles can also become entangled in groundline or surface systems. Records of stranded or entangled sea turtles indicate that fishing gear can wrap around the neck, flipper, or body of the sea turtle and severely restrict swimming or feeding (Balazs 1985, STDN 2016). As a result, sea turtles can incur injuries and in some cases, mortality immediately or at a later time.

NMFS Northeast Region Sea Turtle Disentanglement Network's (STDN) database, a component of the Sea Turtle Stranding and Salvage Network, provides the most complete dataset of sea entanglements. Based on information provided in this database, a total of 333 sea turtle entanglements in vertical line gear were reported to the STDN and NMFS GARFO between 2002 and 2016 (STDN 2016).[11] Of the 333 reports, 316 were classified as probable or confirmed vertical line gear entanglement with a high confidence rating. Out of the 316 confirmed and

8 Warden (2011a) defined the Mid-Atlantic as south of Cape Cod, Massachusetts, to approximately the North Carolina/South Carolina border.
9 Turtle Excluder Devices (TEDs) allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. TEDregulations can be found at: 50 CFR 223.206, 68 FR 8456, and 50 CFR 223.206.
10 Murray 2015 defined the Mid-Atlantic as the boundaries of the Mid-Atlantic Ecological Production; roughly waters west of 71°W to the North Carolina/South Carolina border)
11 Data for 2016 was only available through September; data through the remainder of 2016 is still being processed.

probable entanglement events, there were 147 cases in which the gear type associated with the entanglement could be assigned to a specific fishery. The majority of interactions involved leatherback sea turtles (130) followed by loggerhead (16), and green (1) sea turtles. Of the 130 leatherbacks, 68.5 % of the vertical line interactions involved gear associated with the lobster fishery (vertical line), 17.7 % the whelk fishery, 7.7% the seabass fishery, 2.3 % the crab fishery, 1.5 % the conch fishery, 1.5% research , and 0.77 % whelk and lobster fishery (both trap/pots present). Of the 16 loggerheads, 56.3% involved interactions with vertical line associated with the whelk fishery and 43.8% the crab fishery. The one green sea turtle case involved an interaction with vertical line associated with the whelk fishery.

7.6.5 Atlantic Sturgeon

7.6.5.1 Hook and Line Gear

ESA-listed species of Atlantic sturgeon are known to interact with hook and line gear, particularly in nearshore waters from the Gulf Maine to Southern New England (NMFS 2013). Injury and mortality to Atlantic sturgeon can be incurred by hook and line gear interactions, and therefore, can pose a risk to these species. However, the extent to which these interactions are impacting Atlantic sturgeon DPSs is still under investigation and therefore, no conclusions can currently be made on the impact of hook and line gear on the continued survival of Atlantic sturgeon DPSs (NMFS 2013; NMFS 2011b).

7.6.5.2 Bottom Trawl Gear

Atlantic sturgeon interactions (i.e., bycatch) with bottom trawl gear have been observed since 1989; these interactions have the potential to result in the injury or mortality of Atlantic sturgeon (NMFS NEFSC FSB 2015, 2016). Three documents, covering three time periods, that use data collected by the Northeast Fisheries Observer Program to describe bycatch of Atlantic sturgeon in gillnet and bottom trawl gear: Stein et al. (2004b) for 1989-2000; ASMFC (2007) for 2001-2006; and Miller and Shepard (2011) for 2006-2010; none of these documents provide estimates of Atlantic sturgeon bycatch by Distinct Population Segment. Miller and Shepard (2011), the most of the three documents, analyzed fishery observer data and VTR data in order to estimate the average annual number of Atlantic sturgeon interactions in gillnet and otter trawl in the Northeast Atlantic that occurred from 2006 to 2010. This timeframe included the most recent, complete data and as a result, Miller and Shepard (2011) is considered to represent the most accurate predictor of annual Atlantic sturgeon interactions in the Northeast gillnet and bottom trawl fisheries (NMFS 2013).

Based on the findings of Miller and Shepard (2011), NMFS (2013) estimated that the annual bycatch of Atlantic sturgeon in bottom otter trawl gear to be 1,342 sturgeon. Miller and Shepard (2011) observed Atlantic sturgeon interactions in trawl gear with small (< 5.5 inches) and large (≥ 5.5 inches) mesh sizes. Based on NEFOP observed sturgeon mortalities,Miller and Shepard (2011) concluded that, gillnet gear, in general, posed a greater risk of mortality to Atlantic sturgeon than did trawl gear. Estimated mortality rates in gillnet gear were 20.0%, while those in otter trawl gear were 5.0% (Miller and Shepard 2011; NMFS 2013). Similar conclusions were reached in Stein *et al*. (2004b) and ASMFC (2007) reports; after review of observer data from 1989-2000 and 2001-2006, both studies concluded that observed mortality is much higher in gillnet gear than in trawl gear. However, an important consideration to these findings is that observed mortality is considered a minimum of what actually occurs and therefore, the conclusions reached by Stein *et al*. (2004b), ASMFC (2007), and Miller and Shepard (2011) are not reflective of the total mortality associated with either gear type. To date, total Atlantic sturgeon mortality associated with gillnet or trawl gear remains uncertain.

7.6.5.3 Pot/Trap Gear

To date, there have been no observed/documented interactions with Atlantic sturgeon and pot/trap gear (NMFS NEFSC FSB 2015, 2016). Based on this information, pot/trap gear is not expected to pose an interaction risk to any Atlantic sturgeon and therefore, is not expected to be a source of injury or mortality to this species.

7.6.6 Atlantic Salmon

7.6.6.1 Pot/Trap and Hook and Line Gear

To date, there have been no observed/documented interactions with Atlantic salmon and hook and line or pot/trap gear (NMFS NEFSC FSB 2015, 2016). Based on this information, these gear types are not expected to pose an interaction risk to any Atlantic salmon and therefore, are not expected to be source of injury or mortality to this species.

7.6.6.2 Bottom Trawl Gear

Atlantic salmon interactions (i.e., bycatch) with bottom trawl gear have been observed since 1989; in many instances, these interactions have resulted in the injury and mortality of Atlantic salmon (NMFS NEFSC FSB 2015, 2016). According to the Biological Opinion issued by NMFS Greater Atlantic Regional Fisheries Office on December 16, 2013, NMFS Northeast Fisheries Science Center's (NEFSC) Northeast Fisheries Observer and At-Sea Monitoring Programs documented a total of 15 individual salmon incidentally caught on more than 60,000 observed commercial fishing trips from 1989 through August 2013 (NMFS 2013; Kocik *et al*. 2014). Of these fifteen Atlantic salmon, four were observed bycaught in bottom otter trawl gear (Kocik (NEFSC), pers. comm (February 11, 2013) in NMFS 2013). Since 2013, no additional Atlantic salmon have been observed in bottom trawl gear (NMFS NEFSC FSB 2015, 2016). Based on the above information, bottom trawl interactions with Atlantic salmon are likely rare (NMFS 2013; Kocik *et al*. 2014).

8.0 REFERENCES

Able K. W. and M. P. Fahay. 1998. The First Year in the Love of Estuarine Fishes in the Middle Atlantic Bight. New Brunswick, NJ. Rutgers University Press.

Able, K.W., L.S. Hales Jr., and S.M. Hagan, 2005. Movement and growth of juvenile (age 0 and 1+) tautog (*Tautoga onitis [L.]*) and cunner (*Tautogolabrus adspersus [Walbaum]*) in a southern New Jersey estuary, Journal of Experimental Marine Biology and Ecology 327 (2005) 22– 35.

Adams, A. J. 1993. Dynamics of fish assemblages associated with an offshore artificial reef in the southern Mid-Atlantic Bight. M.S. Thesis, College of William and Mary, Williamsburg, Virginia.

Arendt, M. D., J. A. Lucy and T. A. Munroe. 2001. Seasonal occurrence and site-utilization patterns of adult tautog, *Tautoga onitis* (Labridae), at manmade and natural sites in Lower Chesapeake Bay. Fishery Bulletin. 99:519-527.

Atlantic States Marine Fisheries Commission (ASMFC). 2007. Special Report to the Atlantic Sturgeon Management Board: Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. August 2007. 95 pp.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Auster, P. J. 1989. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North and Mid-Atlantic)-tautog and cunner. U.S. Fish and Wildlife Service U.S. fish and Wildlife Service Biological Report 82 (11.105).

Azarovitz, T. R, C. J. Byrne, M. J. Silverman, B. L. Freeman, W. G. Smith, S. C. Turner, B. A. Halgren, and P. J. Festa. 1979. Effects on finfish and lobster. *In* L. Swanson, and C. Sindermann (ed.), Oxygen depletion and associated benthic mortalities in New York Bight, 1976. NOAA Professional Paper 11.

Bain, M. B., N . Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River Estuary: Lessonsfor Sturgeon Conservation. Instituto Espanol de Oceanografia. Boletin 16: 43-53.

Balazs, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-54:387-429.

Baum, E.T. 1997. Maine Atlantic Salmon - A National Treasure. Atlantic Salmon Unlimited, Hermon, Maine.

Baumgartner, M.F., T.V.N. Cole, R.G. Campbell, G.J. Teegarden and E.G. Durbin. 2003. Associations between North Atlantic right whales and their prey, Calanus finmarchicus, over diel and tidal time scales. Mar. Ecol. Prog. Ser. 264: 155–166.

Baumgartner, M.F. and B.R. Mate. 2003. Summertime foraging ecology of North Atlantic right whales. Mar. Ecol. Prog. Ser. 264: 123–135.

Baumgartner, M.F., N.S.J. Lysiak, C. Schuman, J. Urban-Rich, and F.W. Wenzel. 2011. Diel vertical migration behavior of *Calanus finmarchicus* and its influence on right and sei whale occurrence. Marine Ecology Progress Series 423:167-184.

Berrien, P. L., M. P. Fahay, A. W. Kendall Jr. and W. G. Smith. 1978. Ichthyoplankton from the R.V. Dolphin Survey of Continental Shelf Waters Between Martha's Vineyard, Massachusetts and Cape Lookout, North Carolinga, 1965-66. NOAA – NMFS Sandy Hook Laboratory – Northeast Fisheries Science Center. Tech. Ser. Rep. 15. Highlands, NJ. 20 pp.

Bigelow, H. B. and W. C. Schroeder. 1953. Fishes of the Gulf of Maine. U. S. Fish & Wildlife Service Fishery Bulletin 77:1-576.

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 2:51-61.

Bort, J., S. Van Parijs, P. Stevick, E. Summers and S. Todd. 2015. North Atlantic right whale Eubalaena glacialis vocalization patterns in the central Gulf of Maine from October 2009 through October 2010. Endang. Species Res. 26(3):271–280.

Bourne, D. W. and J. J. Govoni. 1988. Distribution of fish eggs and larvae and patterns of water circulation in Narragansett Bay, 1972-1973. American Fisheries Society Symposium 3:132-148.

Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in southern Georgia waters, June 1991. Gulf of Mexico Science 1996(1):39-44.

Braun-McNeill, J., and S.P. Epperly. 2002. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). Marine Fisheries Review 64(4):50-56.

Braun-McNeill, J., C.R. Sasso, S.P.Epperly, C. Rivero. 2008. Feasibility of using sea surface temperature imagery to mitigate cheloniid sea turtle–fishery interactions off the coast of northeastern USA. Endangered Species Research: Vol. 5: 257–266, 2008.

Bridges, D. W. and M. P. Fahay. 1968. Sexual dichromatism in the tautog, *Tautoga onitis* (Linnaeus), with an observation of possible courtship behavior. Transactions of the American Fisheries Society 97:208-209.

Briggs, P. T. 1969. The sport fisheries for tautog in the inshore waters of eastern Long Island. New York Fish and Game Journal 16:238-254.

Briggs, P. T., and J. S. O'Connor. 1971. Comparison of shore-zone fishes over naturally vegetated and sand-filled bottoms in Great South Bay. New York Fish and Game Journal 18:15-41.

Briggs, P. T. 1975. An evaluation of artificial reefs in New York's marine waters. New York Fish and Game Journal 22:51-56.

Briggs, P. T. 1977. Status of tautog populations at artificial reefs in New York waters and effect of fishing. New York Fish and Game Journal 24:154-167.

Brinson, A. A. and K. Wallmo. 2013. Attitudes and Preferences of Saltwater Recreational Anglers: Report from the 2013 National Saltwater Angler Survey, Volume I. U.S. Dept. of Commer., NOAA Technical Memorandum NMFS-F/SPO-135, 45 p.

Brown, M.B., O.C. Nichols, M.K. Marx, and J.N. Ciano. 2002. Surveillance of North Atlantic right whales in Cape Cod Bay and adjacent waters. Final report to the Division of Marine Fisheries, Commonwealth of Massachusetts. September 2002. 29 pp.

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Chenoweth, S. 1963. Spawning and fecundity of the tautog, *Tautoga onitis.* M. S. Thesis, University of Rhode Island, Kingston.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. Can. J. Zool. 71: 440-443.

Clarke, P. E., J. J. Pereira, L. A. Auker, C. P. Parkins, and L. M. Vinokur. 2006. Size-Related Variation in the Diet of Juvenile Tautogs from Long Island Sound. Transactions of the American Fisheries Society. 135:1361-1370.

Cole, T.V.N., P. Hamilton, A.G. Henry, P. Duley, R. M. Pace III, B. N. White, T. Frasier. 2013. Evidence of a North Atlantic right whale *Eubalaena glacialis* mating ground. Endang Species Res 21: 55–64.

Collins, M. R. and T. I. J. Smith. 1997. Distribution of shortnose and Atlantic sturgeons in South Carolina. North American Journal of Fisheries Management. 17: 995-1000.

Colton, J. B., Jr., W. G. Smith, A. W. Kendall, Jr., P. L. Berrien, and M. P. Fahay. 1979. Principal spawning areas and times of marine fishes, Cape Sable to Cape Hatteras. Fishery Bulletin 76:911-915.

Collette, B.B. and Klein-MacPhee. Eds. 2002. Bigelow, H.B. and W.C. Schroeder's Fishes of the Gulf of Maine. Third Edition. Smithsonian Institution Press. Washington, D.C. 748 pp.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Cooper, R. A. 1964. Some vital statistics of the tautog, *Tautoga onitis* (Linneaus), from Rhode Island. Ph.D. Thesis, University of Rhode Island, Kingston.

Cooper, R. A. 1966. Migration and population estimation of the tautog, *Tautoga onitis* (Linnaeus), from Rhode Island. Transactions of the American Fisheries Society 95:239-247.

Cooper, R. A. 1967. Age and growth of the tautog, *Tautoga onitis* (Linnaeus), from Rhode Island. Transactions of the American Fisheries Society 96:134-142.

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. Fisheries 31: 218-229.

Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, Acipenser brevirostrum, LeSuer 1818.

Deacutis, C. 1982. Feeding behavior of red hake and tautog, and responses to oil-tainted food. Ph.D. Thesis, University of Rhode Island, Kingston.

Defilippi, J. Atlantic Coastal Cooperative Statistics Program. Personal Communication. January 15, 2016.

Dixon, M. S. 1994. Habitat selection in juvenile tautog, *Tautoga onitis,* and juvenile cunner, *Tautogolabrus adspersus.* M.S. Thesis, University of Connecticut, Noank.

Doctor, S., Tyler, T., Weedon, C. and A. Willey. 2015. MDDNR-Fisheries Service, Investigation of Maryland's Coastal Bays and Atlantic Ocean Finfish Stocks, USFWS Federal Aid Project, F-50-R-24.

Dodge, K.L., B. Galuardi, T. J. Miller, and M. E. Lutcavage. 2014. Leatherback Turtle Movements, Dive Behavior, and Habitat Characteristics in Ecoregions of the Northwest Atlantic Ocean. PLOS ONE 9 (3) e91726: 1-17.

Dorf, B. A. 1994. Ecology of juvenile tautog *(Tautoga onitis,* Family Labridae) in Narragansett Bay, Rhode Island. Ph.D. Thesis, University of Rhode Island, Kingston.

Dorf, B. A. and J. C. Powell. 1997. Distribution, abundance and habitat characteristics of juvenile tautog *(Tautoga onitis,* Family Labridae) in Narragansett Bay, Rhode Island, 1987-1992. Estuaries. 20(3):589-600.

Dumais, S. A. 2005. Age, Growth, Reproductive Biology and Diet of Tautog (*Tautoga onitis*) on the Shinnecock Artificial Reef. State University of New York, Stony Brook, Stony Brook.

Dumais et al. 2016. 30 Day Commercial Tagging Trial for Tautog. New York State Department of Environmental Conservation.

Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.J. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. Fishery Bulletin 108:450-465.

Dunton, K.J., D. Chapman, A. Jordaan, K. Feldheim, S. J. O'Leary, K. A. McKown, and M. G. Frisk. 2012. Brief Communications: Genetic mixed-stock analysis of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* in a heavily exploited marine habitat indicates the need for routine genetic monitoring. Journal of Fish Biology 80: 207–217.

Dunton, K.J., A. Jordaan, D. O. Conover, K.A. McKown, L. A. Bonacci, and M. G. Frisk. 2015. Marine Distribution and Habitat Use of Atlantic Sturgeon in New York Lead to Fisheries Interactions and Bycatch. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 7:18–32.

Dovel, W.L. and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River Estuary, New York. New York Fish and Game Journal 30: 140-172.

Eckert, S.A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements of foraging habitats of leatherback sea turtles (*Dermochelys coriacea*) nesting in Florida. Chel. Cons. Biol. 5(2): 239-248.

Eklund, A. M. and T. E. Targett. 1990. Reproductive seasonality of fishes inhabiting hard bottom areas in the Middle Atlantic Bight. Copeia 1990:1180-1184.

Eklund, A. M. and T. E. Targett. 1991. Seasonality of fish catch rates and species composition from the hard bottom trap fishery in the Middle Atlantic Bight (US east coast). Fisheries Research 12:1-22.

Elzey, S and Trull, K. 2016. Identification of a nonlethal method for aging tautog (Tautoga onitis). Fisheries Bulletin. 114:377–385. http://fishbull.noaa.gov/1144/elzey.pdf

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93:254-261.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995b. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bulletin of Marine Science 56(2):547-568.

Epperly, S.P., J. Braun, and A. Veishlow. 1995c. Sea turtles in North Carolina waters. Conservation Biology 9(2):384-394.

Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite archival tags to identify oceanic-migratory patterns for adult Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus* Mitchell, 1815. J. Appl. Ichthyol. 27: 356–365.

Fay, C., M. Bartron, S. Craig, A. Hecht, J. Pruden, R. Saunders, T. Sheehan, and J. Trial. 2006. Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. 294 pages.

Ferraro, S. P. 1980. Pelagic Fish Eggs and Larvae of the Peconic Bays, New York 1972-1974. PhD. Thesis. State University of New York, Stony Brook, Stony Brook.

Festa, P. J. 1979. The fish forage base of the Little Egg Harbor estuary. New Jersey Dept. of Environmental Protection, Div. Of Fish, Game, and Shellfisheries, Bureau of Fisheries, Nacote Creek Research Station. Port Republic, New Jersey. Technical Report 24M.

Good, C. 2008. Spatial Ecology of the North Atlantic Right Whale (*Eubalaena glacialis*). Doctoral Dissertation, Duke University. Available at: http://dukespace.lib.duke.edu/dspace/handle/10161/588

Griffin, D.B., S. R. Murphy, M. G. Frick, A. C. Broderick, J. W. Coker, M. S. Coyne, M. G. Dodd, M. H. Godfrey, B. J. Godley, L. A. Hawkes, T. M. Murphy, K. L. Williams, and M. J. Witt. 2013. Foraging habitats and migration corridors used by a recovering subpopulation of adult female loggerhead sea turtles: implications for conservation. Mar. Biol. 160: 3071–3086.

Grover, J. J. 1982. The comparative feeding ecology of five inshore, marine fishes off Long Island, New York. Ph. D. Thesis, Rutgers University.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. Reports of the International Whaling Commission 42: 653-669.

Hamilton, P.K., and C.A. Mayo. 1990. Population characteristics of right whales (*Eubalaena glacialis*) observed in Cape Cod and Massachusetts Bays, 1978-1986. Reports of the International Whaling Commission, Special Issue No. 12: 203-208.

Hartley, D., A. Whittingham, J. Kenney, T. Cole, and E. Pomfret. 2003. Large Whale Entanglement Report 2001. Report to the National Marine Fisheries Service, updated February 2003.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. Current Biology 16: 990-995.

Hawkes, L.A., M.J. Witt, A.C. Broderick, J.W. Coker, M.S. Coyne, M. Dodd, M.G. Frick, M.H. Godfrey, D.B. Griffin, S.R. Murphy, T.M. Murphy, K.L. Williams, and B.J. Godley. 2011. Home on the range: spatial ecology of loggerhead turtles in Atlantic waters of the USA. Diversity and Distributions 17:624–640.

Henry, A.G., T.V.N. Cole, L. Hall, W. Ledwell , D. Morin , and A. Reid. 2016. Serious injury and mortality and determinations for baleen whale stocks along the Gulf of Mexico, United States east coast and Atlantic Canadian provinces, 2010-2014. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-10; 51 p.

Hildebrand, S. F. and W. C. Schroeder. 1928. Fishes of the Chesapeake Bay. Bulletin of the United States Bureau of Fisheries 43: 1-366.

Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, *Chelonia mydas* (Linnaeus 1758). USFWS Biological Report 97(1):1-120.

Hostetter, E. B. and T. A. Munroe. 1993. Age, growth, and reproduction of tautog *Tautoga onitis* (Labridae: Perciformes) from coastal waters of Virginia. Fishery Bulletin 91:45-64.

Hutt, Clifford, Sabrina Lovell, and Scott Steinback. 2015. The Economics of Independent Marine Recreational Fishing Bait and Tackle Retail Stores in the United States, 2013. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-F/SPO-151, 110 p. http://spo.nmfs.noaa.gov/tm/TM151a.pdf

Hyvarinen, P., P. Suuronen and T. Laaksonen. 2006. Short-term movement of wild and reared Atlantic salmon smolts in brackish water estuary – preliminary study. Fish. Mgmt. Eco. 13(6): 399 -401.

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. Proc. R. Soc. B, 272: 1547-1555.

James, M.C., S.A. Sherrill-Mix, K. Martin, and R. A. Myers. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. Biological Conservation 133: 347-357.

Jefferson, T.A., D. Fertl, J. Bolanos-Jimenez and A.N. Zerbini. 2009. Distribution of common dolphins (*Delphinus spp.*) in the western North Atlantic: a critical re-examination. Mar. Biol. 156:1109-1124.

Johnson, A. J., G. S. Salvador, J. F. Kenney, J. Robbins, S. D. Kraus, S. C. Landry, and P. J. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales*, Marine Mammal Science* 21(4): 635-645.

Kenney, J., and D. Hartley. 2001. Draft Large Whale Entanglement Summary 1997-2001. Report to the National Marine Fisheries Service, updated October.

Kenney, R.D., M.A.M. Hyman, R.E. Owen, G.P. Scott and H.E. Winn. 1986. Estimation of prey densities required by western North Atlantic right whales. Mar. Mamm. Sci. 2: 1–13.

Kenney, R.D., H.E. Winn and M.C. Macaulay 1995. Cetaceans in the Great South Channel, 1979-1989: right whale (*Eubalaena glacialis*). Cont. Shelf Res. 15: 385–414.

Khan, C., T.V.N. Cole, P. Duley, A. Glass, M. Niemeyer, and C. Christman. 2009. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2008 Results Summary. NEFSC Reference Document 09-05. 7 pp.

Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2010. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2009 Results Summary. NEFSC Reference Document 10-07. 7 pp.

Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2011. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2010 Results Summary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-05. 6 pp.

Khan C., T. Cole, P. Duley, A. Glass, and J. Gatzke, J. Corkeron. 2012. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2011 Results Summary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-09; 6 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

Knowlton, A.R., P.K. Hamilton, M.K. Marx, H.M. Pettis, and S.D. Kraus. 2012. Monitoring North Atlantic right whale (*Eubalaena glacialis*) entanglement rates: a 30 yr retrospective. Marine Ecology Progress Series 466:293-302.

Kocik. J.F., S.E. Wigley, and D. Kircheis. 2014. Annual Bycatch Update Atlantic Salmon 2013 U.S. Atlantic Salmon Assessment Committee Working Paper 2014:05. Old Lyme, CT. 6 pp.(cited with permission of authors).

Kuropat, C., R. Mercaldo-Allen, E. Caldarone, R. Goldberg, B. Phelan, and F. Thurberg, 2002. Evaluation of RNA concentration as an indicator of growth in young-of-the-year winter flounder

Pseudopleuronectes americanus and tautog *Tautoga onitis*. Marine Ecology Progress Series, 230:265-274.

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitat used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: A hierarchical approach. Transactions of the American Fisheries Society 129: 487-503.

Lacroix, G.L. and McCurdy, P. 1996. Migratory behavior of post-smolt Atlantic salmon during initial stages of seaward migration. J. Fish Biol. 49, 1086-1101.

Lacroix, G. L, McCurdy, P., Knox, D. 2004. Migration of Atlantic salmon post smolts in relation to habitat use in a coastal system. Trans. Am. Fish. Soc. 133(6): pp. 1455-1471.

Lacroix, G.L. and D. Knox. 2005. Distribution of Atlantic salmon (*Salmo salar*) postsmolts of different origins in the Bay of Fundy and Gulf of Maine and evaluation of factors affecting migration, growth, and survival. Can. J. Fish. Aquat. Sci. 62: 1363–1376.

Laney, R.W., J.E. Hightower, B.R. Versak, M.F. Mangold, W.W. Cole Jr., and S.E. Winslow 2007. Distribution, habitat use, and size of Atlantic sturgeon captured during cooperative winter tagging cruises, 1988–2006. Pages 167-182. In: J. Munro, D. Hatin, J. E. Hightower, K. McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, (editors), Anadromous sturgeons: Habitats, threats, and management. Am. Fish. Soc. Symp. 56, Bethesda, MD.

LaPlante, L. H. and E. T. Schultz. 2007. Annual Fecundity of Tautog in Long Island Sound: Size Effects and Long-Term Changes in Harvested Population. Transactions of the American Fisheries Society. 136:1520-1533.

Lankford, T. E. Jr. 1999. Ecomorphological Limits to the Onset of Mulluscivory in Juvenile Tautog, *Tautog onitis* (Perciformes: Labridae). Presented at the First Biennial Conference on the Biology of Tautog and Cunner. Mystic Connecticut. November 30 and December 1, 1999.

Lovell, Sabrina, Scott Steinback, and James Hilger. 2013. The Economic Contribution of Marine Angler Expenditures in the United States, 2011. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-134, 188 p.

Lyssikatos MC. 2015. Estimates of cetacean and pinniped bycatch in Northeast and mid-Atlantic bottom trawl fisheries, 2008-2013. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-19.

Malchoff, M. H. 1993. Age, growth and distribution of Cunner *(Tautogolabrus adspersus)* and tautog *(Tautoga onitis)* larvae in the New York Bight: a single season analysis. M.S. Thesis, Bard College.

Mansfield, K.L., V.S. Saba, J. Keinath, and J.A. Musick. 2009. Satellite telemetry reveals a dichotomy in migration strategies among juvenile loggerhead sea turtles in the northwest Atlantic. Marine Biology 156:2555-2570.

Mayo, C.A. and M.K. Marx. 1990. Surface foraging behaviour of the North Atlantic right whale, *Eubalaena glacialis*, and associated zooplankton characteristics. Can. J. Zool. 68: 2214–2220.

McClellan, C.M., and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. Biology Letters 3:592-594

McLellan, W.A., E. Meagher, L. Torres, G. Lovewell, C. Harper, K. Irish, B. Pike and A.D. Pabst 2004. Winter right whale sightings from aerial surveys of the coastal waters of the U.S. mid-Atlantic. 15th Biennial Conference on the Biology of Marine Mammals.

Miller, T. and G. Shepard. 2011. Summary of Discard Estimates for Atlantic Sturgeon. Northeast Fisheries Science Center, Population Dynamics Branch, August 2011.
Miller and Shepard 2016?

Mitchell, G.H., R.D. Kenney, A.M. Farak, and R.J. Campbell. 2003. Evaluation of occurrence of endangered and threatened marine species in naval ship trial areas and transit lanes in the Gulf of Maine and offshore of Georges Bank. NUWC-NPT Technical Memo 02-121A. March 2003. 113 pp.

Morreale, S.J. and E.A. Standora. 2005. Western North Atlantic waters: Crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. Chel. Conserv. Biol. 4(4):872-882.

Monteleone, D. M. 1992. Seasonality and abundance of ichthyoplankton in Great South Bay, New York. Estuaries 15:230-238.

Murphy, T.M., S.R. Murphy, D.B. Griffin, and C. P. Hope. 2006. Recent occurrence, spatial Distribution, and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. Chel. Cons. Biol. 5(2): 216-224.

Murray, K.T., 2008. Estimated Average Annual Bycatch of Loggerhead Sea Turtles (*Caretta caretta*) in US Mid-Atlantic Bottom Otter Trawl Gear, 1996–2004, second ed. US Dep. Commer., Northeast Fish Sci. Cent. Ref. Doc. 08-20, p. 32. <http://www.nefsc.noaa.gov/publications/crd/crd0820>.

Murray, K.T. 2011. Interactions between sea turtles and dredge gear in the U.S. sea scallop (*Placopecten magellanicus*) fishery, 2001-2008. Fisheries Research 107:137-146.

Murray, K.T. 2013. Estimated loggerhead and unidentified hard-shelled turtle interactions in mid-Atlantic gillnet gear, 2007-2011. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NM-225. 20 pp. Available at http://www.nefsc.noaa.gov/publications/tm/.

Murray, K.T. 2015. The importance of location and operational fishing factors inestimating and reducing loggerhead turtle (*Caretta caretta*)interactions in U.S. bottom trawl gear. Fisheries Research 172: 440–451.

National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB). 2015. Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2014 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html

NMFS Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB). 2016. Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2015 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

NMFS. 1991. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 105 pp.

NMFS. 2005. Revision- recovery plan for the North Atlantic right whale (*Eubalaena glacialis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 137 pp.

NMFS. 2010. Final recovery plan for the fin whale (*Balaenoptera physalus*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 121 pp.

NMFS. 2011a. Final recovery plan for the sei whale (*Balaenoptera borealis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 108 pp.

NMFS. 2011b. Bycatch Working Group Discussion Notes. NMFS Sturgeon Workshop, Alexandria, VA. February 11, 2011.

NMFS. 2012. North Atlantic Right Whale (*Eubalaena glacialis*) five year review: summary and evaluation. NOAA Fisheries Service, Northeast Regional Office, Gloucester, MA. 36pp.

NMFS. 2013. NMFS-Greater Atlantic Region Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries.

National Marine Fisheries Service (NMFS). 2014. Final Environmental Impact Statement for Amending the Atlantic Large Whale Take Reduction Plan: Vertical Line Rule. National Marine Fisheries Service. May 2014.

NMFS. 2015a. Endangered Species Act Section 4(b)(2) Report: Critical Habitat for the North Atlantic Right Whale (*Eubalaena glacialis*). Prepared by National Marine Fisheries Service

Greater Atlantic Regional Fisheries Office and Southeast Regional Office, December 2015. http://www.greateratlantic.fisheries.noaa.gov/regs/2016/January/16narwchsection4_b__2_report012616.pdf

NMFS. 2015b. North Atlantic Right Whale (*Eubalaena glacialis*). Source Document for the Critical Habitat Designation: A review of information pertaining to the definition of "critical habitat" Prepared by National Marine Fisheries Service Greater Atlantic Regional Fisheries Office and Southeast Regional Office, July 2015.

NMFS and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, D.C. 58 pp.

NMFS and USFWS. 1992. Recovery plan for leatherback turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. Silver Spring, Maryland: National Marine Fisheries Service. 139 pp.

NMFS and USFWS. 2005. Recovery plan for the Gulf of Maine distinct population segment of the Atlantic salmon (*Salmo salar*). National Marine Fisheries Service, Silver Spring, MD.

NMFS and USFWS. 2016. Draft recovery plan for the Gulf of Maine distinct population segment of the Atlantic Salmon (*Salmo salar*). http://www.fisheries.noaa.gov/pr/pdfs/20160329_atlantic_salmon_draft_recovery_plan.pdf

NMFS and USFWS. 2007a. Kemp's ridley sea turtle *(Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 2007b. Green sea turtle (*Chelonia mydas*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

NMFS and USFWS. 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (*Caretta caretta*), Second revision. Washington, D.C.: National Marine Fisheries Service. 325 pp.

NMFS and USFWS. 2013. Leatherback sea turtle (*Dermochelys coriacea*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 91 pp.

NMFS and USFWS. 2015. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 62 pp.

NMFS and USFWS. 2016. Draft Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*). http://www.fisheries.noaa.gov/pr/pdfs/20160329_atlantic_salmon_draft_recovery_plan.pdf

NMFS, USFWS, and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, MD. 156 pp. + appendices.

National Oceanic and Atmospheric Administration (NOAA). 2008. High numbers of right whales seen in Gulf of Maine: NOAA researchers identify wintering ground and potential breeding ground. NOAA press release. December 31, 2008.

Oliver, M.J., M. W. Breece, D. A. Fox, D. E. Haulsee, J. T. Kohut, J. Manderson, and T. Savoy. 2013. Shrinking the Haystack: Using an AUV in an Integrated Ocean Observatory to Map Atlantic Sturgeon in the Coastal Ocean. Fisheries 38(5): 210-216.

O'Leary, S.J., K. J. Dunton, T. L. King, M. G. Frisk, and D.D. Chapman. 2014. Genetic diversity and effective size of Atlantic sturgeon, *Acipenser oxyrhinchus oxyrhinchus,* river spawning populations estimated from the microsatellite genotypes of marine-captured juveniles. Conserv Genet: DOI 10.1007/s10592-014-0609-9; ISSN 1566-0621.

Olla, B. L., A. J. Bejda, and A. D. Martin. 1974. Daily activity, movements, feeding, and seasonal occurrence in the tautog, *Tautoga onitis.* Fishery Bulletin 72:27-35.

Olla, B. L., A. J. Bejda, and A. D. Martin. 1975. Activity, movements, and feeding behavior of the cunner, *Tautogolabrus adspersus,* and comparison of food habits with young tautog, *Tautoga onitis,* off Long Island, New York. Fishery Bulletin 73:895-900.

Olla, B. L., A. J. Bejda, and A. D. Martin. 1979. Seasonal dispersal and habitat selection of cunner, *Tautogolabrus adspersus,* and young tautog, *Tautoga onitis,* in Fire Island Inlet, Long Island, New York. Fishery Bulletin 77:255-261.

Olla, B. L. and C. Samet. 1977. Courtship and spawning behavior of the tautog, *Tautoga onitis* (Pisces: Labridae), under laboratory conditions. Fishery Bulletin 75:585-599.

Orth, R. J. and K. L. Heck Jr. 1980. Structural Components of Eelgrass (*Zostera marina*) Meadows in Lower Chesapeake Bay-Fishes. Estuaries 3(4):278-288.

Pace, R.M. III and R. Merrick. 2008. Northwest Atlantic Ocean Habitats Important to the Conservation of North Atlantic Right Whales (*Eubalaena glacialis*). NEFSC Ref. Doc. 08-07.

Parker, R. O., Jr., A. J. Chester, and R. S. Nelson. 1994. A video transect method for estimating reef fish abundance, composition, and habitat utilization at Gray's Reef National Marine Sanctuary, Georgia. Fishery Bulletin 92:787-799.

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala sp*.) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Rep. Int. Whal. Comm. (Special Issue) 14: 51- 68.

Payne, P.M., L. A**.** Selzer, and A. R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Marine Fisheries Service-NEFSC, Woods Hole, MA. 294pp.

Payne, P.M., J.R. Nicholas, L. O'Brien and K.D. Powers 1986. The distribution of the humpback whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes americanus*. Fish. Bull. 84: 271-277.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham and J.W. Jossi 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fish. Bull. 88: 687-696.

Perry, D. M. 1994. Artificial spawning of tautog under laboratory conditions. Progressive Fish-Culturist 56:33-36.

Phelan B.A., R. Goldberg, A.J. Bejda, J. Pereira, S. Hagan, P. Clark, A.L. Studholme, A. Calabrese, and K.W. Able. 2000. Estuarine and habitat-related differences in growth rates of young-of-the-year winter flounder (Pseudopleuronectes americanus) and tautog (Tautoga onitis) in three northeastern US estuaries. J Experimental Marine Biology and Ecology, 247(1):1–28.

Reddin, D.G. 1985. Atlantic salmon (*Salmo salar*) on and east of the Grand Bank. J. Northwest Atl. Fish. Soc. 6(2):157-164.

Reddin, D.G and P.B. Short. 1991. Postsmolt Atlantic salmon (*Salmo salar*) in the Labrador Sea. Can. J. Fish Aquat. Sci. 48:2-6.

Reddin, D.G and K.D. Friedland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. 4th Int. Atlantic Salmon Symposium. St. Andrews, N.B. Canada.

Risch, D., C. W. Clark, P. J. Dugan, M. Popescu, U. Siebert, and S. M. Van Parijs. 2013. Minke whale acoustic behavior and multi-year seasonal and diel vocalization patterns in Massachusetts Bay, USA. Mar Ecol Prog Ser 489: 279–295.

Robbins, J. 2009. Scar-based inference into the Gulf of Maine humpback whale entanglement: 2003-2006. Report to National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. NOAA Contract #EA133F04SE0998.

Rubio, G., A. A. Brinson, and K. Wallmo. 2014. Attitudes and Preferences of Saltwater Recreational Anglers: Report from the 2013 National Saltwater Angler Survey, Volume II Regional Analysis. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-143, 115 p.

Sasso, C.R., and S.P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. Fisheries Research 81:86-88.

Savoy, T., and D. Pacileo. 2003. Movements and important habitats of subadult Atlantic sturgeon in Connecticut waters. Transactions of the American Fisheries Society. 132: 1-8.

Schevill, W.E., W.A. Watkins, and K.E. Moore. 1986. Status of *Eubalaena glacialis* off Cape Cod. Report of the International Whaling Commission, Special Issue 10: 79-82.

Schilling, M. R., I. Seipt, M. T. Weinrich, S. E. Frohock, A. E. Kuhlberg, and P. J. Clapham. 1992. Behavior of individually-identified sei whales *Balaenoptera borealis* during an episodic influx into the southern Gulf of Maine in 1986. Fishery Bulletin 90:749–755.

Sea Turtle Disentanglement Network (STDN). 2016. Northeast Region Sea Turtle Disentanglement Network Summary of Entanglement/Disentanglement Data from 2002-2016. Unpublished report compiled by NMFS NERO.

Seminoff, J.A., C.D. Allen, G.H. Balazs, P.H. Dutton, T. Eguchi, H.L. Hass, S.A. Hargrove, M. Jensen, D.L. Klemm, A.M. Lauritsen, S.L. MacPherson, P. Opay, E.E. Possardt, S. Pultz, E. Seney, K.S. Van Houtan, and R.S. Waples. 2015. Status Review of the Green Turtle (*Chelonia mydas*) Under the Endangered Species Act. NOAA Technical Memorandum: NOAA-TM-NMFS-SWFSC-539. NMFS Southwest Fisheries Science Center, March 2015.

Simpson, D. G. 1989. Population dynamics of the tautog, *Tautoga onitis,* in Long Island Sound. M.S. Thesis, Southern Connecticut State University, New Haven.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Sogard, S. M. and K. W. Able. 1991. A comparison of eelgrass, sea lettuce, macroalgae, and marsh creeks as habitats for epibenthic fishes and decapods. Estuarine, Coastal and Shelf Science 33:50l-519.

Sogard, S. M., K. W. Able, arid M. P. Fahay. 1992. Early life history of the tautog *Tautoga onitis* in the Mid-Atlantic Bight. Fishery Bulletin 90:529-539.

Steimle, F. W. and L. Ogren. 1982. Food of fish collected on artificial reefs in the New York Bight and off Charleston, South Carolina. Marine Fisheries Review 44:49-52.

Steimle, F. W. and P. A. Shaheen. 1999. Tautog, *Tautoga onitis:* life history and habitat requirements. Northeast Fisheries Science Center. NOAA Technical Memorandum. NMFS-NE-118. Woods Hole, Massachusetts.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004a. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. Transactions of the American Fisheries Society 133: 527-537.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004b. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. North American Journal of Fisheries Management 24: 171-183.

Stolgitis, J. A. 1970. Some aspects of the biology of tautog, *Tautoga onitis* (Linnaeus), from the Weweantic River Estuary, Massachusetts, 1966. M.S. Thesis, University of Massachusetts, Amherst.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

TEWG (Turtle Expert Working Group). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.

TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.

TEWG (Turtle Expert Working Group). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555:1-116.

TEWG (Turtle Expert Working Group). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

Timoshkin, V. P. 1968. Atlantic sturgeon (*Acipenser sturio* L.) caught at sea. Prob. Ichthyol. 8(4):598.

Vu, E., D. Risch, C. Clark, S. Gaylord, L. Hatch, M. Thompson, D. Wiley, and S. Van Parijs. 2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aq. Biol.14(2):175–183.

Waldman, J.R., T. King, T. Savoy, L. Maceda, C. Grunwald, and I. Wirgin. 2013. Stock Origins of Subadult and Adult Atlantic Sturgeon, *Acipenser oxyrinchus*, in a Non-natal Estuary, Long Island Sound. Estuaries and Coasts 36:257–267.

Warden, M.L. 2011a. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. Biological Conservation 144: 2202–2212.

Warden, M.L. 2011b. Proration of loggerhead sea turtle (*Caretta caretta*) interactions in US Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. NEFSC Reference Document 11-04; 8 pp. http://www.nefsc.noaa.gov/publications/crd/.

Waring, G. T., C. P. Fairfield, C. M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA shelf. ICES C.M. 1992/N:12 29 pp

Waring G.T., E. Josephson, C.P. Fairfield-Walsh, K. Maze-Foley K, editors. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2007. NOAA Tech Memo NMFS-NE-205. 415 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2010. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2010. NOAA Tech Memo NMFS-NE-219. 606 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2014. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2013. NOAA Tech Memo NMFS- NE-228. 475 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2014. http://www.nmfs.noaa.gov/pr/sars/pdf/atl2014_final.pdf

Waring, G.T., E. Josephson , K. Maze-Foley , and P. E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2015. NOAA Technical Memorandum NMFS-NE-238. http://www.nmfs.noaa.gov/pr/sars/pdf/atlantic2015_final.pdf

Watkins, W.A., and W.E. Schevill. 1982. Observations of right whales (*Eubalaena glacialis*) in Cape Cod waters. Fish. Bull. 80(4):875-880.

White G. G., T.A. Munroe, and H. M. Austin. 2003. Reproductive seasonality, fecundity, and spawning frequency of tautog (*Tautoga onitis*) in the lower Chesapeake Bay and coastal waters of Virginia. Fishery Bulletin 101:424-442.

Whitting, D. A., K. W. Able, and M. P. Fahay. 1999. Larval fishes of a Middle Atlantic Bight estuary: assemblage structure and temporal stability. Can. J. Aquat. Sci. 56:222-230.

Whittingham, A., D. Hartley, J. Kenney, T. Cole, and E. Pomfret. 2005a. Large Whale Entanglement Report 2002. Report to the National Marine Fisheries Service, updated March 2005.

Whittingham, A., M. Garron, J. Kenney, and D. Hartley. 2005b. Large Whale Entanglement Report 2003. Report to the National Marine Fisheries Service, updated June 2005.

Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. Reports of the International Whaling Commission (Special issue). 10: 129-138.

Wippelhauser, G.S. 2012. A Regional Conservation Plan For Atlantic Sturgeon in the U. S. Gulf of Maine. Prepared on behalf of Maine Department of Marine Resources, Bureau of Science. NOAA Species of Concern Grant Program Award #NA06NMF4720249A.

Wippelhauser, G.S., and T.S. Squiers. 2015. Shortnose Sturgeon and Atlantic Sturgeon in the Kennebec River System, Maine: a 1977–2001 Retrospective of Abundance and Important Habitat. Transactions of the American Fisheries Society 144:591–601

Wirgin, I., L. Maceda, J.R. Waldman, S. Wehrell, M. Dadswell, and T. King. 2012. Stock origin of migratory Atlantic sturgeon in the Minas Basin, Inner Bay of Fundy, Canada, determined by microsatellite and mitochondrial DNA analyses.

Wirgin, I., M. W. Breece , D. A. Fox , L. Maceda , K. W. Wark, and T. King. 2015a. Origin of Atlantic Sturgeon Collected off the Delaware Coast during Spring Months. North American Journal of Fisheries Management 35: 20–30.

Wirgin, I., L. Maceda, C. Grunwald, and T. L. King. 2015b. Population origin of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* by-catch in U.S. Atlantic coast fisheries. Journal of Fish Biology 86(4):1251–1270.

Zawacki, C. S. 1969. Long Island's artificial fishing reefs. The Conservationist, New York State 24:18-21.

Appendix 1.

Millstone Entrainment Sampling
Samples have been taken since 1976 at the Millstone Nuclear Power Plant in Waterford, Connecticut. Sampling frequency varies seasonally; over the period in which tautog eggs and larvae are collected, samples are taken day and night three times (May) or twice (June through August) a week. A conical plankton net (1.0 x 3.6 m, 335 microns mesh size) collects samples at outflow sites at the Millstone Nuclear Power Plant. Readings from four flowmeters mounted in the mouth of the net account for variations in horizontal and vertical flow. Sample volume is typically about 200 m^3. All ichthyoplankton collections are immediately fixed in 10% formalin.

Samples are split repeatedly in the laboratory using a NOAA Bourne splitter. Successive splits are sorted and counted until at least 50 larvae (and 50 eggs for samples processed for eggs) are found, or until one half of the sample volume was processed. Tautog eggs are enumerated in all samples collected from April through October. Tautog and Cunner have eggs of similar appearance and were distinguished on the basis of a weekly bimodal distribution of egg diameters (Williams 1967).

Means of annual cumulative sum of egg entrainment for the years 2013 – 2015 show that 63% of the eggs are captured between weeks 18 and 30 (May 1 – July 31), 71% are captured between weeks 18 and 32 (May 1 – mid-August), and 78% are captured between weeks 18 and 34 (Figure 1). As Tautog eggs hatch between 42-48 hours after spawning (Kuntz and Radcliffe, 1918), the presence of eggs is a good indicator of spawning activity.

Other resources
Other studies of Tautog in southern New England indicate that the majority of spawning takes place between May and end of July, with continued spawning through the end of August (LaPlante and Schultz, 2007; Berrien and Sibunka, 1999).

References

Berrien, Peter and Sibunka, John (1999) Distribution patterns of fish eggs in the U.S. Northeast Continental Shelf Ecosystem, 1977-1987. Seattle, WA, NOAA/National Marine Fisheries Service, (NOAA Technical Report NMFS, 145)

Kuntz A., Radcliffe L. (1918) Notes on the embryology and larval development of twelve teleostean fishes. U.S. Bulletin of the Bureau of Marine Fisheries, 35, 87–134.

LaPlante L.H., Schultz E.T (2007) Annual Fecundity of Tautog in Long Island Sound:
Size Effects and Long-Term Changes in a Harvested Population. Transactions of the American Fisheries Society 136:1520–1533.

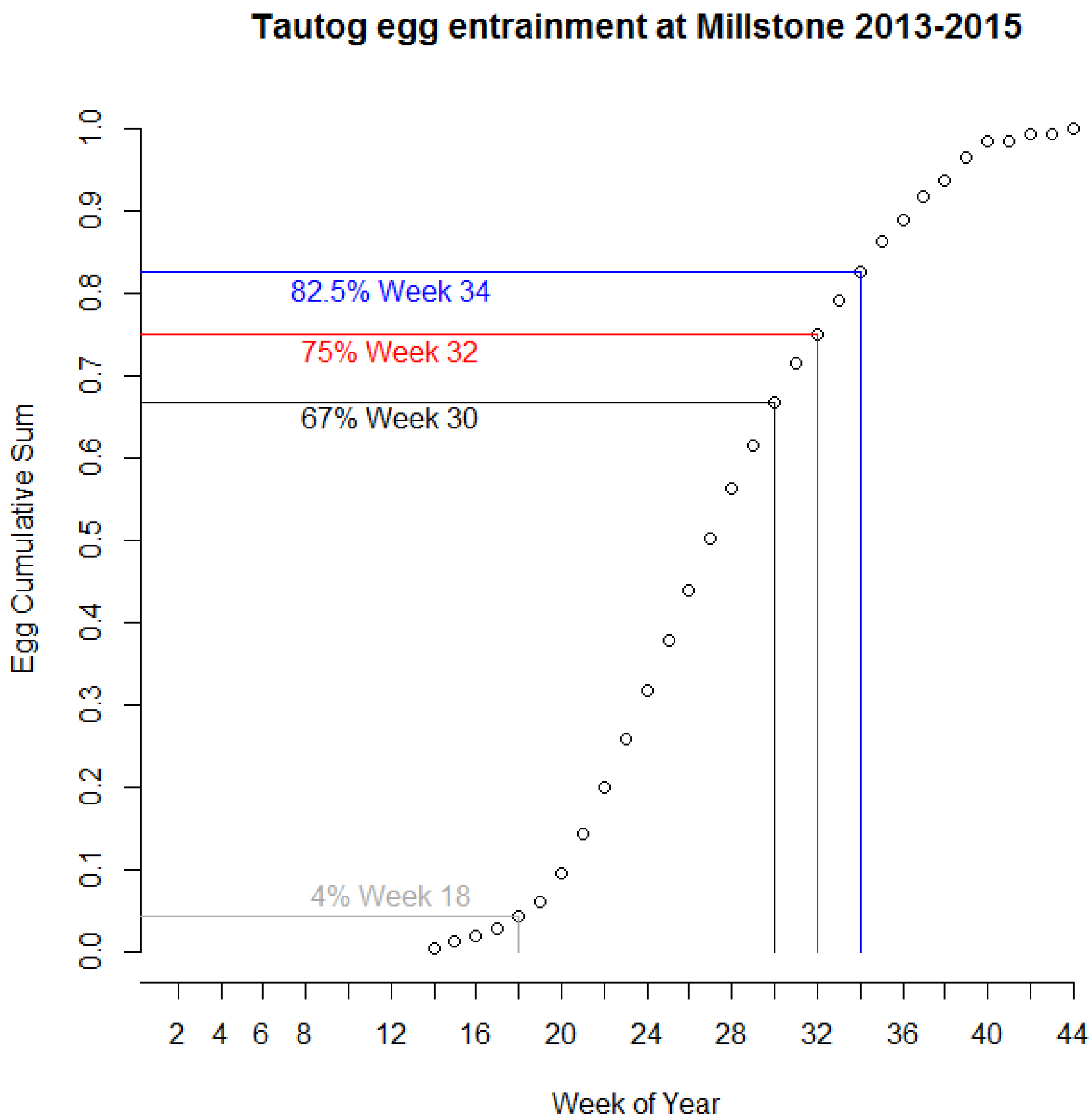


Figure 1: Mean annual cumulative sum of Tautog egg entrainment at the Dominion Millstone Power Station (Waterford, CT) for the years 2013-2015

Tautog Regional Harvest Reduction Analysis
Massachusetts-Rhode Island

Background

In October of 2016 the Tautog Management Board (Board) approved the creation of an Amendment to the fishery management plan for tautog. The Amendment will set forth management measures for the recreational and commercial fisheries for tautog that are meant to reduce the regional harvest in an effort to get the stock in to better stock status. The Amendment will achieve this reduction through the creation of regional management plans which match the structure of the current stock assessment regions.

Four regions will be established by the Amendment. Each region will implement tautog management programs that utilize minimum size limits, maximum possession limits, quotas, and seasonal closures that are designed to achieve a specific regional harvest reduction. The MARI region will contain the states of Massachusetts and Rhode Island. All states will agree to the regulations implemented within the region, though they may differ. Per the outcome of the February 2017 Tautog Board meeting, the MARI region is not overfished and overfishing is not occurring based on the selection of SPR reference points. Despite this, the tautog stock remains at a low biomass level, and some modest changes to management may be warranted in this region. The following is a method and two possible options for the states of RI and MA to consider for tautog management.

Methods and Results

The following are tools that can be used by RI and MA to calculate harvest reductions. The methods described below all use MRIP recreational data for the years of 2013 – 2015, only waves 2 – 6 are available for analysis in these states during these years. Additionally, both RI and MA have a commercial quota in state waters. Any needed reductions on the commercial side will be achieved through reductions in quota.

Four methods of estimating future recreational tautog harvest were employed. These included; 1.) seasonal reductions calculated from daily harvest rates based on MA and RI harvest from 2013 - 2015 waves 2 – 6 according to MRIP data; 2.) bag limit reduction calculations based on MA and RI harvest from 2013 - 2015 waves 2 – 6 according to MRIP data; 3.) reductions achieved from increasing the minimum size based on MRIP size distribution data from 2013 - 2015 waves 2 – 6, and 4.) a methodology for combining size, bag, and season harvest reduction calculations based on MA and RI harvest from 2013 - 2015 waves 2 – 6 according to MRIP data. In all cases, illegal harvest was accounted for in an effort to not give credit for illegal harvest and to also make the assumption that illegal harvest will occur in a similar fashion in the future as it has in the past.

Bag Limit Adjustments
Changes in harvest due to possession limit adjustments were analyzed using MRIP intercept data. In general, the analysis takes the intercept data as described above, weights and expands it, and simulates the effects of different bag limits were they to be implemented in the future. There is an added complication of differing seasonal regulations between MA and RI, these were accounted for in the analysis. The results of the analysis are indicated below (Table 1a and b).

Table 1a - The projected effects of various bag limits on future tautog recreational landings in MA and RI in waves 2 – 4 and a portion of wave 5, calculated as percent decrease from current management configuration.

Bag	1	2	3
RI	32%	7%	0%
MA	30%	7%	0%
2 States Combined	28%	5%	0%

Table 1b - The projected effects of various bag limits on future tautog recreational landings in MA and RI for a portion of wave 5 and all of wave 6, calculated as percent decrease from current management configuration.

Bag	1	2	3	4	5	6
RI	59%	32%	15%	6%	1%	0%
MA	30%	7%	0%	NA	NA	NA
2 States Combined	57%	30%	12%	4%	1%	0%

Seasonal Adjustments
Seasonal adjustments were also calculated by using the MRIP intercept data. In general, the analysis takes the intercept data for 2013-2015, weights and expands it, and calculates an average daily harvest rate for the data by wave. This harvest is then accumulated through the year, showing the different rates per wave as differing slopes in the lines (Figure 2). As noted above, calculations were run removing illegal harvest. Harvest reductions needed could be calculated based on these daily harvest rates by removing periods of time (closing a season) to accumulate enough of a harvest reduction to meet management goals.

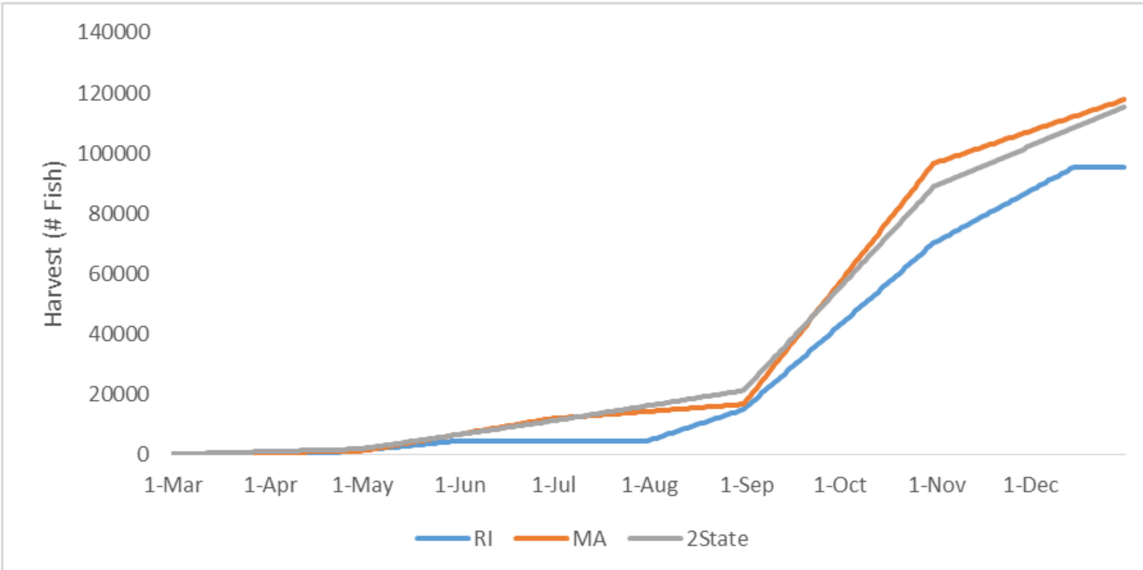


Figure 2 - Results of the season 1 catch rate analysis for MARI. The three lines represent state specific or combined state scenarios.

Minimum Size Adjustments

Minimum size adjustments were calculated by using the MRIP size data. In general, the analysis takes the size data from the MRIP survey, weights and expands it, and calculates a harvest at size in ½ inch bins. This harvest is then adjusted by simulating a new minimum size, protecting the harvest underneath the new minimum size, and calculating the reduction in harvest achieved (Figure 3, Table 2). An important note on the analysis is that illegal harvest (harvest on fish smaller than the legal 16 inch minimum size) was added back in to the analysis, so the assumption is that illegal harvest will remain in the future in the same proportions as it occurred in 2016.

One final calculation was made when adjusting size limits. For this portion of the analysis, the newly protected fish that had been harvested in previous years but would now be too small to harvest were considered discards. For these discarded fish, a 2.5% mortality rate was applied, and these dead discards were used to down weight the total reduction calculation for minimum size adjustments.

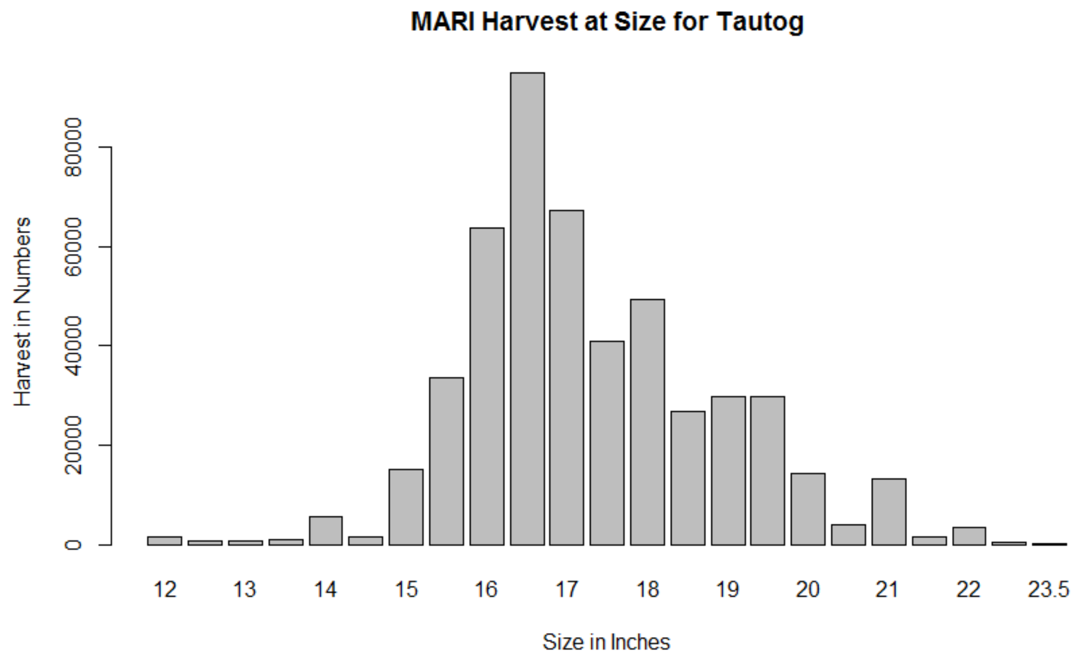


Figure 3 - Harvest at length 2013-2015 for the MARI region.

Table 2 - The projected effects of a size limit increase on recreational harvest in the MARI region, calculated as percent decrease from current management configuration. The right two columns account for dead discards.

Size	16.5”	17”	16.5” w/ discards	17” w/ discards
RI	14%	34%	13.6%	33%
MA	16%	39%	15.6%	38%
2 States Combined	14%	36%	13.6%	35%

Combination Seasonal, Bag, and Size Limit Adjustments

Combination seasonal and bag limit adjustments were also calculated by using the MRIP intercept data. In general, the analysis takes the intercept data, weights and expands it, and calculates a daily harvest level under simulated bag limits. This harvest is then accumulated through time and reported out. The results are presented below (Table 3). This table shows two options that seek to get the two states management programs in sync. Neither of these options use size limit as a management metric, and therefore concentrate on season and bag limit. Both RI and MA have a 16” minimum size which is fairly large. Pending the outcome of the TC analysis on slot limits, this may be an additional management strategy that the MARI region may wish to investigate.

Table 3 - Results of the combination season, bag, and size limit analysis for RI under 2 reduction strategies for Season 1

Options	Size (inches)	Bag Limit	Open Season	Reduction
Combined States Option 1	16	3	March 1 - May 31; August 1 - October 14	9%
		4	Oct 15 – Dec 31	
Combined States Option 2	16	3	March 1 - May 31; August 1 - October 14	19%
		3	Oct 15 – Dec 31	

Ed Liotta
45 Mapleton Ave
Farmingville, NY 11738
ed4136-977@optonline.net

Ashton Harp
ASMFC Fisheries Management Plan Coordinator
1050 N Highland Street
Arlington, VA 22201
Email: aharp@asmfc.org
Phone: 703-842-0740

4/28/2017

This is my public comment on Tautog fishing for the Atlantic States Marine Fisheries Commission’s 2017 Spring (May) Meeting.

Please read, a reference to Tautog spawning in the paragraph below. ASMFC posted on their website: http://www.asmfc.org/uploads/file//58f8d01fTautog.pdf

“Spawning begins in April in the southern part of the Mid-Atlantic Bight and begins in summer in the northern parts of the range. The spawning season generally extends from mid-May to mid-August and peaks in June and July.”

The States of New Jersey, Connecticut, and New York should not have a Tautog fishing season anytime from Mid May till Mid August when the Tautog is spawning.

The States of New Jersey, Connecticut, and New York should all have the same Tautog fishing season days, size, and possession limits.

Tautog fishing should only be recreational fishing if there is any commercial fishing it should be restricted like recreational.

Fishing for Tautog should only be using hook and line, not pots or traps. When pots or traps are used the lines can break leaving the Tautog to die eventually.

There should be large fines for people using small Tautog for bait, or people keeping undersize or out of season fish.

Thank you
Ed Liotta

Tina Berger

Subject: FW: Tautog

-----Original Message-----
From: Jcschoenig [mailto:wtfever@optonline.net]
Sent: Friday, April 28, 2017 10:14 PM
To: Ashton Harp <aharp@asmfc.org>
Subject: Tautog

My name is John S Schoenig and I am the Conservation Chairman for the Imperial Sportsmen and Suffolk Seniors fishing clubs. I actively attend all the meetings of the MRAC held at the DEC in New York.
I have on behalf of the two clubs have trying to get a spring Blackfish season in New York. We have not had one in 6years. At a recent meeting of MRAC they and the DEC agreed to actively support one. However it had to be approved by the technical committee of the ASMFC and it was not on their agenda for May. The DEC told me that they will ask for it to be put on the September agenda.
In my request for a spring Blackfish season i furthered said that no one should have possession of Blackfish during the spawn, any Blackfish on a recreational boat had to be euthanized and i am in favor of Commercial tagging to stop Recreational sales. I am also in favor of a separate Long Island Sound Region. I would like to know the Demarcation location for the East End.
Also note that the ASMFC considers Blackfish to be a Recreational fish 🐟 however in New York our season is 3 months and Commercial is 11 months (open during the spawn) Thank you for the opportunity to contact you during the public comment period.

Sent from my iPhone

Tina Berger

Subject: FW: Tautog

-----Original Message-----
From: Jcschoenig [mailto:wtfever@optonline.net]
Sent: Friday, April 28, 2017 10:14 PM
To: Ashton Harp <aharp@asmfc.org>
Subject: Tautog

My name is John S Schoenig and I am the Conservation Chairman for the Imperial Sportsmen and Suffolk Seniors fishing clubs. I actively attend all the meetings of the MRAC held at the DEC in New York.
I have on behalf of the two clubs have trying to get a spring Blackfish season in New York. We have not had one in 6years. At a recent meeting of MRAC they and the DEC agreed to actively support one. However it had to be approved by the technical committee of the ASMFC and it was not on their agenda for May. The DEC told me that they will ask for it to be put on the September agenda.
In my request for a spring Blackfish season i furthered said that no one should have possession of Blackfish during the spawn, any Blackfish on a recreational boat had to be euthanized and i am in favor of Commercial tagging to stop Recreational sales. I am also in favor of a separate Long Island Sound Region. I would like to know the Demarcation location for the East End.
Also note that the ASMFC considers Blackfish to be a Recreational fish 🐟 however in New York our season is 3 months and Commercial is 11 months (open during the spawn) Thank you for the opportunity to contact you during the public comment period.

Sent from my iPhone

Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM V TO AMENDMENT 6 TO THE ATLANTIC STRIPED BASS INTERSTATE FISHERY MANAGEMENT PLAN

This draft document was developed for Management Board review and discussion only. This document is not intended to solicit public comment as part of the Commission/State formal public input process. Comments on this draft document may be given at the appropriate time on the agenda during the scheduled meeting. If approved, a public comment period will be established to solicit input on the issues contained in the document.

ASMFC Vision:
Sustainably Managing Atlantic Coastal Fisheries

May 2017

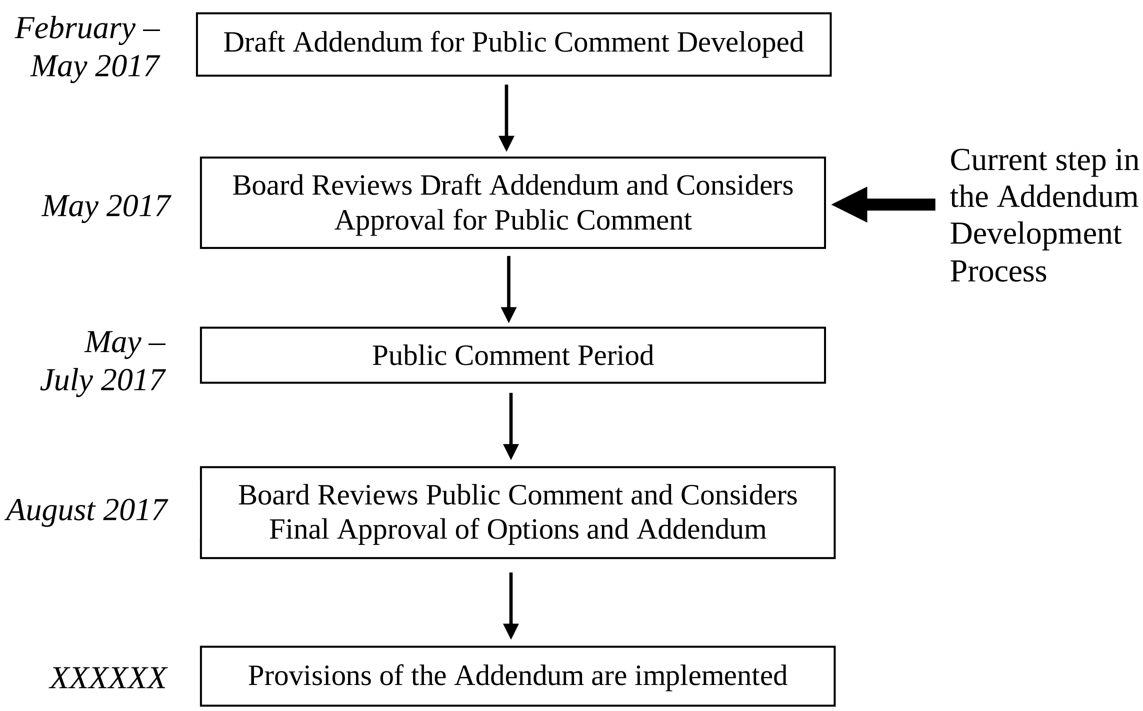
Public Comment Process and Proposed Timeline

In February 2017, the Atlantic Striped Bass Management Board initiated an addendum to Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass to consider changes to coastwide commercial and recreational regulations. This draft addendum presents background on the Atlantic States Marine Fisheries Commission's management of striped bass, the addendum process and timeline, a statement of the problem, and proposed management options.

The public is encouraged to submit comments regarding this document at any time during the addendum process. **The final date comments will be accepted is 5pm on [Month Day], 2017**. Comments may be submitted by mail, email, or fax. If you have any questions or would like to submit comment, please use the contact information below.

Mail: Max Appelman, Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street Suite 200A-N
Arlington, VA 22201

Email: mappelman@asmfc.org
(Subject: Striped Bass Addendum V)
Phone: (703) 842-0740
Fax: (703) 842-0741



1.0 Introduction

Atlantic striped bass are managed through the Atlantic States Marine Fisheries Commission (Commission) in state waters (0-3 miles) and through NOAA Fisheries in federal waters (3-200 miles). The management unit includes the coastal migratory stock between Maine and North Carolina. Atlantic striped bass are currently managed under Amendment 6 (2003) to the Interstate Fishery Management Plan (FMP) and Addenda I–IV.

At its February 2017 meeting, the Board initiated the development of Draft Addendum V to Amendment 6 to the Atlantic Striped Bass FMP to consider a relaxation of the coastwide commercial and recreational regulations to bring fishing mortality to the target-level based on the 2016 stock assessment update. The Board's action responds to concerns raised by Chesapeake Bay jurisdictions regarding continued economic hardship endured by its stakeholders since the implementation of Addendum IV and information from the 2016 stock assessment update indicating that fishing mortality in 2015 (the terminal year of the assessment) is below the target.

2.0 Overview

2.1 Statement of the Problem

According to the results of the 2016 stock assessment update, the Atlantic striped bass stock is not overfished and overfishing is not occurring. Furthermore, implementation of Addendum IV successfully reduced fishing mortality (F) below the F target of 0.18; F in 2015 was estimated to be 0.16. However, stakeholders from the Chesapeake Bay jurisdictions, especially from the for-hire sector (e.g., charter boats), have expressed economic hardship due to the implementation of more restrictive measures required by Addendum IV. To address this issue, and based on results of the 2016 assessment update indicating F is below the target, the Board determined that coastwide commercial and recreational regulations could be relaxed to increase F to the target-level and provide more opportunities for fishermen to retain fish. As such, Draft Addendum V proposes alternative management measures aimed to increase removals by 10% compared to 2015-levels in order to achieve F target. However, the issue of relaxation becomes confounded as length-frequency data from the catch in 2015 indicates a strong presence of the 2011 year class which is anticipated to join the coastal spawning population this year, and conservation of the 2011 year class was an objective of Addendum IV.

2.2 Background

2.2.1 Management History

For centuries, Atlantic striped bass (*Morone saxatilis*) have formed the basis of one of the most important fisheries on the U.S. Atlantic coast. The Commission first developed an FMP for Atlantic striped bass in 1981 in response to declining landings and juvenile recruitment in the 1970's. However, overfishing and poor environmental conditions led to the collapse of the fishery in the 1980s and many Atlantic coast states imposed complete moratorium on harvest beginning with

Maryland and Delaware in 1985[1]. The fisheries reopened in 1990 under Amendment 4 which implemented regulations designed to rebuild the resource rather than maximize yield. Commercial fisheries were limited to 20% of the average landings from the 1972-1979 base period, and recreational fisheries implemented a one fish bag limit and a 28 inch minimum size limit along the coast and 18 inch minimum size limit in producer areas (i.e., the Hudson River and Chesapeake Bay), however, states could implement alternative management measures as long as F remained below the target. In 1995, when the fishery was declared restored, Amendment 5 increased the F target and put in place regulations to achieve that F target including an increase in the coastal recreational bag limit from one fish to two, and an increase in the commercial harvest to 70% of that during the base period.

Since Amendment 4, the foundation of the striped bass management program has been to maintain harvest at or below an F target. Amendment 6, implemented in 2003, modified the F targets and thresholds, and introduced a new set of biological reference points (BRPs) based on the 1995 estimate of female spawning stock biomass (SSB), the year the stock was declared restored, as well as a list of management triggers based on the BRPs, (i.e., SSB and F targets and thresholds). These new reference points and management triggers have enabled the Board to be more responsive to changes in the stock.

Amendment 6 also phased in new regulations for both the commercial and recreational fisheries. Coastal commercial fisheries (i.e., fisheries that operate in ocean waters) were managed by a 28 inch minimum size limit (with the exception of the Delaware Bay fishery) and state-specific quota allocations, which were restored to 100% of the states' average landings during the 1972-1979 base period. Additionally, states could implement lower size limits through conservation equivalency often resulting in a reduced quota for that state. The Chesapeake Bay commercial fisheries were managed by an 18 inch minimum size limit and an annually adjusted quota based on changes in exploitable stock biomass, and split between the jurisdictions of Maryland, Virginia and the Potomac River Fisheries Commission (PRFC). The Chesapeake Bay commercial fishery measures aimed to maintain fishing mortality at or below the Chesapeake Bay-specific F target (0.27).

For the recreational fisheries, Amendment 6 required all states to implement a two fish bag limit and a 28 inch minimum size limit. The Chesapeake Bay and Albemarle Sound/Roanoke River (A/R) regulatory programs differed from the coastal migratory program because these programs were predicated on a more conservative F target. Accordingly, these jurisdictions were able to implement separate seasons, harvest caps, and size and bag limits as long as they remained under the F target for those areas.

Approved in 2007, Addendum I to Amendment 6 established a bycatch monitoring and research program to increase the accuracy of data on striped bass discards and also recommended development of a web-based angler education program. Addendum II was implemented in 2010

[1] Connecticut, New York, New Jersey, Virginia and the Potomac River Fisheries Commission followed suit between 1986 and 1989 (North Carolina closed their ocean fishery in 1984, but still allowed striped bass landings in inland waters).

and established a new definition of recruitment failure. In 2012, Addendum III was approved. The Addendum requires states and jurisdictions with commercial striped bass fisheries to implement a commercial harvest tagging program. The Addendum was initiated in response to significant poaching events in the Chesapeake Bay and aims to limit illegal harvest of striped bass.

Federal waters, also known as the exclusive economic zone (EEZ), has been closed to the harvest, possession, and targeting of striped bass since 1990, with the exception of a defined transit zone within Block Island Sound, to provide additional protection to striped bass and ensure the effectiveness of state regulations. A recommendation was made in Amendment 6 to re-open federal waters to commercial and recreational fisheries. However, NOAA Fisheries concluded opening the EEZ to striped bass fishing was not warranted at that time.

Implementation of Addendum IV

In October 2014, the Commission approved Addendum IV. The Addendum established one set of F reference points for the coastal migratory population in all management areas because modeling and data limitations precluded the ability to estimate separate stock specific reference points (i.e., coastal and Chesapeake Bay F reference points as previously used). Additionally, the 2013 benchmark stock assessment indicated that SSB was below the target for two consecutive years and F was above the target in at least one of those years, triggering management action (ASMFC 2003). While the SSB was not below its threshold nor F above its threshold, a decline in SSB has been observed since 2003. Accordingly, the Addendum also required a reduction in removals in order to reduce F to a level at or below the new F target. To achieve this, starting in 2015, coastal commercial state quotas were reduced by 25% percent from the Amendment 6 allocation, and the Chesapeake Bay commercial quota was set at its 2012 harvest level less 20.5%. For the recreational sector, coastal states reduced to a one fish bag limit and maintained a 28 inch minimum size limit to achieve a 25% reduction in removals from 2013 harvest levels. The Chesapeake Bay jurisdictions implemented a two fish bag limit with a slot limit from 20-28 inches or a two fish bag limit with one fish in the 20-28 inch slot and one fish over a 28 inch minimum size limit to achieve a 20.5% reduction in removals from 2012 harvest levels. Some states elected to implement alternative management measures through the FMPs conservation equivalency process.

Since the A/R stock was deemed by the Commission to contribute minimally to the coastal migratory population, Addendum IV also formally defers management of the A/R stock to the State of North Carolina using reference points from the latest North Carolina A/R stock assessment accepted by the Technical Committee (TC) and approved for management use by the Board. Accordingly, the recreational and commercial fisheries in the A/R operate under North Carolina's FMP while the North Carolina recreational and commercial fisheries in the Atlantic Ocean continue to operate under the Commission's management measures for the rest of the coastal fisheries.

2.2.2 Status of the Stock

The 2013 benchmark stock assessment for coastal migratory Atlantic striped bass was peer-reviewed at the 57th Northeast Regional Stock Assessment Workshop (SAW), and approved by the Board for management use in October 2013. Among other changes, the statistical catch-at-age (SCA) model – which produces estimates of F, SSB, abundance and recruitment – was generalized to allow specification of multiple fleets, different stock-recruitment relationships, and year- and age-specific natural mortality rates. New F reference points were chosen to link the target and threshold F with the target and threshold female SSB, which is that level of SSB estimated in 1995 (the year the Commission originally declared coastal and Chesapeake Bay striped bass stocks restored). Additionally, the SAW Review Committee identified high priority items for consideration in future assessments including continued improvement of the spatial modeling of the stock and incorporating tagging data to better account for population dynamics.

The Atlantic striped bass stock assessment is updated with the most recent catch and survey data roughly every two years to provide annual estimates of SSB and F. The assessment was most recently updated in 2016 using catch and survey data through 2015 (ASMFC 2016a). The striped bass stock is said to be overfished when female SSB falls below the SSB threshold, and overfishing is occurring when F is estimated to be above the F threshold. In 2015, the Atlantic striped bass stock was not overfished or experiencing overfishing. SSB has declined since 2003 while total F has fluctuated between 0.18 and 0.27 from 2003 to 2014. In 2015, SSB was estimated at 58,853 metric tons (129 million pounds) which is below the SSB target of 72,032 metric tons and just above the SSB threshold of 57,626 metric tons (Figure 1). Total F was estimated at 0.16 in 2015 which is below the F threshold of 0.22 and below the F target of 0.18 (Figure 2). However, the TC stresses that although the assessment is very good, it may not be able to distinguish between F point estimates of 0.16 and 0.18. In other words, the upper and lower bounds of the confidence intervals for both F estimates would essentially overlap.

2.2.3 Status of the Fishery

Commercial Fishery Status

From 2003 to 2014, under the Amendment 6 quota management system, total and state-specific commercial harvest of striped bass has varied little from year-to-year, ranging from an estimated 2.4 to 3.1 million pounds for coastal fisheries (Table 1 and Figure 3) and 3.3 to 4.4 million pounds for Chesapeake Bay fisheries (Table 2 and Figure 3). Massachusetts and New York account for the majority of coastal commercial landings with a combined average of 67% annually. In 2015, through the implementation of Addendum IV, the coastal commercial quota was reduced by 25% resulting in an estimated harvest of 1.9 million pounds, and the Chesapeake Bay commercial quota was set at 3,120,247 pounds (a 20.5% reduction from the 2012 harvest estimate) resulting in an estimated harvest of 2.9 million pounds. Within the A/R management area, commercial harvest (Albemarle Sound only) from 2003 to 2015 ranged from 68,214 to 273,636 pounds and was estimated at 113,475 pounds in 2015 (Table 3).

Commercial dead discards continue to be a source of uncertainty in the Atlantic striped bass stock assessment, and estimates vary considerably from year to year making it difficult to account for commercial dead discards during development of potential alternative management measures. To estimate commercial releases, the assessment uses the ratio of tags returned from the recreational fishery to those returned from the commercial fishery, and then apportions the releases among gears based on gear-specific tag-returns. Commercial dead discards are then estimated via gear-specific post-release mortality rates. In 2015, total commercial dead discards were estimated at 299,566 fish, a 68% decrease from 2014 (931,391 fish) and the lowest estimate since 2010 (Table 4).

Unlike the Chesapeake Bay commercial fishery, the coastal commercial fishery has regularly underachieved its quota by roughly 20% annually since 2003 (Table 1). The coastal quota underage is mainly attributed to game fish status in several states. Accordingly, commercial fishing for striped bass in Maine, New Hampshire, Connecticut, and New Jersey is prohibited. Together, these four states are allocated 9% of the total coastal commercial quota. Furthermore, the underage has increased in recent years since migratory striped bass have not been available to the ocean fishery in North Carolina resulting in minimal harvest. However, it is important to note that the anticipated arrival of the 2011 year class along the coast could impact the availability of striped bass to North Carolina ocean fisheries (see section on *availability of the 2011 year class* below).

Recreational Fishery Status

From 2003 to 2014, total coastal recreational harvest has ranged from a high of 26.6 million pounds in 2008 to a low of 16.7 million pounds in 2012 (Table 5 and Figure 3). In 2015, following implementation of Addendum IV, coastal recreational harvest was estimated at 13.3 million pounds, a 33% decrease from 2014. Harvest from New York (30%), New Jersey (24%) and Massachusetts (23%) accounted for 77% of the annual coastal recreational harvest since 2003.

From 2003 to 2014, recreational harvest from the Chesapeake Bay has fluctuated from a high of 6.4 million pounds in 2006 to a low of 2.5 million pounds in 2013 (Table 2 and Figure 3). However, the annual harvest has dropped from an average of 5.4 million pounds (2003 to 2009) to 3.1 million pounds (2010 to 2015). In 2015, following implementation of Addendum IV, Chesapeake Bay recreational harvest was estimated at 3.5 million pounds, a 6% decrease from 2014.

In the A/R, a recreational fishery quota is divided equally between the two management areas. From 2003-2014, the A/R recreational quota was set at 275,000 pounds and average harvest was 106,513 pounds. In 2015, the quota was set at 137,500 pounds and harvest was estimated at 126,970 pounds (Table 3).

From 2003 to 2008, the number of fish released alive averaged 17.0 million fish, resulting in an average estimated dead discards of 1.5 million fish (Table 4). Since then the number of fish released has been much lower, averaging 7 million fish from 2009 to 2015 and resulting in an annual average estimated dead discards of 637,370 fish. Reasons for the decline may include, but are not limited to, a reduction in stock size from the peak in 2003, a decreased availability of fish in nearshore areas, and changes in angler behavior in response to socioeconomic factors.

2.2.4 Performance of Addendum IV Regulatory Measures in 2015

Following the first full year of Addendum IV implementation, the Atlantic Striped Bass Plan Review Team (PRT) conducted a preliminary analysis on the performance of Addendum IV regulatory measures by comparing actual harvest in 2015 to the reference period (2013 for the ocean and 2012 for the Chesapeake Bay). The PRT determined that at the coastwide-level, the predicted harvest reduction for 2015 was nearly the same as the observed harvest; the estimated and realized reduction in harvest across all regions and fisheries was 25.8% and 25.9%, respectively (ASMFC 2016b). Also, the commercial harvest reduction for both the coastal (24.9%) and Chesapeake Bay (25.1%) fisheries was close to the predicted reductions (Table 6). However, the recreational fisheries along the coast and in the Chesapeake Bay diverged significantly from the predicted values (Table 7 and Table 8).

As a result of these findings, the Board tasked the TC to identify the variables contributing to the large differences in the recreational fishery between the observed harvest and those estimated by the TC during development of Addendum IV.

Availability of the 2011 year class

The TC concluded that changes in effort, changes in the size and age structure of the population, and the distribution of the 2011 year class along the coast relative to the Chesapeake Bay were the most significant variables contributing to the large differences in the realized harvest compared to those estimated by the TC (ASMFC 2016c). The 2011 year class was the largest recruitment event since 2004, and was nearly fully available to the Chesapeake Bay recreational fisheries in 2015 (age 4), whereas these fish were only partially available to the ocean recreational fisheries (i.e., due to age at first migration, there was a greater proportion of the 2011 year class in the Chesapeake Bay relative to the ocean in 2015). The population dynamics at this age, coupled with the length of those fish in 2015 relative to the Chesapeake Bay's and ocean's minimum size limits, led to increased catch rates and harvest of striped bass in the Chesapeake Bay.

Based on the accepted age at first migration (Secor and Piccoli 2007), individuals from the large 2011 year class are currently migrating out of the Chesapeake Bay to join the coastal migratory population. Accordingly, these fish are anticipated to become increasingly available to coastal recreational fisheries over the next few years. Furthermore, based on state submitted catch at length data, it is not uncommon for age six striped bass to be of harvestable size (i.e., 28" or greater) and are therefore likely to be the target of coastal fisheries this year (ASMFC 2016a).

Preliminary 2016 Recreational Removals Estimate

In 2015, total recreational removals (harvest and dead discards from Atlantic coastal and Chesapeake Bay fisheries) were estimated at 2,100,094 fish (ASMFC 2016a). According to the Marine Recreational Information Program (MRIP), the 2016 preliminary removals estimate (harvest and dead discards) is 2,668,887 fish, which is a 27% increase from 2015 or an increase of 568,793 fish. It is important to note that this addendum aims to achieve an increase in total removals (i.e., commercial and recreational harvest plus dead discards) by 10%, or approximately 327,000 fish relative to 2015 total removals. In other words, under status quo regulations (i.e., current recreational and commercial regulations), target F could be achieved or exceeded in 2017. Refer to Appendix 1 for recreational fishery regulations by state and fishery.

2.2.5 Socioeconomic Impacts

Overall benefits of increasing catch are expected to benefit direct users with providing more fish to them with the following further pluses. For commercial fishermen this means expected increased incomes provided that substitute fish such as farmed striped bass are not filling the market. For recreational fishermen, including for-hire participants, this means increased numbers of trips and/or numbers of recreational fishermen, enhanced bait sales and further ancillary economic activity such as hotel rooms, and meals associated with trips, more tackle sales, and affiliated materials. However, short term gains in harvest could be negated by an overall decline in the future performance of the fishery given the uncertainties in the data.

3.0 Management Options

The coastwide area can be defined as the entire management unit (i.e., all coastal and estuarine areas of all states and jurisdictions from Maine through North Carolina) excluding the Albemarle Sound/Roanoke River management areas. For management purposes, the coastwide area is further divided into the Chesapeake Bay management area (i.e., Maryland, Potomac River Fisheries Commission, District of Columbia and Virginia fisheries that operate in inland waters) and the coastal management area which refers to ocean waters (i.e., all fisheries from Maine through North Carolina that operate in estuarine or ocean waters). Draft Addendum V does not propose alternative options for the Albemarle Sound/Roanoke River management areas managed by the State of North Carolina under the auspice of the Commission.

In October 2016, the TC was tasked to determine the percent liberalization in harvest that would increase F from the 2015 terminal year estimate of 0.16 to the FMP F target of 0.18. To do this, the TC performed a stock projection analysis using a constant F of 0.16 in 2015 and F of 0.18 in 2016 and 2017 to estimate total removals in 2016 and 2017 (ASMFC 2017). Results indicate that an estimated 10% increase from 2015 removals, or 3.33 million fish, would achieve F target (0.18) in 2017. It is important to note that estimated removals includes commercial harvest, recreational harvest, commercial dead discards and recreational dead discards. The TC also noted that according to the 2016 preliminary removals estimate (3,557,510 fish), a 6% decrease in removals would be required to achieve F target in 2017.

Accordingly, the following proposed management measures aim to increase removals by 10% relative to the 2015 removals estimate of 3,017,358 fish, as determined by the TC (ASMFC 2017), to achieve F target in 2017[2] (i.e., to increase removals to 3.33 million fish, including dead discards). Amendment 6 (Section 4.6) also allows states to submit alternative regulations that are conservation equivalents to regulations approved in this document for TC review and Board approval. Several states currently implement conservation equivalency programs in order to have management measures that meet the needs of their state's fishery (see Appendix 1). Additionally, states may voluntarily implement management programs that are more conservative than those required herein. If the Board approves changes to the current striped bass management program through this document, all states would need to re-submit conservation equivalency programs for Board approval.

[2] The TC projected removals through 2017. However, due to state regulatory processes, effective implementation of alternative management measures approved through this document would not occur until the end of 2017, or early 2018. Therefore, the Board should consider the effects of implementation of Addendum V beyond the timeframe of the projections.

This section would replace Section 3.1 in Addendum IV to Amendment 6.

3.1 Proposed Recreational Fishery Management Program

Recreational fisheries will be constrained by minimum size limits and bag limits. Jurisdictions may use additional regulations to ensure the target fishing mortality rate is not exceeded (i.e., fishing seasons or harvest caps). If a jurisdiction uses harvest caps in its recreational fishery, any amount over the cap shall be subtracted from the following year's recreational quota.

Option A: Status Quo

It is important to note that this addendum aims to achieve an increase in total removals (i.e., commercial and recreational harvest plus dead discards) by 10%, or approximately 327,000 fish, relative to 2015. Therefore, status quo regulations (i.e., current recreational and commercial regulations) could achieve or exceed target F in 2017 because 2016 preliminary removals are estimated to be greater than a 10% increase relative to 2015 levels. Refer to Appendix 1 for recreational fishery regulations by state and fishery.

<u>Coastal Recreational Fishery</u>

All coastal jurisdictions (excluding Chesapeake Bay and the Albemarle Sound/Roanoke River) will be constrained by a one fish bag limit and 28-inch minimum size limit. Any coastal jurisdiction submitting a proposal for conservation equivalency must demonstrate through quantitative analysis that its proposal achieves at least a 25% reduction in harvest (including estimated dead discards) from its coastal recreational fishery relative to 2013 harvest. All conservation equivalency proposals are subject to TC review and Board approval. Note: the Chesapeake Bay spring trophy fishery is part of the coastal fishery for management purposes.

Note: jurisdictions with approved conservation equivalency programs do not need to resubmit proposals. However, jurisdictions must follow the Commission's conservation equivalency process (Amendment 6 (Section 4.6) and the Conservation Equivalency Policy and Technical Guidance Document) in order to implement any future alternative regulations (i.e., regulations that differ from the one fish bag limit and 28 inch minimum size limit, or that differ from those currently implemented).

<u>Chesapeake Bay Management Area Recreational Fishery (Maryland, Potomac River Fisheries Commission, District of Columbia and Virginia would implement)</u>

The Chesapeake Bay jurisdictions will submit a management program that achieves at least a 20.5% reduction from 2012 harvest (including estimated dead discards) in the Chesapeake Bay recreational fishery for TC review and Board approval. The Chesapeake Bay fisheries reductions were based on 2012 harvest because the Bay-wide quota had already been reduced by 14% in 2013.

Note: jurisdictions with approved programs do not need to resubmit proposals. However, jurisdictions must follow the Commission's conservation equivalency process (Amendment 6 (Section 4.6) and the Conservation Equivalency Policy and Technical Guidance Document) in order to implement any future alternative regulations (i.e., regulations that differ from those currently implemented).

Option B: relax recreational fishery regulations

The tables below provide a suite of options for both the coastal and Chesapeake Bay recreational fisheries. When providing input on these options, please identify one preferred option each for the coastal and Chesapeake Bay fisheries. All size limits are in total length (TL). Estimated total removals include dead discards.

Coastal Recreational Fishery (All jurisdictions would implement)

The following alternative management measures would apply to all coastal recreational fisheries. For Option B1, 2015 jurisdiction-specific measures (i.e., bag limits, and upper bound of any slot limits) would also apply (refer to Appendix 1).

Option	Bag Limit*	Size Limit*	Season*	% Diff From 2015 Removals	Estimated Total Removals (number of fish)
B1	1	27 inch minimum	*(see Appendix 1)*	+12	1,360,566
B2	Submit a program that achieves no more than a 10% increase from 2015 removals (including estimated dead discards) for TC review and Board approval				

* Additional jurisdiction-specific restrictions, or exceptions through conservation equivalency, may apply (refer to *Appendix 1*).

Chesapeake Bay Management Area Recreational Fishery (Maryland, Potomac River Fisheries Commission, District of Columbia and Virginia would implement)

The following alternative management measures would apply to Chesapeake Bay recreational fisheries. Bag limits and size limits under Options B3 and B4 would apply to the specific dates listed and 2015 jurisdiction-specific measures (i.e., bag limits, and minimum size and slot limits) would apply to all other time periods (refer to Appendix 1).

Option	Bag Limit	Size Limit*	Season	% Diff From 2015 Removals	Estimated Total Removals (number of fish)
B3	2	19-28 inch slot	September 1 - October 31	+9	881,885
B4	2	19-28 inch slot	May 16 - August 31	+9	884,695
B5	Submit a program that achieves no more than a 10% increase from 2015 removals (including estimated dead discards) for TC review and Board approval				

* One of the two fish possession limit can be greater than 28 inches. Additional jurisdiction-specific restrictions, or exceptions through conservation equivalency, may apply (refer to *Appendix 1*).

This section would replace Section 3.2 in Addendum IV to Amendment 6.

3.2 Proposed Commercial Fishery Management Options

In the tables below all quota options and harvest estimates are in pounds. It is important to note that total estimated harvest does not include dead discards. See Section 2.2.3 for more information on commercial dead discard estimates.

Option A: Status Quo

Coastal Commercial Fishery

No change to the Addendum IV coastal commercial quota of 2,854,709 pounds and the state-specific coastal commercial quota allocations. These quotas reflect a 25% reduction from the previous Amendment 6 quotas. *Note: jurisdictions with approved conservation equivalency programs do not need to resubmit proposals.*

Chesapeake Bay Management Area Commercial Fishery (Maryland, Potomac River Fisheries Commission and Virginia would implement)

No change to the Addendum IV Chesapeake Bay commercial quota of 3,120,247 pounds. This quota represents a 20.5% reduction from 2012 Chesapeake Bay commercial harvest.

	For Reference	OPTION A Status Quo
	2015 Harvest	**Addendum IV Quota**
Chesapeake Bay Total	**2,942,522**	**3,120,247**
Coastal Total	**1,886,522**	**2,854,709**
State-Specific Coastal Commercial Quota Allocations		
Maine*	-	188
New Hampshire*	-	4,313
Massachusetts	865,753	869,813
Rhode Island	188,475	182,719
Connecticut**	-	17,813
New York	515,459	795,795
New Jersey**	-	241,313
Delaware	144,068	145,085
Maryland	34,626	98,670
Virginia	138,141	138,640
North Carolina	0	360,360
Total Estimated Harvest +	**4,829,044**	**5,350,969 (5,711,329)**
% Diff From 2015 Harvest +	**0%**	**+11% (+18%)**

* Commercial harvest/sale prohibited, with No re-allocation of quota to the recreational fishery

** Commercial harvest/sale prohibited, with re-allocation of quota to the recreational fishery

+ For Option A, total estimated harvest assumes no commercial harvest for game fish states (i.e., Maine, New Hampshire, Connecticut, and New Jersey) and North Carolina. Total estimated harvest in parenthesis assumes no commercial harvest for game fish states only.

Option B: applies a 10% increase to the Addendum IV quota.

Coastal Commercial Fishery

The coastal commercial quota will be 3,140,180 pounds and will be allocated to coastal jurisdictions following the state-specific quota allocation percentages in Amendment 6 and Addendum IV.

Chesapeake Bay Management Area Commercial Fishery (Maryland, Potomac River Fisheries Commission and Virginia would implement)

The Chesapeake Bay commercial quota will be 3,432,272 pounds.

	For Reference	OPTION B
	2015 Harvest	**10% Increase to Add IV Quota**
Chesapeake Bay Total	**2,942,522**	**3,432,272**
Coastal Total	**1,886,522**	**3,140,180**
State-Specific Coastal Commercial Quota Allocations		
Maine*	-	207
New Hampshire*	-	4,744
Massachusetts	865,753	956,794
Rhode Island	188,475	200,991
Connecticut**	-	19,594
New York	515,459	875,375
New Jersey**	-	265,444
Delaware	144,068	159,594
Maryland	34,626	108,537
Virginia	138,141	152,504
North Carolina	0	396,396
Total Estimated Harvest +	**4,829,044**	**5,886,067 (6,282,464)**
% Diff From 2015 Harvest +	**0%**	**+22% (+30%)**

* Commercial harvest/sale prohibited, with No re-allocation of quota to the recreational fishery

** Commercial harvest/sale prohibited, with re-allocation of quota to the recreational fishery

\+ For Option B, total estimated harvest assumes no commercial harvest for game fish states (i.e., Maine, New Hampshire, Connecticut, and New Jersey) and North Carolina. Total estimated harvest in parenthesis assumes no commercial harvest for game fish states only.

4.0 Compliance Schedule

If approved, states must implement Addendum V according to the following schedule to be in compliance with the Atlantic Striped Bass Interstate Fishery Management Plan:

XXXXXX: States submit proposals to meet requirements of Addendum V.

XXXXXX: Management Board reviews and takes action on state proposals.

[Month Day, Year]: States implement regulations.

5.0 Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 2003. Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass. Washington (DC): ASMFC. Fisheries Management Report No. 41. 63 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2013. Update of the Striped Bass Stock Assessment using Final 2012 Data. A report prepared by the Atlantic Striped Bass Technical Committee. 74 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2014. Addendum IV to Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass. ASMFC. Fisheries Management Report No.

Atlantic States Marine Fisheries Commission (ASMFC). 2016a. Update of the Striped Bass Stock Assessment. A report prepared by the Atlantic Striped Bass Technical Committee. M16-088. 101 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2016b. 2016 Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Atlantic Striped Bass. Approved August 3, 2016. 37 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2016c. Performance Evaluation of Addendum IV Regulatory Measures in 2015. A memorandum prepared by the Atlantic Striped Bass Technical Committee to the Atlantic Striped Bass Management Board. October 5, 2016. M16-087. 14 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2017. Percent Liberalization in Harvest (0.16 to 0.18) and Dataset Recommendation for Conservation Equivalency Proposals. A memorandum prepared by the Atlantic Striped Bass Technical Committee to the Atlantic Striped Bass Management Board. January 13, 2017. M17-011. 4 p.

Secor, D.H. and P.M. Piccoli. 2007. Oceanic migration rates of Upper Chesapeake Bay striped bass (*Morone saxatilis*), determined by otolith microchemical analysis. Fisheries Bulletin 105: 62-73.

Southwick Associates. 2005. The Economics of Recreational and Commercial Striped Bass Fishing. Report for Stripers Forever. Available online at: https://www.stripersforever.org/wp-content/uploads/2013/01/Stripers.pdf

6.0 Tables and Figures

Table 1. Total coastal commercial harvest of Atlantic striped bass by state (pounds) and percent of quota utilized, 2003-2015. Source: ASMFC State Compliance Reports.

	Coastal Commercial Harvest by State							Total Coastal Commercial Harvest	Coastal Commercial Quota	Percent Quota Utilized
Year	MA	RI	NY	DE	MD^	VA^	NC*^			
2003	1,055,439	246,312	753,261	188,419	98,149	159,786	434,369	2,935,735	3,414,258	86%
2004	1,206,305	245,204	741,668	181,974	115,453	160,301	421,645	3,072,550	3,515,882	87%
2005	1,104,737	242,303	689,821	173,815	46,871	184,734	454,521	2,896,802	3,467,748	84%
2006	1,312,168	238,797	688,446	185,987	91,093	194,934	352,036	3,063,461	3,524,083	87%
2007	1,040,328	240,627	729,743	188,668	96,301	165,587	424,723	2,885,977	3,362,332	86%
2008	1,160,122	245,988	653,100	188,719	118,005	164,400	299,162	2,829,496	3,491,171	81%
2009	1,138,291	234,368	789,891	192,311	127,327	140,420	189,995	2,812,603	3,484,774	81%
2010	1,224,356	249,520	782,402	185,410	44,802	116,338	272,632	2,875,460	3,510,897	82%
2011	1,163,865	228,163	854,731	188,620	21,401	158,811	242,600	2,858,191	3,441,327	83%
2012†	1,219,665	239,913	681,399	194,324	77,551	170,788	6,226	2,589,866	3,406,527	76%
2013	1,002,519	231,280	823,801	191,424	93,532	182,427	0	2,524,983	3,372,173	75%
2014	1,138,507	217,037	531,456	167,902	120,923	183,668	0	2,359,493	3,764,770	63%
2015	865,753	188,475	509,135	144,068	34,626	138,141	0	1,880,198	2,854,706	66%

* NC values represent harvest during the December 1- November 30 fishing year
^ MD, VA, and NC harvest from ocean only. Does not include harvest from the Chesapeake Bay or Albemarle Sound/Roanoke River
†The impacts of hurricane Sandy may have caused lower harvest in 2012 in some states

Table 2. Total recreational and commercial harvest of Atlantic striped bass from the Chesapeake Bay in pounds, 2003-2015. Source: ASMFC State Compliance Reports and Marine Recreational Information Program (MRIP) queried March, 2017.

Chesapeake Bay Harvest			
Year	**Commercial**	**Recreational**	**Total Harvest**
2003	4,169,585	5,129,482	9,299,067
2004	4,156,977	4,337,252	8,494,229
2005	4,102,804	6,185,654	10,288,458
2006	4,008,349	6,420,077	10,428,426
2007	4,206,503	5,555,408	9,761,911
2008	4,369,971	4,286,008	8,655,979
2009	4,403,215	6,055,353	10,458,568
2010	4,092,654	2,981,647	7,074,301
2011	3,925,048	3,508,349	7,433,397
2012	3,924,839	2,756,875	6,681,714
2013	3,293,337	2,531,108	5,824,445
2014	3,578,178	3,724,504	7,302,682
2015	2,940,291	3,517,462	6,457,753

Table 3. Total recreational and commercial harvest of Atlantic striped bass from the Albemarle Sound and Roanoke River Management Areas in pounds, 2003-2015. Source: North Carolina Department of Marine Fisheries.

Albemarle Sound and Roanoke River Management Area Harvest				
Year	**Commercial**		**Recreational**	
	Quota	**Harvest**	**Quota**	**Harvest**
2003	275,000	266,555	275,000	90,964
2004	275,000	273,636	275,000	187,288
2005	275,000	232,693	275,000	171,007
2006	275,000	186,399	275,000	120,518
2007	275,000	171,683	275,000	89,125
2008	275,000	74,921	275,000	64,353
2009	275,000	96,134	275,000	106,894
2010	275,000	199,829	275,000	83,507
2011	275,000	134,538	275,000	114,097
2012	275,000	115,940	275,000	159,727
2013	275,000	68,214	275,000	40,094
2014	275,000	71,372	275,000	50,584
2015	137,500	113,475	137,500	126,970

Table 4. Total (coastal and Chesapeake Bay) commercial and recreational dead discards in number of fish, 2003-2015. Source: ASMFC 2016a.

Total Dead Discards by Sector				
Year	**Recreational Releases (B2)**	**Recreational Dead Discards (9% of B2)**	**Commercial Dead Discards**	**Total Dead Discards**
2003	14,611,333	1,315,020	261,974	1,576,994
2004	17,053,333	1,534,800	465,642	2,000,442
2005	18,078,899	1,627,101	798,544	2,425,645
2006	23,343,299	2,100,897	194,524	2,295,421
2007	16,110,023	1,449,902	606,599	2,056,501
2008	12,510,987	1,125,989	308,715	1,434,704
2009	7,970,813	717,373	611,944	1,329,317
2010	6,258,081	563,227	254,841	818,068
2011	5,932,480	533,923	617,457	1,151,380
2012	5,191,891	467,270	792,861	1,260,131
2013	8,539,986	768,599	525,581	1,294,180
2014	7,282,547	655,429	931,391	1,586,820
2015	8,397,456	755,771	299,566	1,055,337

Table 5. Total coastal recreational harvest (pounds) of Atlantic striped bass by state, 2003-2015. Source: Marine Recreational Information Program (MRIP) queried March, 2017.

	Coastal Recreational Harvest by State											Total Coastal Harvest
Year	**ME**	**NH**	**MA**	**RI**	**CT**	**NY**	**NJ**	**DE**	**MD**	**VA***	**NC**	
2003	253,911	281,548	4,889,035	1,502,454	1,251,538	3,409,573	4,258,557	292,168	15,744	440,045	841,063	17,435,636
2004	224,925	96,412	6,235,558	1,372,679	1,714,526	3,735,780	5,534,805	330,633	41,127	871,501	4,833,046	24,990,992
2005	380,367	281,940	5,119,345	1,760,248	2,174,578	5,383,146	5,887,184	288,596	17,351	437,684	2,164,859	23,895,298
2006	322,599	180,775	4,861,391	891,453	2,055,320	6,068,519	6,922,320	260,192	2,717	1,121,379	1,729,663	24,416,328
2007	234,077	68,393	5,099,862	1,677,132	1,474,178	7,900,930	3,666,723	99,216	0	274,650	835,145	21,330,306
2008	267,642	83,703	5,720,651	823,287	1,751,665	10,997,906	4,876,106	348,328	0	1,160,098	522,708	26,552,094
2009	328,259	115,461	4,795,791	1,039,173	846,014	5,032,805	4,201,610	275,052	43,684	40,945	160,922	16,879,716
2010	105,734	68,912	4,277,990	1,094,343	1,253,639	6,991,705	5,341,095	246,407	102,616	72,023	435,756	19,990,220
2011	91,705	370,798	3,504,603	1,257,302	758,216	8,969,767	6,197,026	241,149	2,590	249,452	2,042,981	23,685,589
2012†	55,890	162,982	5,441,893	913,874	843,443	6,486,256	2,448,032	361,170	28,688	4,162	0	16,746,390
2013	102,877	226,689	4,193,416	3,025,818	2,242,037	8,624,422	6,039,027	253,062	183,572	23,208	0	24,914,128
2014	100,213	78,310	4,397,183	2,161,265	1,717,083	7,169,999	4,129,807	107,421	22,782	0	0	19,884,063
2015	63,878	30,614	2,701,724	798,394	1,362,279	3,189,222	5,145,204	34,808	13,848	0	0	13,339,971

*Does not include Technical Committee estimates of wave 1 harvest
†the impacts of hurricane Sandy may have caused lower harvest in 2012 in some states.

Table 6: Estimated and realized harvest reductions for striped bass commercial fisheries. Source: ASMFC 2016b.

Ocean (Commercial – Pounds of fish)							
	Amd. 6 2013 Quota	2013 Harvest	Add. IV 2015 Quota	2015 harvest	Estimated Reduction from 2013 Quota	Actual Reduction from 2013 Quota	Actual Reduction from 2013 Harvest
Ocean Total	3,806,275	2,532,870	2,854,706	1,902,363	-25.0%	-50.0%	-24.9%

Chesapeake Bay (Commercial – Pounds of fish)					
	2012 Harvest	Add. IV 2015 Quota	2015 harvest	Estimated Reduction from 2012 Harvest	Actual Reduction from 2012 Harvest
Chesapeake Bay Total	3,924,372	3,120,247	2,940,291	-20.5%	-25.1%

Table 7: Estimated and realized changes in removals for striped bass recreational fisheries. Removals includes angler harvest (A + B1) plus dead discards (9% of B2). Source: ASMFC 2016b.

Recreational Fisheries (Numbers of fish)					
Region	Reference Removals Estimate*	2015 Removals Estimate	2015 Removals	Estimated Change in Removals	Actual Change in Removals
Ocean	2,153,773	1,517,063	1,141,556	-29.6%	-47.0%
Chesapeake Bay	538,111	419,726	852,524	-22.1%	+58.4%

* 2013 for Ocean, 2012 for Bay

Table 8: Realized changes in removals for striped bass recreational fisheries. Source: ASMFC 2016b.

Region	Sector	Reference Level	2015 Removals	Change in Removals
Chesapeake Bay	Recreational Harvest (A+B1)	330,380	500,465	+51%
	Recreational Release Mortality (9% B2)	207,731	352,059	+69%
Ocean	Recreational Harvest (A+B1)	1,618,015	735,438	-55%
	Recreational Release Mortality (9% B2)	535,758	406,118	-24%

Figure 1. Atlantic striped bass female spawning stock biomass (SSB) relative to the SSB reference points, 1982-2015. Source: ASMFC 2016a.

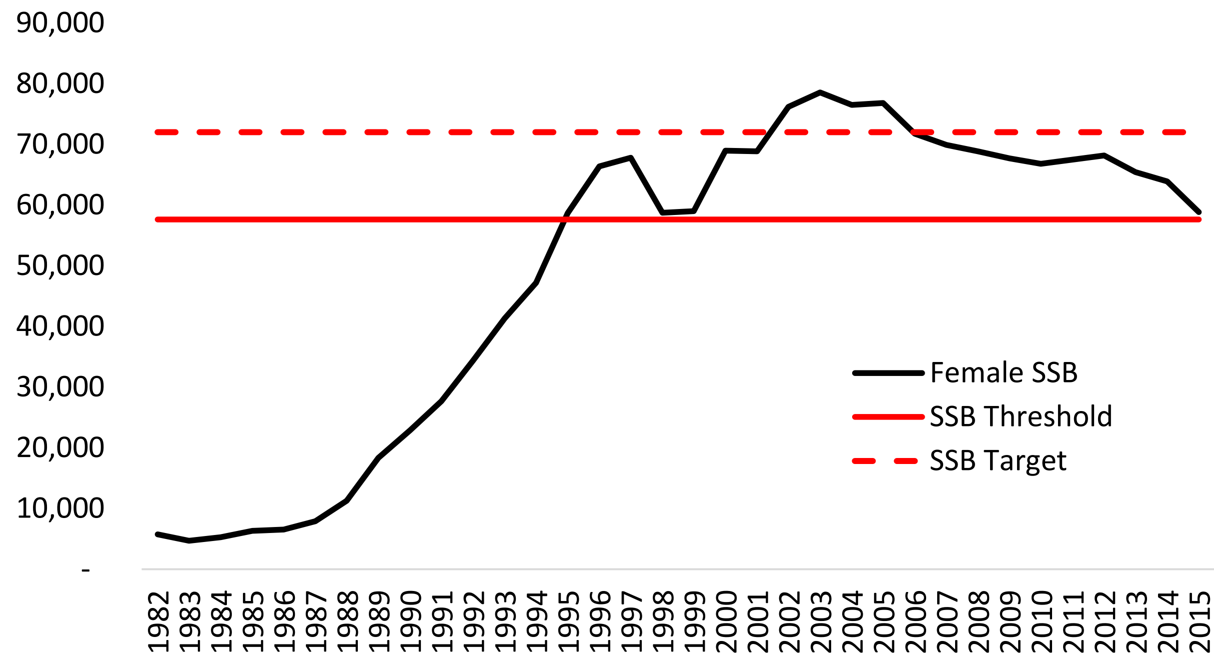


Figure 2. Atlantic striped bass fishing mortality (F) relative to the F reference points, 1983-2015. Source: ASMFC 2016a.

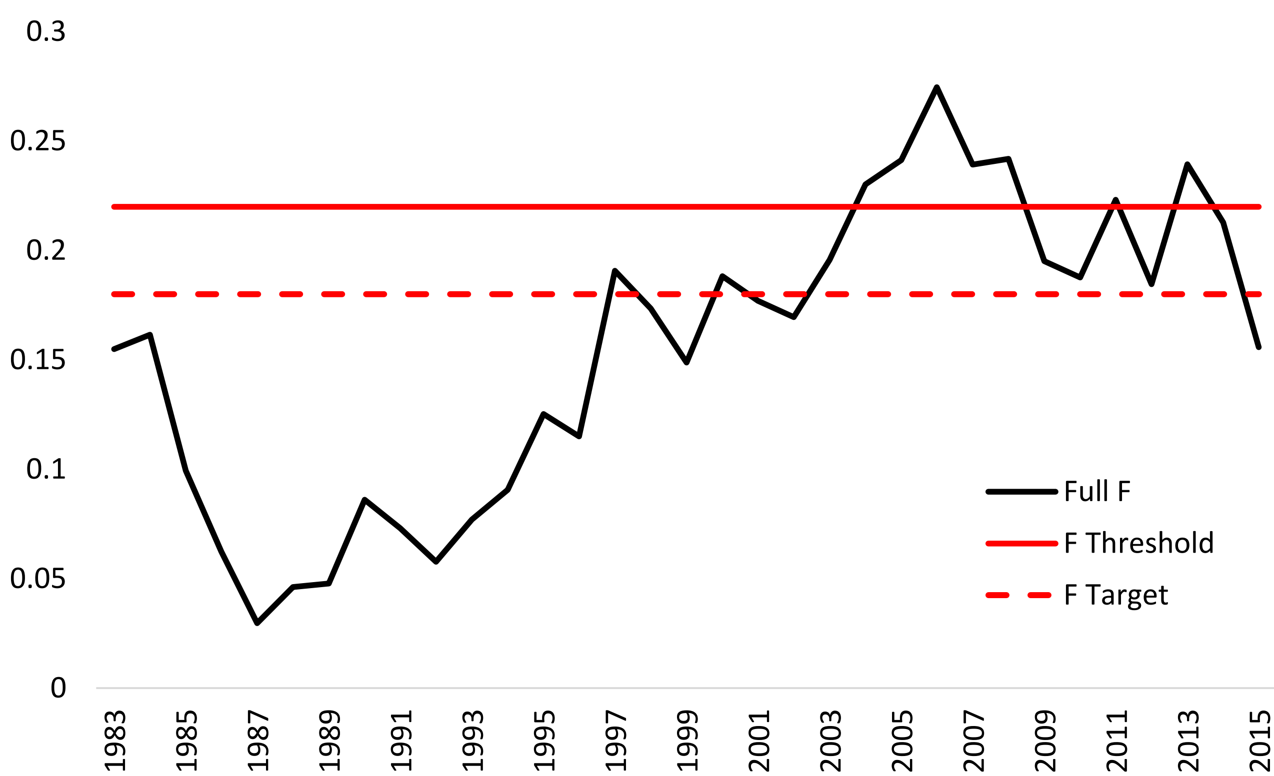
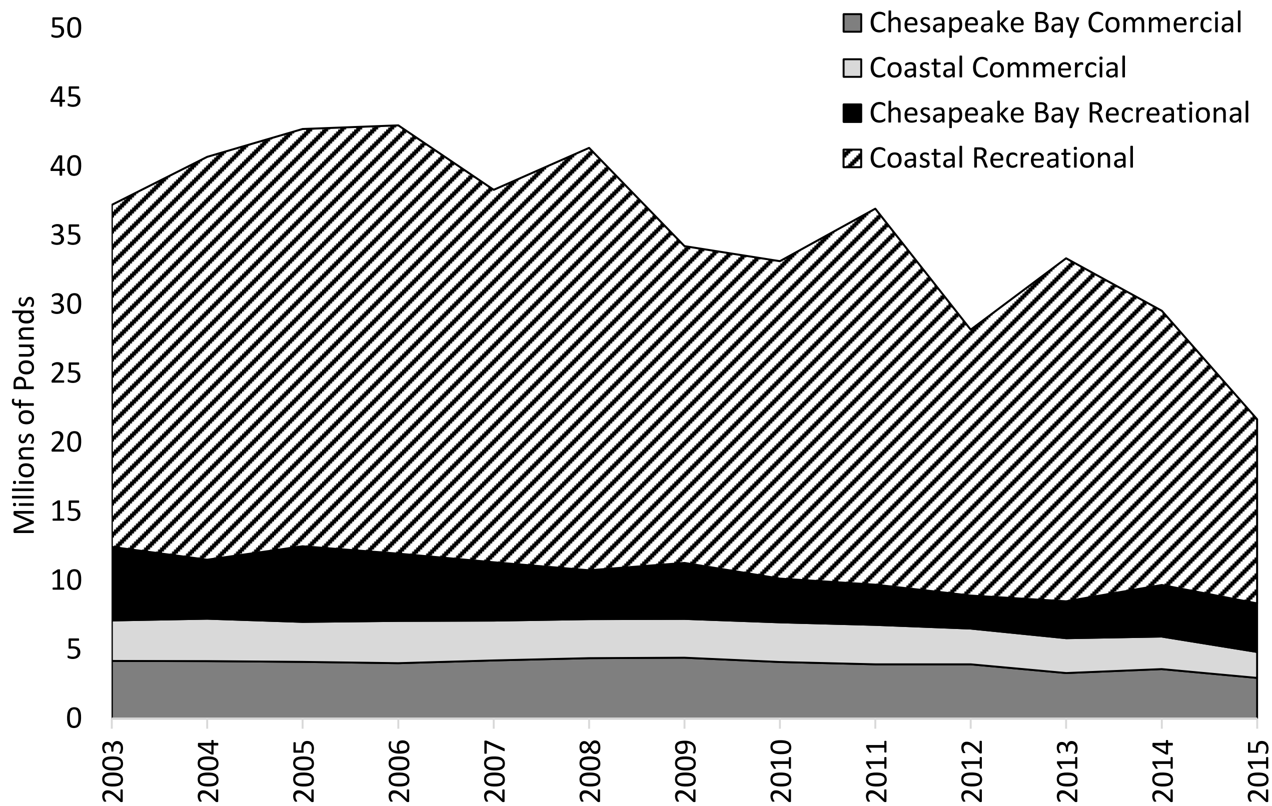


Figure 3. Commercial and recreational directed harvest (i.e., does not include dead discards) from the Chesapeake Bay and along the coast by sector, 2003-2015. Source: ASMFC 2016a.



7.0 Appendix 1

Summary of Atlantic Striped Bass Commercial Regulations in 2015. Source: Annual State Compliance Reports. ^Conservation equivalency

STATE	SIZE LIMITS	SEASONAL QUOTA	OPEN SEASON
ME	Commercial fishing prohibited		
NH	Commercial fishing prohibited		
MA	34" TL min size	869,813 lbs. Hook & line only	6.23 until quota reached; 15 fish/day for fishers with a commercial lobster or boat permit; 2 fish/day for fishers with a commercial individual or rod and reel permit (striped bass endorsement required with all permits)
RI	Floating fish trap: 26" min General category (mostly rod & reel): 34" min.	Total: 181,572^ lbs., split 39:61 between trap and general category. Gill netting prohibited.	Trap: 4.1 – 12.31, or until quota reached; unlimited possession limit until quota reached General Category: 6.8-8.31, 9.8-12.31, or until quota reached. Closed Fridays and Saturdays during both seasons. 5 fish/vessel/day possession limit.
CT	Commercial fishing prohibited		
NY	28-38" TL min size Ocean only (Hudson River closed to commercial harvest)	795,795 lb. Pound nets, gill nets (6-8"stretched mesh), gill nets (<6" or >8" stretched mesh (by-catch only, 7 fish/trip), hook & line, otter trawl (by-catch only 21 fish/trip).	6.1 – 12.15, or until quota reached. Limited entry permit only.
NJ	Commercial fishing prohibited		
PA	Commercial fishing prohibited		

(Continued – Summary of commercial regulations in 2015). ^Conservation equivalency

STATE	SIZE LIMITS	SEASONAL QUOTA	OPEN SEASON
DE	Gillnet: 20" min in DE Bay/River during spring season. 28" in all other waters/seasons. Hook and Line: 28" min	Gillnet: 137,831 lbs. Hook and line: 14,509 lbs.	Gillnet: 2.15-5.31 (2.15-3.31 for Nanticoke River) & 11.15-12.31; drift nets only from 2.15-28 (str. Mesh >4") & 5.10-31; no fixed nets in DE or Nanticoke Rivers; Hook and Line: 4.1–12.31
MD	Bay and Rivers: 18-36" Ocean: 24" minimum	Bay and River: 1,471,888 lbs. (part of Bay- wide quota). Gear specific quotas and landing limits. Ocean: 90,727^ lbs.	Bay Pound Net: 6.1-12.31, Mon-Sat Bay Haul Seine: 6.1-11.27, Mon-Fri Bay Hook & Line: 6.1-11.26, Mon-Thu Bay Drift Gill Net: 1.1-3.13, 12.1-12.31 Ocean Drift Gillnet & Trawl: 1.1-4.30, 11.1-12.31, Mon- Fri
PRFC	18" min all year 36" max 2.15–3.25	583,362 lbs (part of Bay-wide quota). Allocated by gear and season.	Hook & line: 2.15-3.25, 6.1-12.31 Pound Net & Other: 2.15-3.25, 6.1-12.15 Gill Net: 1.1-3.25, 11.9-12.31
DC	Commercial fishing prohibited		
VA	Bay and Rivers: 18" min, and 28" max size limit 3.26–6.15 Ocean: 28" min	Bay and Rivers: 1,064,997 lbs Ocean: 138,640 lbs. (ITQ- system for both areas)	Bay and Rivers: 1.16-12.31 Ocean: 1.16-12.31
NC	Ocean: 28"	360,360 lbs. (split between gear types). Number of fish allocated to each permit holder. Allocation varies by permit.	Beach seine: 1.1-3.31 Gill net: 1.1-2.14 Trawl: 1.20-3.31 Mon-Thur

Summary of Atlantic Striped Bass Recreational Regulations in 2015. Source: Annual State Compliance Reports.

STATE	SIZE LIMITS	DAILY BAG LIMIT	OTHER	OPEN SEASONS
ME	28" min	1 fish	Hook & line only	All year, except spawning areas closed 12.1 – 4.30 and catch and release only 5.1 – 6.30
NH	28" min	1 fish	No netting; no gaffing; no culling	All year
MA	28" min	1 fish	Hook & line only	All year
RI	28" min	1 fish/person *	None	All year
CT	28" min Striped Bass Bonus Program: 22-28" slot	1 fish (SBBP: 1 fish, limit of one voucher per angler per year)	Hook & line only; no spearing; no gaffing. SBBP Quota: 3,018 fish**	All year. SBBP 5.1 – 12.31; all state waters
NY	Ocean and DE River: 28" min Hudson River: 18-28" slot limit, or ≥40"	1 fish	Angling only. Spearing permitted in ocean waters. Catch and release only during closed season in ocean waters.	Ocean: 4.15 – 12.15 Hudson River: 4.1 – 11.30 Delaware River: All year
NJ	1 fish at 28 to < 43", and 1 fish ≥43" (Striped Bass Bonus Program: 1 fish 24 - <28" slot, limit of one permit per angler per day)		SBBP Quota: 215,912 lbs **	Closed 1.1 – 2.28 in all waters except in the Atlantic Ocean, and 4.1 – 5.31 in the lower Delaware River and tributaries (spawning ground closure)
PA	28" min	1 fish	Hook & line only; three rods per individual	All year, except 4.1 – 5.31, two fish bag limit and a 21-25" slot limit from the PA/DE state line upstream to the Calhoun Street Bridge
DE	28" min, no harvest 38-43" (inclusive).	2 fish	Hook & line, spear (for divers) only. Circle hooks required in spawning season.	All year except 4.1-5.31 in spawning grounds (catch & release allowed). In Del. River, Bay & tributaries, may only harvest 20-25"slot from 7.1-8.31

*regulation went into effect on April 6, 2015.

** Commercial quota reallocated to recreational fishery

(Continued – Summary of recreational regulations in 2015)

STATE	SIZE LIMITS	DAILY BAG LIMIT	OTHER	OPEN SEASON
MD	Ocean: 28" min CB Trophy: 28 to ≤36" slot, OR ≥40" CB Summer/Fall: (2) 20-28" slot OR (1) 20-28" slot, (1) > 28" min	Ocean: 1 fish Bay Trophy: 1 fish Bay Summer/Fall: 2 fish	See compliance report for specifics.	Ocean: All year SF: 1.1-5.3 Bay Trophy: 4.18-5.15 Bay Summer/Fall: 5.16-12.15
PRFC	Trophy: 28-36" slot or > 40" Summer/Fall: 20" min with 1 fish > 28"	Trophy: 1 fish Summer/Fall: 2 fish	No more than two hooks or sets of hooks for each rod or line	Trophy: 4.18 -5.15 Summer/Fall: 5.16-12.31
DC	≥ 20", only one fish >28"	2 fish	Hook & line only	5.16-12.31
VA	Ocean: 28" Bay/Coastal Trophy: 36" min (28" max in tribs) CB Spring: (2) 20-28" slot OR (1) 20-28" slot, (1) > 36" min CB Fall: (2) 20-28" slot OR (1) 20-28" slot, (1) > 28" min	Ocean: 1 fish Bay/Coast Trophy: 1 fish Bay Spring/Fall: 2 fish	Hook & line, rod & reel, hand line only. Gaffing is illegal in Virginia marine waters.	Ocean: 1.1-3.31, 5.16-12.31 Bay/Tribs Trophy: 5.1-6.15 Coastal Trophy: 5.1-5.15 Bay Spring: 5.16-6.15 Bay Fall: 10.4-12.31
NC	Ocean: 28" min size	Ocean: 1 fish/day	No gaffing	Ocean: All year

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

May 1, 2017

To: **Atlantic Striped Bass Management Board**

From: **Atlantic Striped Bass Technical Committee**

RE: **Comments on proposed options in Draft Addendum V to Amendment 6 to the Atlantic Striped Bass Fishery Management Plan**

In February 2017, the Atlantic Striped Bass Board (Board) tasked the Plan Development Team (PDT) to develop an addendum that considers the relaxation of coastwide commercial and recreational regulations to bring fishing mortality to the target based on information from the 2016 stock assessment update. The Atlantic Striped Bass Technical Committee (TC) reviewed draft Addendum V, and has the following comments:

- In October 2016, the Board tasked the TC to determine the percent liberalization in harvest that would increase fishing mortality (F) from the 2015 terminal year estimate of 0.16 to the FMP target value of 0.18. To accomplish this, the TC completed several population projections and determined that a 10-11% increase in removals from 2015 levels would increase F to 0.18 in 2017. Due to the timing required for developing and adopting an addendum through the Commission, and the time required by states to promulgate and adopt new regulations, it is likely that any management options adopted by the Board through Draft Addendum V would not be effective until late 2017 or early 2018. As a result, the Board should consider the fact that the 10-11% liberalization was applied to 2017 removals, not 2018, which is the year that Draft Addendum V regulations would most likely be implemented.

- Developing options that increase bag limits or decrease minimum size limits, requires some level of knowledge regarding the length frequency of discarded fish under the current regulations. For Atlantic striped bass, two main data sources that collect such data[1] are the American Littoral Society (ALS) fish tagging program and the Marine Recreational Information Program (MRIP). The TC has concerns with these data sources given that both can be variable from year to year regarding the number of fish tagged and the level of sampling that occurs. Additionally, recent changes in MRIP methodology may also impact the discard estimates used in the development of Draft Addendum V proposed options.

- The change in distribution and length frequency of available fish is another factor that can change substantially from year to year, and is not accounted for in the draft Addendum V proposed options. The 2011 year class has had a strong presence in the Chesapeake Bay (CB)

[1] Some states (e.g., Maryland) also collect length information on discarded fish, among other data, through volunteer angler reporting programs.

in recent years. As this year class becomes older and more mature, a larger proportion of those fish will leave the CB and migrate to the coast, where they will become part of the coastal fishery. The movement of fish out of the CB and into the coastal fishery is expected to result in changes in the level of catch, harvest, and dead discards, in both the CB and coastal fisheries. However, it is still poorly understood what the magnitude of these changes will be and therefore was not accounted for in the Draft Addendum V proposed options.

- Angler behavior is a variable that can greatly affect harvest estimates from year to year and with changing regulations, but that cannot be accounted for. The proposed options in Draft Addendum V assume angler behavior will be identical to that observed in 2015, the first year under new Addendum IV regulations.

- The TC highlighted similar concerns as those listed above during the development (and implementation) of Draft Addendum IV. In 2016, after Addendum IV regulations had been in place for a full year, the Plan Review Team (PRT) conducted a preliminary analysis on the performance of Addendum IV regulatory measures by comparing 2015 harvest estimates to those predicted by the TC, by sector and region. The PRT found that on a coastwide scale, the 2015 harvest estimate and the predicted harvest were very close. However, for the recreational fishery in the ocean and the CB, the harvest estimates differed significantly from that predicted. Further investigation by the TC revealed recreational fisheries in the ocean saw a greater reduction than predicted, and recreational fisheries in the CB experienced an increase in harvest relative to the reference period. The most significant variables found to contribute to these large differences were changes in effort and changes in the size, age structure, and the distribution of the 2011 year class along the coast relative to the Chesapeake Bay. As the proposed options in Draft Addendum V make similar assumptions to those used in developing Addendum IV, the TC cautions the Board that the estimated increases could be significantly under or over predicting harvest.

- The motion made by the Board at their February 2017 meeting was based on the information presented in the 2016 stock assessment update (which contains data through 2015) and a projection analysis that estimated a 10% increase in removals from 2015 would increase F from 0.16 in 2015 to 0.18 (target F) in 2017. Preliminary 2016 removals however, were estimated to be ~18% greater than 2015 removals under Addendum IV regulations with no additional changes. As a result, the TC cautions the Board that using data through 2015 for the development of proposed options for Draft Addendum V, and not accounting for the increase in removals estimated for 2016, could result in an F different than F target in 2017. Additionally, the projections presented to the Board were through 2017 only. If Addendum V were to be approved by the Board in 2017, most states would be unable to implement changes until 2018, thus adding to the uncertainty of the proposed measures achieving F target.

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

TO: Atlantic Menhaden Management Board

FROM: Megan Ware, FMP Coordinator

DATE: April 27, 2017

SUBJECT: Update on Development of Draft Amendment 3

At the February 2017 meeting, the Atlantic Menhaden Management Board (Board) tasked the Plan Development Team (PDT) with drafting Amendment 3. Included in meeting materials is the latest draft of Amendment 3. The PDT notes that this is a working draft and changes will continue to be made following the May Board meeting.

Several conference calls have taken place over the last three months. The PDT met via conference call on February 22nd, March 31st, and April 26th to work on Draft Amendment 3. Additionally, the Allocation Workgroup met via conference call on April 17th to review the allocation methods and provide recommendations to the Board on ways to hone-in on the number of management alternatives. Finally, the BERP Workgroup met via conference call on April 24th to discuss the development of Lenfest reference points for menhaden. The purpose of this memo is provide an update to the Board on progress made to date and identify areas of focus over the next three months.

Reference Points
The BERP Workgroup had a conference call with members of the Lenfest Forage Fish Task Force to clarify the methods used to calculate the Pikitch et al. (2012) reference points. The BERP Workgroup is currently calculating the various ERP options based on existing guidelines for forage fish species (e.g. Pikitch et al (2012), 75% rule-of-thumb, etc). It is expected that those will be ready ahead of the August Board meeting and will be included in a subsequent draft of Amendment 3.

Allocation Methods
Preliminary allocation tables are provided for most of the allocation methods currently included in Draft Amendment 3. It is important to note that these values are subject to change given many states 2016 landings are preliminary and New York has submitted a proposal to re-calibrate their menhaden landings (see below). Seasonal allocation percentages have not been calculated given the data submitted by states included landings by year, not month. If the Board is interested in pursuing the seasonal allocation method, staff may have to use ACCSP data to calculate these percentages.

The allocation section (*Section 4.3.2*) is divided into three tiers, based on the possible combinations of allocation methods. To complete an allocation method, an option must be chosen in each tier. If the Board selects an allocation method which does not include state specific quotas, a coastwide reporting mechanism is needed to monitor quotas in-season. Specifically, as Draft Amendment 3 currently reads, states would need to submit landings to

SAFIS to allow for near real-time monitoring of either a coastwide, regional, seasonal, fleet, or sector based quota.

At the February 2017 meeting, the Board agreed to keep all allocation methods presented in the PID in draft Amendment 3. As the PDT has begun to delve into this management document, it has become clear that there a multitude of allocation methods, and there is concern that this could impede effective public comment and resulting Board action in November. The Allocation Workgroup met to discuss ways to hone-in on the allocation methods. They are recommending several changes to Draft Amendment 3, such as removing the three-fleet allocation method and replacing the current regional approaches with a management alternative that creates a regional quota for the New England states and jurisdictional quotas for the mid-Atlantic and South Atlantic states (see subsequent memo from the Allocation Workgroup). The Board will need to review these recommendations and provide direction to the PDT.

Allocation Timeframes

Currently, data from 1985-2016 are used to calculate allocation percentages in Draft Amendment 3. The Allocation Workgroup is recommending that data prior to 2007 not be used to calculate allocation percentages given only one reduction facility was operating from 2007-2016 and reporting has significantly improved over the last decade. The Board will need to discuss this recommendation and provide direction to the PDT. If older landings data are used in Draft Amendment 3, the Board will need to decide if historic reduction landings from states which no longer have a reduction fishery should be used to calculate allocation percentages. It is also important to note that Florida did not collect gear specific landings data prior to 1993. If the Board would like to include data between 1985 and 1992, the PDT will have to estimate Florida's gear specific landings using data between 1993 and 1994 (a net ban was implemented in 1995).

NY Proposal on Re-Calibrated Landings

ASMFC received a proposal from New York on April 11th to re-calibrate the state's menhaden landings prior to 2013. The intent of this proposal is to address inconsistent or nonexistent reporting in the state. The proposal uses the difference in landings between 2009-2012 (when there was limited reporting) and 2013-2016 (when reporting was required) to scale historic landings. The proposal from New York is included in supplemental materials.

The PDT discussed this proposal on their April 26th conference call and compiled a list of questions for New York regarding the re-calibration. The questions focus on the inclusion of purse seine landings in the calibration, given these gears have historically been required to report, and other changes in the fishery, such as changes in the number of participants or gears used, which could have contributed to the reported increase in landings from 2013-2016. Pending the answers to these questions, the PDT will provide a recommendation to the Board regarding this proposal.

Areas of Continued Focus

Under the current timeline, the Board is scheduled to review and approve Draft Amendment 3 for public comment in August 2017. In the coming months, the PDT will continue to develop and refine the document. Areas of focus will include finalizing allocation percentages, further developing *Section 4.3.5 Incidental Catch and Small Scale Fisheries*, reviewing reporting requirements for effective quota monitoring, compiling the reference points based on existing guidelines for forage fish species, and including socio-economic data from the recent study on the commercial fishery. The AP is also expected to meet to provide guidance on Draft Amendment 3 to the Board and PDT.

Questions for the Board to Consider
The following is a list of questions for the Board to consider ahead of the May meeting.

1. How can the number of allocation methods be honed-in?
    a. Should the current regional allocation methods be replaced with an option that creates a regional quota for the New England states and jurisdictional quotas for the Mid-Atlantic and South Atlantic states (per the recommendation of the Allocation WG)?
    b. Should the two-fleet allocation method be maintained while the three-fleet allocation method is removed from Draft Amendment 3 (per the recommendation of the Allocation WG)?
    c. Should a management alternative for soft caps be maintained (per the recommendation of the Allocation WG)?
    d. Is the Board still interested in pursuing a seasonal allocation method given ACCSP landings, not state submitted landings, may be used in the calculations?
2. Should the allocation timeframes be altered to only include data from 2007-2016 (per the recommendation of the Allocation WG)?
    a. If data between 1985 and 2005 is going to be used in calculating allocation percentages, should reduction landings from states which no longer have a reduction fishery be included in the calculations?

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

TO: Atlantic Menhaden Management Board

FROM: Allocation Work Group

DATE: April 27, 2017

SUBJECT: Recommendations on Management Alternatives to Include in Draft Amendment 3

The Allocation Work Group (WG) met via conference call on April 17th to discuss the allocation methods currently included in Draft Amendment 3. The purpose of this call was to provide recommendations to the Board on ways to hone-in on the number of allocation options, given the current multitude of variations may complicate the document and thus impede effective public comment and resulting Board action in November. The discussion focused on four topics: 1) the fleet capacity allocation method; 2) the use of soft quotas; 3) the regional allocation method; and 4) the use of historic reduction landings from states which no longer have a reduction fishery. Below is a summary of the questions posed to the WG and the recommendations made for Board consideration.

Allocation Work Group Participants:
-Robert Ballou (RI)
-Jim Gilmore (NY)
-Russ Allen (NJ)
-Lynn Fegley (MD)
-Rob O'Reilly (VA)
-Robert Boyles (SC)
-Megan Ware (ASMFC)

1. Fleet Capacity Allocation Method
<u>Questions:</u> Are there benefits (or concerns) for either the two-fleet or three-fleet allocation method? Should one of these options be removed from Draft Amendment 3?

<u>Recommendation:</u> The WG recommended that the two-fleet option be maintained in Draft Amendment 3 but the three-fleet option be removed from the document. Overall, the WG concluded that the three-fleet option is overly complicated and the two-fleet option still achieves the goals of this allocation method: 1) to ensure that small gears and stationary gears have equitable access to menhaden commercial quota, along with the larger mobile gears; and 2) to simplify management and reduce the administrative burden on states with lower menhaden landings (e.g. in states where the management cost exceeds the value of the fishery).

2. Soft Quotas
<u>Questions:</u> Should soft quotas be included as a management alternative? If yes, for which gears should this option apply?

<u>Recommendation:</u> The WG recommended that soft quotas be maintained as a management alternative in Draft Amendment 3. They commented that in the two-fleet option, the small-capacity fleet has only accounted for 4-6% of commercial harvest in recent years and, under a soft cap, landings by these gear types would still be monitored. The WG recommended that

the soft cap option be further developed by the PDT so that there are clear, up-front controls on the small-capacity fleet, such as a trip limit or limited entry mechanism. They also recommended that, if a soft cap is implemented, there be an annual evaluation of landings by gear type. This will allow the Board to assess trends in the fishery and consider a management response should harvest by a specific gear type significantly increase.

3. Regional Allocation Method
Questions: Is there a regional allocation method which best reflects the menhaden fishery? Is there a regional allocation option which should be removed from Draft Amendment 3?

Recommendation: Members of the WG expressed concern about the current regional allocation options, specifically that they may exclude some states from participating in the fishery due to the timing and movement of menhaden. Others noted that grouping large mobile gears and small stationary gears within a single region may disadvantage specific participants in the fishery. Importantly, the WG did note that, given the episodic nature of menhaden in the New England states, a regional approach may be favorable in this area. As a result, the WG recommended that the current regional allocation options be removed from Draft Amendment 3 and replaced with an option that considers a regional quota for the New England states (Maine through Connecticut or New York) and jurisdictional quotas for the Mid-Atlantic and South Atlantic states (New York or New Jersey through Florida).

4. Historic Menhaden Landings
Question: Should historic reduction harvest from states which no longer have a reduction fishery be included in the landings used to calculate allocation percentages?

Recommendation: Members of the WG expressed discomfort using landings data from over a decade ago to inform current allocation percentages. Some noted that historic landings are less reliable as many states did not require reporting from menhaden harvesters and dealers. Others noted that historic trends may not be indicative of the current fishery, especially in regard to states which once had a reduction fishery but no longer do. Many pointed to issues surrounding the allocation of summer flounder quota as a sign that historic landings, pre-dating 2007, should not be used to determine future allocations. As a result, the WG recommended that the timeframes currently included in Draft Amendment 3 be replaced with the following options:

A) 2009-2011 (status quo)
B) 2013-2016 (four years under Amendment 2)
C) 2007-2012 (six years before Amendment 2)
C) 2012-2016 (five most recent years of data)
C) 2007-2016 (most recent decade of data)

For all of these time periods, there is only one reduction plant in operation, which negates the need to address the use of historic reduction landings from states that no longer have a reduction fishery. These timeframes also address concerns about inconsistent or nonexistent reporting in the 1980's and 1990's.

To provide context to the Board's discussion, state-by-state allocation tables are presented below for the time periods proposed.

Table 1: State-by-state allocation percentages for the time periods recommended by the Allocation WG.

	2009-2011 TAC %	2013-2016 TAC %	2007-2012 TAC %	2012-2016 TAC %	2007-2016 TAC %
ME	0.02%	0.29%	0.16%	0.22%	0.21%
NH	0.00%	0.00%	0.00%	0.00%	0.00%
MA	0.84%	0.67%	1.19%	0.59%	1.00%
RI	0.02%	0.19%	0.02%	0.15%	0.08%
CT	0.02%	0.01%	0.02%	0.01%	0.02%
NY	0.07%	0.31%	0.08%	0.25%	0.16%
NJ	11.29%	11.16%	11.44%	12.63%	11.34%
DE	0.01%	0.03%	0.02%	0.03%	0.02%
MD	1.51%	1.71%	1.95%	1.97%	1.86%
PRFC	0.62%	0.75%	0.88%	0.85%	0.83%
VA	85.08%	84.59%	83.90%	83.05%	84.15%
NC	0.50%	0.20%	0.33%	0.18%	0.28%
SC	0.00%	0.00%	0.00%	0.00%	0.00%
GA	0.00%	0.00%	0.00%	0.00%	0.00%
FL	0.02%	0.07%	0.02%	0.06%	0.04%

Atlantic States Marine Fisheries Commission

Draft Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden

ASMFC Vision Statement:
Sustainably Managing Atlantic Coastal Fisheries

April 2017

Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden

Prepared by

Atlantic States Marine Fisheries Commission
Atlantic Menhaden Plan Development Team

Plan Development Team Members:
Jeff Brust, New Jersey Department of Fish and Game
Joe Cimino, Virginia Marine Resources Commission
Jesse Hornstein, New York Department of Environmental Conservation
Nicole Lengyel, Rhode Island Department of Environmental Management
Nichola Meserve, Massachusetts Department of Marine Fisheries
Derek Orner, National Marine Fisheries Service
Harry Rickabaugh, Maryland Department of Natural Resources
Winnie Ryan, Maritime Research
Andrew Scheld, Virginia Institute for Marine Science
Krista Shipley, Florida Fish and Wildlife Conservation Commission
Megan Ware (Chair), Atlantic States Marine Fisheries Commission

This is a report of the Atlantic States Marine Fisheries Commission pursuant to U.S. Department of Commerce, National Oceanic and Atmospheric Administration Award Nos. XXXXXXXXX.

The Atlantic States Marine Fisheries Commission seeks your input on Draft Amendment 3 to the Atlantic Menhaden Fishery Management Plan.

The public is encouraged to submit comments regarding this document during the public comment period. Comments must be received by **5:00 PM (EST) on XXXXX.** Regardless of when they were sent, comments received after that time will not be included in the official record. The Atlantic Menhaden Management Board will consider public comment on this document before finalizing Amendment 3.

You may submit public comment by attending a public hearing held in your state or jurisdiction or mailing, faxing, or emailing written comments to the address below. Comments can also be referred to your state's members on the Atlantic Menhaden Management Board or Atlantic Menhaden Advisory Panel; however, only comments received at a public hearing or written comments submitted to the Commission will become part of the public comment record.

Mail: Megan Ware
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200 A-N
Arlington VA. 22201

Email: comments@asmfc.org
(Subject: Amend 3)
Phone: (703) 842-0740
Fax: (703) 842-0741

If your organization is planning to release an action alert in response to Draft Amendment 3, or if you have questions, please contact Megan Ware at (703)-842-0740.

The timeline for completion of Amendment 3 is as follows:

	Oct 2016	Nov 2016 – Jan 2017	Feb 2017	Mar – July 2017	Aug 2017	Sept – Oct 2017	Nov 2017
Approval of Draft PID by Board	**X**						
Public review and comment on PID		**X**					
Board review of public comment; Board direction on what to include in Draft Amendment 3			**X**				
Preparation of Draft Amendment 3 ***Current Step***				**X**			
Review and approval of Draft Amendment 3 by Board for public comment					**X**		
Public review and comment on Draft Amendment 3						**X**	
Board review of public comment on Draft Amendment 3							**X**
Review and approval of the final Amendment 3 by the Board, Policy Board and Commission							**X**

Table of Contents

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission (ASMFC), under the authority of the Atlantic Coastal Fisheries Cooperative Management Act, is responsible for managing Atlantic menhaden (*Brevoortia tyrannus)* from Maine through Florida. ASMFC has coordinated the interstate management of Atlantic menhaden in state waters (0-3 miles) since 1981. Amendment 3 to the Interstate Fishery Management Plan for Atlantic menhaden replaces Amendment 2. Management authority in the exclusive economic zone (3-200 miles from shore) lies with NOAA Fisheries.

1.1 BACKGROUND INFORMATION

At their May 2015 meeting, the Atlantic Menhaden Management Board (Board) initiated the development of Amendment 3 to the Atlantic Menhaden FMP to pursue the development of ecological reference points (ERPs) and revisit allocation methods. The Board approved the Amendment 3 Public Information Document for public comment in October 2016. Public comment was received and hearings were held between December 2016 and January 2017. At their February 2017 meeting, the Board tasked the Plan Development Team (PDT) with developing Draft Amendment 3.

1.1.1 Statement of Problem

1.1.1.1 Ecological Reference Points

Amendment 2 established single-species reference points to manage the menhaden stock. These reference points were based on maximum spawning potential (MSP) and included a measure of fishing mortality (F) and spawning stock biomass (SSB) to determine an overfishing and overfished status. Per Amendment 2, overfishing was defined by a target and threshold of $F_{30\%MSP}$ and $F_{15\%MSP}$, respectively, while an overfished stock was defined by a target and threshold of $SSB_{30\%MSP}$ and $SSB_{15\%MSP}$, respectively.

In 2015, the Board approved a new Atlantic Menhaden Benchmark Stock Assessment which updated the reference points for Atlantic menhaden in order to provide a better measure of sustainability. Specifically, the overfishing target and threshold were changed to $F_{57\%MSP}$ (0.38) and $F_{26\%MSP}$ (1.26), respectively. Furthermore, an overfished target and threshold based on fecundity (FEC) were established at $FEC_{57\%MSP}$ (189,270 billion eggs) and $FEC_{26\%MSP}$ (86,821 billion eggs), respectively. As of 2013, the terminal year used for the 2015 assessment, the stock is not overfished (FEC=170,536 billion eggs) and overfishing is not occurring (F=0.22).

An important outcome of the 2015 Stock Assessment and Peer Review Report was the high priority given to the development of ERPs for Atlantic menhaden management. Menhaden serve an important role in the marine ecosystem as they convert phytoplankton into protein and, in turn, provide a food source to a variety of species including larger fish (e.g., weakfish, striped bass, bluefish, cod), birds (e.g., bald eagles, osprey), and marine mammals (e.g., humpback whales, bottlenose dolphin). As a result, changes in the abundance of menhaden may have implications for the marine ecosystem. ERPs provide a method to assess the status of menhaden not only with regard to their own sustainability, but also with regard to their interactions with predators and the status of other prey species. This method accounts for changes in the abundance of several species when setting an overfished and overfishing threshold for menhaden. The benefit of this approach is that it allows fishery managers to consider the harvest of menhaden within a broad ecosystem context, which includes other fish, birds, mammals, and humans who utilize and depend on marine resources.

1.1.1.2 Allocation

Amendment 2 established a first-ever commercial total allowable catch (TAC) for Atlantic menhaden and divided this catch into commercial quotas for participating jurisdictions from Maine through Florida. The allocation formula assigns each state a percentage of the TAC based on each jurisdiction's average landings between 2009 and 2011. Since it was implemented in 2013, the quota system has maintained the annual harvest of menhaden below the annual coastwide TAC set by the Board.

Amendment 2 requires allocation to be revisited every three years. In reviewing menhaden allocations, the Board expressed interest in investigating different allocation methods and timeframes given concerns that the approach may not strike a balance between gear types and regions. Specifically, some states have expressed concern that under the current allocation method, increases in the TAC result in limited benefits to small-scale fisheries. In addition, concerns have been expressed that the current allocation method does not provide a balance between the present needs of the fishery and future growth opportunities. Given improvements in the condition of the Atlantic menhaden stock, the three-year period of historical catch on which allocation is based may limit states who currently have minimal quota from participating in the growing fishery. Some states have also found evidence of un-reported landings during the reference period, meaning the quota system may have reduced their fisheries to a greater extent than originally intended.

1.1.2 Benefits of Implementation

Amendment 3 is designed to integrate the ecological role of menhaden into the management of the species and establish an allocation method which provides fair and equitable access to all participants in the fishery.

Amendment 3 contains a management program designed to account for the multiple roles that menhaden play, both in supporting fisheries for human use and the marine ecosystem. Issues addressed in Amendment 3 include:

1. <u>Reference Points:</u> How menhaden should be allocated between the marine ecosystem, and those that harvest menhaden for human use.
2. <u>Allocation Method:</u> How menhaden should be allocated between those jurisdictions and fisheries which directly or indirectly harvest menhaden.
3. <u>Allocation Timeframe:</u> The timeframe upon which the allocation method is based.

4. Quota Transfers: How menhaden quota is moved between those which receive an allocation.
5. Quota Rollovers: Whether unused quota can be rolled over into the subsequent fishing year.
6. Incidental Catch: How landings from non-directed fisheries are accounted for in the management of the species.
7. Episodic Events Program: A program designed to minimize discards in the fishery when menhaden are in greater abundance than they normally occur.
8. Chesapeake Bay Reduction Fishery Cap: A cap which limits harvest by the reduction fishery in the Chesapeake Bay, an important nursery ground for menhaden.

1.1.2.1 Ecological Benefits
Atlantic menhaden occupy an important link in the coastal marine food chain as they transfer planktonic material into animal biomass. Due to their interconnectivity with other species, menhaden provide top-down controls on phytoplankton and zooplankton populations while supporting a variety of predator species, including important commercial and recreational species such as striped bass and weakfish, iconic bird species such as osprey and bald eagles, and charismatic marine mammals such as the humpback whale. Reduced menhaden populations may impact the abundance and diversity of predator populations, particularly if other prey options are limited or not available. The geographic extent of menhaden from Maine to Florida highlights the widespread ecological role of this species as they affect marine ecosystems along the Atlantic coast. Overall, maintaining a healthy Atlantic menhaden population will contribute to a balanced marine ecosystem (see *Section 1.2.1.5 Ecological Roles* for additional information).

1.1.2.2 Social/Economic Benefits
Managing menhaden ecologically and providing equitable access to menhaden across all Atlantic coast states will provide a more stable economic and social base for both bait and reduction fisheries, and consumptive and non-consumptive stakeholders. It is expected that this will allow for greater resilience in communities dependent upon fisheries along the eastern coast of the United States.

1.2 DESCRIPTION OF THE RESOURCE

1.2.1 Species Life History

1.2.1.1 Stock Structure and Migration
Atlantic menhaden are euryhaline species that inhabit nearshore and inland tidal waters from Florida to Nova Scotia, Canada. Size-frequency information and tagging studies indicate that the Atlantic menhaden resource is a single unit stock (Dryfoos et al. 1973; Nicholson 1972 and 1978). Recent genetic studies also support the treatment of Atlantic menhaden as a single stock (Anderson 2007; Lynch et al. 2010).

Spawning occurs principally at sea, with some activity in bays and sounds in the northern portion of its range (Judy and Lewis 1983). Eggs hatch at sea and the larvae are transported by ocean currents (Checkley et al. 1988; Nelson et al. 1977; Quinlan et al. 1999) to estuaries where they metamorphose and grow rapidly as juveniles (Edwards 2009). Adults stratify by size during the summer, with older, larger individuals migrating north to southern New England by May and the Gulf of Maine by June. During November and December, most of the adult population that migrated north of Chesapeake Bay moves south of the Virginia and North Carolina capes. Adults that remain in the south Atlantic region during spring and summer migrate south later in the year, reaching northern Florida by fall. Schools of adult menhaden reassemble in late March or early April and migrate northward. By June the population is redistributed from Florida to Maine (Ahrenholz, 1991).

1.2.1.2 Age and Growth

Atlantic menhaden older than age-6 were present in the spawning population during the 1950s and early 1960s, but fish older than age-6 have been uncommon since. In recent years, the majority of the landings are comprised of fish ages 1-4 (SEDAR, 2015).

Growth of Atlantic menhaden varies from year-to-year and occurs primarily during the warmer months (AMTC 2006). Growth of juveniles is density dependent (Ahrenholz et al. 1987); in other words, growth rates are accelerated during the first year when juvenile abundance is low and are reduced when juvenile abundance is high. Lengths of young-of-year menhaden range widely in size, and this variation is a function of density, timing of larval ingress, temperature, and food availability (Ahrenholz 1991; Houde 2011). Adult menhaden can reach a total length of up to 500 mm and a weigh over 1.5 kg (Cooper, 1965; Smith and O'Bier, 1996; SEDAR, 2015). Due to their greater migratory range (see *Section 1.2.1.1*), larger fish of a given age are captured farther north than smaller fish of the same age (Nicholson 1978; Reish et al. 1985). This fact complicates any attempt to estimate overall growth for the entire stock from size-at-age data compiled from any individual area along the coast.

1.2.1.3 Spawning and Reproduction

Some Atlantic menhaden become sexually mature during their first year, with more than 50% mature at age-2 (SEDAR, 2015). First-spawning age-3 fish have accounted for most of the stock's egg production since 1965 (Vaughan and Smith 1988). Atlantic menhaden mature at smaller sizes at the southern end of their range (180 mm FL in the south Atlantic versus 210 mm FL in the Chesapeake Bay and 230 mm farther north) because of latitudinal differences in size-at-age and the fact that larger fish of a given age are distributed farther north than smaller fish of the same cohort (Lewis et al. 1987).

Spawning of Atlantic menhaden is thought to occur throughout the year (Higham and Nicholson, 1964); however, it varies by season and region based on migration patterns. Spawning in the north occurs in the summer months (Kendall and Reintjes,1975; Judy and Lewis, 1983; Lozano and Houde, 2012), mid-Atlantic spawning occurs in early fall as fish start to migrate south, and peak spawning occurring in the South Atlantic Bight in December (Higham and Nicholson, 1964; Judy and Lewis, 1983; Lozano and Houde, 2012). Spawning is followed by the coastward dispersion of eggs and larvae, and ingress into estuaries where juvenile development occurs (Warlen, 1994; Rice et al., 1999; SABRE, 1999; Warlen et al., 2002; Lozano and Houde, 2013; Houde et al., 2016).

Timing and location of spawning seem to be limited by temperature, usually occurring in waters warmer than 14-16°C (Stegmann et al. 1999, Light and Able 2003), or within the 15-20°C isotherms (MDSG 2009). Hall et al. (1991) report that temperatures below 5 or above 33°C are lethal to larvae, and based on a review of field and laboratory studies, Warlen et al. 2002 concluded that optimum temperature for hatching, larval survival, and growth is ≥16°C. Reported salinities range from ~25 to 33 (MDSG 2009), although salinity tolerance limits for eggs and larvae are wide ranging. Available literature has not been summarized to indicate typical or persistent locations of continental shelf spawning areas but egg concentrations have been observed near shorelines, bay mouths or inlets as well as 70 to 140 km offshore (Marak et al 1962, Kendall and Reintjes 1975, Judy and Lewis 1983).

Recently, there has been progress in relating measures of primary productivity to recruitment and growth of YOY menhaden. Research has shown there has been a positive correlation between recruitment and euphotic-zone *chl-a* and integrated annual primary production in the Chesapeake Bay (Houde and Harding 2009), suggesting that menhaden populations are controlled in part by bottom-up processes (i.e., quantity of food available). Despite these findings, additional work has found no significant correlation between YOY menhaden abundance and *chl-a* for the entire four-decade period that included periods of both low and high menhaden recruitment events in Chesapeake Bay. The strong correlation between YOY menhaden abundance and *chl-a* in recent years (1989-2004) as noted above did not persist throughout the longer time series (1966-2006). On average, years with low freshwater flow and low turbidity supported higher abundances and recruitment of YOY menhaden (Love et al 2006; Lynch et al 2010; Houde et al., 2016). Other simple correlations between YOY menhaden abundance and environmental or hydrographic variables were not significant or were only marginally significant (e.g., negative correlations with total dissolved phosphorus and with abundances of zooplankton taxa favored by low salinities). These conflicting bodies of work further highlight the complexity that exists between nutrient cycling, climatic drivers, and understanding the life history traits of Atlantic menhaden.

1.2.1.4 Mortality

The Atlantic menhaden population is subject to a high natural mortality rate. Natural mortality is also higher during the first two years of life than during subsequent years. Literature estimates of natural mortality have ranged from M = 0.37 (Schaaf and Huntsman, 1972) to M= 0.52 (Dryfoos et al., 1985). Previous assessments, beginning with Ahrenholz et al. (1987), used M=0.45, whereas the 2015 benchmark stock assessment used a time varying but age constant natural mortality to better account for known sources of natural mortality such as predation, pollution, habitat degradation, toxic algal blooms, and hypoxia (SEDAR, 2015).

Predation remains a large source of natural mortality for menhaden due to their high abundance in estuaries and coastal waters during the warmer months of the year (Ahrenholz, 1991). Many large piscivorous sea mammals, birds, and fish are potential predators on Atlantic menhaden. Menhaden are preyed upon by species such as bluefish, striped bass, king mackerel, Spanish mackerel, pollock, cod, weakfish, silver hake, tunas, swordfish, bonito, tarpon, and a variety of sharks. See additional details in *Ecological Roles* section below.

Coastal pollution, habitat degradation, and disease also threaten marine fish species like Atlantic menhaden which spend their first year of life in estuarine waters and the rest of their life in both ocean and estuarine waters. Fish kills, due principally to low dissolved oxygen conditions, disease, and parasites are additional and poorly understood sources of natural mortality (Burkholder et al. 1992; Blazer et al. 1999; Noga 2000; Law 2001; Glasgow et al. 2001; Vogelbein et al. 2001; Kiryu et al. 2002; Reimschussel et al. 2003; Burkholder et al. 2005). A variety of diseases are thought to affect menhaden survival (Stephens et al. 1980; Noga and Dykstra 1986; Noga et al. 1988; Levine et al. 1990a; Levine et al. 1990b; Dykstra and Kane 2000; Goshorn et al. 2004; Stine et al. 2005; Blazer et al. 2007). Menhaden are also known to induce fatal hypoxic events and reports of such school-induced hypoxia and resulting fish kills go back to the 1800's (Oviatt et al. 1972; Smith 1999).

1.2.1.5 Ecological Roles

Menhaden occupy an important link in the coastal marine food chain, transferring planktonic material into animal biomass. As a result, menhaden influence the conversion and exchange of energy and organic matter within the coastal ecosystem throughout their range (Peters and Schaaf 1981; Lewis and Peters 1984; Peters and Lewis 1984). Studies have indicated that menhaden are a part of the diet of many species including striped bass (*Morone saxatilis*), bluefish (*Pomatomus saltatrix*), weakfish (*Cynoscion regalis*), and piscivorous birds (Viverette et al. 2007). As a result, changes in the abundance and distribution of menhaden can have impacts on a variety of species given their role in the food web.

Atlantic menhaden occupy two distinct types of feeding niches during their lifetime. Phytoplankton is the major food of juvenile and young adult menhaden. The role of zooplankton in the diet becomes more important in older menhaden as gill raker spacings on their filtering apparatus increase in size (Friedland et al. 1984, 2006). The relative importance of each food type varies with ontogeny, region, and in relation to local availability.

The role of Atlantic menhaden in systems function and community dynamics has received much attention in recent years. Spatially-explicit bioenergetics models have also been used to estimate carrying capacity of menhaden in the Bay as well as the reduction of habitat volume from eutrophication and hypoxia (Brandt and Mason 2003; Luo et al. 2001). Additionally, simulation models indicate that Atlantic menhaden in Narragansett Bay and Chesapeake Bay potentially have substantial effects on zooplankton and phytoplankton populations, and on nutrient dynamics (Durbin and Durbin 1975, 1998; Gottlieb 1998). However, a study by Lynch et al. (2010) for Chesapeake Bay suggests that the menhaden population probably plays little role in removing nitrogen from Chesapeake Bay waters, and may actually provide additional nitrogen to Bay phytoplankton. Results suggest that YOY menhaden focus their grazing on patches of elevated phytoplankton abundance and/or supplement their diet with other sources (e.g. zooplankton and detritus) to maintain a positive nitrogen balance. Population-level estimates of net nitrogen removal imply that menhaden play a minimal role regarding water quality in Chesapeake Bay.

1.2.2 2015 Stock Assessment Summary

Based on tagging (Dryfoos et al. 1973; Nicholson 1978) and genetic studies (Anderson 2007; Lynch 2010), the Atlantic menhaden fishery is believed to be a single stock or population of fish, and is assessed as a single coastwide stock. Data used in the stock assessment includes commercial and recreational landings at age from Maine to Florida, two fishery independent adult indices based on nine state surveys, one each for the northern and southern regions, and a juvenile abundance index (JAI) developed from state seine, trawl, and other gear surveys along the coast.

Growth is estimated using a time invariant weight-length relationship based on fishery-dependent data that is bias corrected using the methods in Schueller et al. (2014). Weight at age is estimated from overall weight-length parameters and annual lengths at age. Maturity at age is developed using maturity records from reduction fishery catches and NEAMAP survey data. A logistic regression is fit to length and maturity data in addition to using time-varying lengths at age to calculate time-varying maturity at age. Natural mortality is calculated by an age-varying, time invariant approach using the methods of Lorenzen (1996) that are scaled to tagging estimates of natural mortality. This estimate of natural mortality accounts for multiple sources of mortality including predation, pollution, habitat degradation, toxic algal blooms, and hypoxia. The assessment model is structured into “fleets-as-areas” in order to account for differences between bait and reduction fisheries in the north and south. In addition, dome shaped selectivity is used for all fishery fleets.

The Beaufort Assessment Model (BAM) is used to produce final assessment results. This is a statistical forward-projection model that has been used in previous Atlantic menhaden assessments (SEDAR 2015).

1.2.2.1 Abundance and Structure

Annual Atlantic menhaden population size (age 0 and older at the start of the fishing season) has ranged from approximately 10 to 85 billion fish since 1955 (Figure 1). Population size averaged 44.9 billion menhaden during 1955-1959 when landings were high (averaging >600,000 mt). During the 1960’s, the menhaden stock contracted geographically, and the population averaged 16.4 billion fish. Total menhaden landings dropped to a low of 172,200 mt in 1969. In the 1970s and 1980s the menhaden population began to expand and the population size averaged 34.7 billion fish. During this time period, average landings rose to over 300,000 mt. During the 1990s, the Atlantic menhaden stock contracted again, and catches declined from 431,500 mt in 1990 to 205,800 mt in 1999. From 2000-2013, the population size has averaged 20.4 billion fish and total catches have averaged about 200,000 mt per year.

The oldest menhaden age classes comprise the smallest proportion of the population (Figure 1), but this proportion has increased in recent years (SEDAR 2015). For this reason, biomass is likely increasing at a faster rate than abundance because of the increased number of older fish at age and the associated increase in weight at age (SEDAR 2015).

1.2.2.2 Fishing Mortality

Highly variable fishing mortalities are noted throughout the entire time series and are dependent upon fishing effort. The highest fishing mortalities for the commercial reduction fishery in the north are estimated to have occurred in the 1950s (Figure 2), whereas the highest fishing mortality rates for the commercial reduction fishery in the south are estimated to have occurred during the 1980s and 1990s (Figure 2). The highest fishing mortalities for the commercial bait fishery in the north are estimated to have occurred in the 1950s and 1990s (Figure 3), while the highest fishing mortality rates for the commercial bait fishery in the south are estimated to have occurred during the late 1990s and early 2000s (Figure 3).

In the 2015 benchmark assessment, the TC initially recommended that the Board adopt a fishing mortality threshold based on the maximum F value at age-2 during the 1960-2012 time period and a target fishing mortality based on the median F value during this time period. However, in order to provide a more robust measure of fishing pressure under changing selectivity, it was recommended by the Peer Review panel that the geometric mean fishing mortality on ages-2 to -4 be used instead of the suggested age-2 reference points. This recommendation was accepted for use by the TC because these ages represent the fully selected fishing mortality rates depending upon the year and fishery (i.e., bait and reduction). As a result, the fishing mortality reference points are F-target ($F_{57\%\ MSP}$) = 0.38 and F-threshold ($F_{26\%\ MSP}$) = 1.26.

Based on these reference points, fishing mortality has remained below the threshold level (1.26) since the 1960s, hovered around the target (0.38) through the 1990s, dropped below the target in 2003, and was estimated to be 0.22 in 2013 (the terminal year of the assessment).

1.2.2.3 Recruitment

Age-0 recruits of Atlantic menhaden (Figure 4) were high during the late 1950s, especially the 1958 year-class. Recruitment was generally poor during the 1960s and high during the late 1970s and early 1980s. Since then, recruitment has been low with notable year classes in 2005 and 2010. The estimated number of age-0 fish in 2013 (the terminal year of the assessment) was 6.38 billion fish, which is the second lowest recruitment event, in numbers of fish, from 1955-2013 (Figure 4).

1.2.2.4 Spawning Stock Biomass (Fecundity)

Often reproductive capacity of a stock is modeled using female weight-at-age, primarily because of a lack of fecundity data. To the extent that egg production is not linearly related to female weight, indices of egg production (fecundity) are better measures of the reproductive output of a stock at a given size and age structure. Additionally, fecundity better emphasizes the important contribution of older and larger individuals to egg production. Thus, in the most recent benchmark stock assessment (SEDAR 2015), modeling increases in egg production with size was preferable to female biomass as a measure of the reproductive capability of the stock.

Population fecundity (*FEC*, number of maturing ova) was highest in the early 1960s, early 1970s, and the present decade, and has generally been higher with older age classes making up a larger proportion of the population (Figure 5). Large values of population fecundity were present in 2012 and 2013, which were the last two years of the model, but were similar in magnitude to historical values of population fecundity. Throughout the time series, age-2 and age-3 fish have produced most of the total estimated number of eggs spawned annually; however, in more recent years, ages-4+ have contributed a higher proportion to the overall number of eggs.

1.2.2.5 Maximum Spawning Potential

Amendment 2 (2013) implemented maximum spawning potential (MSP) based reference points that relate current stock conditions as a percent of unfished conditions. An unfished stock is equal to 100% MSP. Considering the modeling and data input changes that occurred in the 2015 Benchmark Stock Assessment, the TC and Peer Review Panel recommended new MSP based reference points that are applicable to the results of the assessment (ASMFC 2015).

The fecundity (FEC) reference points match the F reference points meaning they are equal to the fecundity estimated when F reaches equilibrium at its target and threshold MSP levels, respectively. The associated reference points for population fecundity are FEC-target ($FEC_{57\%MSP}$) = 189,270 (billions of eggs), and FEC-threshold ($FEC_{26\%MSP}$) = 86,821 (billions of eggs). In other words, the FEC target would maintain 57% of the spawning potential of an unfished stock, and the threshold would preserve 26% of the spawning potential of an unfished stock. In 2013, fecundity was estimated to be 170,536 billion eggs, which is 10% below the target level.

1.2.3 Current Stock Status

The current stock status determination is based on the 2015 Atlantic Menhaden Benchmark Stock Assessment report (SEDAR 2015). The fishing mortality reference points are *F*-target (*F57% MSP*) = 0.38 and *F*-threshold (*F26% MSP*) = 1.26. The associated reference points for population fecundity are *FEC*-target (*FEC57%MSP*) = 189,270 (billions of eggs), and *FEC*-threshold (*FEC26%MSP*) = 86,821 (billions of eggs). Based on the 2015 stock assessment, overfishing is not occurring because fishing mortality for the terminal year (2013) is estimated to be *F* = 0.22 (*F70%MSP*), below both the target and the threshold (Figure 6). Additionally, the stock is not overfished because fecundity for 2013 is estimated to be *FEC* = 170,536 billion eggs, above the threshold and just below the target (Figure 7). See http://www.asmfc.org/species/atlantic-menhaden for the most recent stock assessment reports and most current stock status determination.

1.3 DESCRIPTION OF THE FISHERY

1.3.1 Commercial Fishery

Atlantic menhaden have supported one of the United States' largest fisheries since colonial times. Menhaden have repeatedly been listed as one the nation's most important commercial fisheries in terms of quantity. Preliminary Atlantic menhaden landings in 2016 totaled 180,801 mt (398.6 million lb) (Table 16). Landings records indicate that roughly 25 million mt (55.1 billion lb) of Atlantic menhaden have been caught by fishing fleets operating from Maine to Florida since 1940.

Native Americans were the first to use menhaden, primarily for fertilizer. Colonists soon recognized the value of whole menhaden for fertilizer and local seine fisheries gradually developed from New York to Maine. The menhaden oil industry began in Rhode Island in 1811 (Frye 1999). Numerous small factories were located along the Northeast coasts; however, their supply was limited to fish that could be captured by the traditional shore-based seines. In 1845, the purse seine was introduced, and an adequate supply of raw material was no longer a problem. By 1870, the industry had expanded southward, with several plants in the Chesapeake Bay and North Carolina areas (Whitehurst 1973). The industry gradually developed during the late 1800s and early 1900s and was described in considerable detail prior to World War I by Greer (1915). The primary use of menhaden changed from fertilizer to animal feed after World War I through a process known as fish reduction. Menhaden meal was mixed into poultry, swine, and cattle feeds as the amount used for fertilizer was decreasing (Harrison 1931). The current commercial fishery is divided into the reduction fishery, in which menhaden are produced into fish meal and fish oil, and the bait fishery, in which menhaden are harvested as a bait source for other commercial and recreational fisheries. A variety of gears are used to harvest menhaden commercially (Table 17).

1.3.1.1 Reduction Fishery

<u>Vessels, Reduction Plants, and Harvest Capacity</u>

The early menhaden purse seine reduction fishery utilized sailing vessels until coal-fired steamers were introduced after the Civil War. In the 1930s, diesel-powered vessels began to replace the steamers, although a few sailing vessels were still in use. The use of spotter aircraft to locate schools of menhaden began in 1946, a practice still in use today by the reduction fishery. The refrigeration of vessel holds in the 1960s and 1970s was crucial for the industry to maintain its viability. Despite restricted access to a number of traditional fishing grounds, a reduced fleet size, and fewer processing plants to land fish, refrigerated holds enabled the fleet to maximize the harvest during peak resource availability. Refrigeration also allowed the fleet to stay out longer and access a wider geographic area, greatly improving the ability to catch fish when and where they are available. All seven vessels in the menhaden fleet in 2013 utilized refrigerated fish holds, compared to only 60% of the fleet in 1980.

Currently, commercial reduction menhaden purse seine fishing operations use spotter aircraft to locate schools of menhaden and direct vessels to the fish. When a school is located, two purse boats, with a net stretched between them, are deployed. The purse boats encircle the school and close the net to form a purse, or bag. The net is then retrieved to concentrate the catch, and the mother ship comes along the side and pumps the catch into refrigerated holds. Individual sets can vary from 10 to more than 100 mt, and large vessels can carry 400-600 mt of refrigerated fish.

Historically, the total number of vessels fishing for menhaden was generally related to the availability of the resource. Greer (1915) reported 147 vessels in 1912. During 1955-1959, about 115-130 vessels fished during the summer season, while 30-60 participated in the North Carolina fall fishery. As the resource declined during the 1960s, fleet size decreased by more than 50%. Through the 1970s, approximately 40 vessels fished during the summer season, while nearly 20 were active in the fall fishery. During 1980-1990, 16-33 vessels fished the summer season, and the level of effort in the fall fishery ranged from 3 to 25 vessels. In 2013, only 7 vessels participated in the reduction fishery.

One of the major changes in the reduction fishery has been the decrease in the number of operating reduction plants. During peak landing years (1953-1962), there was anywhere from 19 to 25 reduction plants in operation located along the coast from Maine to Florida. Many plants closed in the late 1960's as the resource began to decline and, in 1975, there were 12 reduction plants in operation. In 1985, this decreased to 6 plants and by 1994, there were only three plants located in Virginia and North Carolina. A major change in the reduction industry took place following the 1997 fishing season, when the two reduction plants operating in Reedville, VA, consolidated into a single company and a single factory; this significantly reduced effort and overall production capacity. Another major event within the industry occurred in the spring of 2005 when the fish factory at Beaufort, NC, closed and the owners sold the property to coastal developers. Today, there is a single reduction plant along the U.S. Atlantic coast located in Reedville, Virginia.

Reduction landings averaged 310,900 mt from 1940-2016, but only averaged 161,700 mt from 2000 – 2016 (Figure 8, Table 18). Reduction landings since 1940 peaked in 1956 at 712,100 mt, with the lowest value since 1940 (131,000 mt) occurring in 2013. It is important to note that 2013 was the first year a TAC was implemented in the menhaden fishery. This TAC represented a 20% reduction from average landings in 2009-2011. Other causes of declines in reduction harvest include lower menhaden abundance, reduced fleet size, and reduced reduction plant capacity.

The directed menhaden purse seine fishery for reduction is seasonal. The presence of menhaden schools is dependent on the temperature of coastal waters. Two fairly distinct fishing seasons occur, the "summer fishery" and the "fall fishery". The summer fishery begins in April with the appearance of schools of menhaden off the North Carolina coast. The fish migrate northward, appearing off southern New England in May-June. The fall fishery begins when migratory fish appear off Virginia and North Carolina. In early fall, this southward migration is initiated by cooling ocean temperatures. By late November-early December, most of the fish are found between Cape Hatteras and Cape Fear, North Carolina.

<u>Reduction Fishery Products</u>
Menhaden reduction plants, through a process of heating, separating, and drying, produce fish meal, fish oil, and fish solubles from fresh menhaden. Meal is a valuable ingredient in poultry and livestock feeds because of its high protein content (at least 60%). Meal can also be found in pet foods for fish and dogs. Menhaden oil is (or has been) used in cooking oils, margarine, soap, linoleum, waterproof fabrics, and certain types of paint. Menhaden oil is often marketed as a source of omega-3 fatty acids and can be incorporated into food and beverage products as well as dietary supplements. Solubles are the aqueous liquid component remaining after oil removal. In general, most meal producers add the soluble component to the meal to create a product termed "full meal." Solubles can be used in the aquaculture industry as an attractant and as a fertilizer.

<u>Internal Waters Processing</u>
Section 306 of the Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265) allows foreign fish processing vessels to operate within the internal waters of a state with the permission of the Governor of that state. Up to three IWP ventures operated within Maine's coastal waters during 1988-1993. Under state jurisdiction, a foreign vessel was permitted to process menhaden caught by US vessels into fish meal and oil during the 1988-1993 fishing seasons. In 1987, two New England-based menhaden vessels began to fish in the Gulf of Maine, landing the catch at a Canadian processing plant. Another Canadian factory in Nova Scotia processed menhaden in 1992 and 1993. No menhaden have been processed in the North Atlantic since the summer of 1993.

1.3.1.2 Bait Fishery

Menhaden from bait fisheries is primarily harvested with purse seines, pound nets, gill nets, and trawls, with a smaller amount of harvest coming from cast nets, fyke nets, and haul seines. Menhaden are taken for bait in almost all Atlantic coast states and are frequently used for bait in crab pots, lobster pots, and hook and line fisheries (both sport and commercial).

Since 1985, the proportion of menhaden landed as bait has generally increased (Table 18, Figure 8). Reported bait landings averaged 10% of the total Atlantic menhaden landings from 1985-2000 and 20% of total landings from 2001 to 2016. This increase in the percent of coastal bait landings can be attributed to better data collection in the fishery and a decline in coastal reduction landings. The closure of reduction plants in New England and the mid-Atlantic may have influenced growth in the bait fishery, making more product available for the lobster and crab pot fisheries, as well as bait for sport fishermen. Additionally, the passage of a net ban in Florida in November 1994 reduced the availability of bait in that state, which may have opened up new markets for menhaden bait caught in Virginia and the Mid-Atlantic States. The appearance of growth in the Atlantic coast bait fishery must be tempered by the knowledge that reporting systems for bait landings, particularly for Atlantic menhaden, have historically been incomplete.

Menhaden bait landings have not always been well-documented leading to an under-estimate of historic harvest. Historically, there have been some well-documented, large-scale, directed bait fisheries for menhaden using gears such as purse seines, pound nets, and gill nets; however, there have also been many small-scale directed bait fisheries, such as those using cast nets and beach seines, which have supplied large quantities of bait and had few, if any, reporting requirements. Estimates of menhaden bait landings have improved over the years as most states implemented reporting requirements for the smaller scale fisheries by the late 2000's. States were required to implement timely reporting as a part of Amendment 2 (2012) in order to monitor quota allocations.

Given the geographic expanse of the menhaden bait fishery, there are regional differences in how and when menhaden are harvested. In the southeast, menhaden landings are dominated by Florida and North Carolina. In Florida, menhaden landings are primarily landed with cast nets as the state implemented a net ban in 1994. Prior to this time, Florida had significant bait landings from gill nets and purse seines. Fishermen in North Carolina use cast nets, gill nets, and pound nets to harvest menhaden. The principal use for menhaden as bait in North Carolina is in the blue crab pot fishery. In addition, some keep menhaden alive in holding tanks for "slow trolling" for king mackerel, or bottom fishing for cobia. There are no directed menhaden fisheries in South Carolina and Georgia.

Menhaden bait landings in Virginia are dominated by purse seine vessels referred to as 'snapper rigs'. These vessels range from about 80 to 135 ft long and primarily sell bait to the sport and crab fisheries. In contrast, the Maryland and Potomac River bait fisheries are primarily executed by pound nets, a large fixed gear. The pound net fishery in the Chesapeake Bay region is prosecuted by numerous small, non-refrigerated vessels. Maximum hold capacity of these pound net vessels is 9 mt or less, but daily catches are usually well below vessel capacity and are limited by the number of fish encountered in the fixed gear. The majority of these fish supply the local blue crab pot fishery.

In the mid-Atlantic, there has been an expansion of the purse seine bait fishery in recent years, particularly in New Jersey. The New Jersey fishery utilizes about 20 carry vessels and about 15 catch vessels per year. Most operations have a catch vessel paired with a specific carry vessel, but some vessels are both catch and carry. Carry vessel length ranges from 59 to 90 feet, though most are in the 70-85 foot range, and catch vessel length ranges from 40 to 88 feet, but most are 40-50 feet. Net length is restricted to 150 fathoms (900 feet) by regulation. In New York and Delaware, menhaden bait landings are primarily caught in pound nets, gill nets, casts, and seines.

In the New England region, purse seine landings in Maine, Massachusetts and Rhode Island account for the majority of the recorded bait landings. The New England operators are fairly small, typically with one harvest vessel, ranging in size from the 30 to 90 feet in length. In Rhode Island, there is a historic floating fish trap fishery which harvests the majority of menhaden. In Connecticut, smaller directed gill net fisheries also harvest menhaden. The bulk of menhaden landings for bait in New England are used in the lobster fishery.

1.3.2 Recreational Fishery

Menhaden are important bait in many recreational fisheries and, as a result, some recreational fishermen employ cast nets to capture menhaden or snag them with hook and line. Recreational harvest is not well captured by the Marine Recreational Information Program (MRIP) because there is not a known direct harvest for menhaden, other than for bait. MRIP intercepts typically capture the landed fish from recreational trips as fishermen come to the dock or on the beach. Since menhaden caught by recreational fishermen are used as bait during their trip, they typically are not part of the catch that is seen by the surveyor completing the intercept.

From what is known, recreational catch has varied over time with a high of 672.3 mt in 1992 and a low of 12.2 metric tons in 2000. The average harvest between 1981 and 2015 was 206.8 mt. Landings have averaged 382.5 mt between 2011 and 2015. Preliminary recreational landings from 2016 are 845 mt, which would be a new high for the timeseries (Figure 9).

1.3.3 Subsistence Fishing

No subsistence fisheries for Atlantic menhaden have been identified at this time.

1.3.4 Non-Consumptive Factors

Menhaden provide an important forage based for many fish, bird, and marine mammal species. Please refer to *Section 1.1.2.1 Ecological Benefits*.

1.3.5 Interactions with Other Fisheries

Incidental bycatch of other finfish species in menhaden purse seines has been a topic of interest and concern for many years to the commercial and recreational fishing industry, as well as the scientific community (Smith 1896; Christmas et al. 1960; Oviatt 1977). Past studies have indicated that there is little or no bycatch in the menhaden purse seine fishery; however, there is currently no requirement for at-sea observers.

The Virginia Institute of Marine Science studied bycatch levels of finfish, turtles, and marine mammals in the Atlantic menhaden fishery. Results from that study indicated that bycatch in the 1992 Atlantic menhaden reduction fishery was minimal, comprising about 0.04% by number (Austin et al. 1994). The maximum percentage bycatch occurred in August (0.14%) while the lowest occurred in September (0.002%). Among important recreational species, bluefish accounted for the largest portion of bycatch (0.0075% of the total menhaden catch). No marine mammals, sea turtles, or other protected species were killed, captured, entangled or observed during sampling.

Additional data are available from the Gulf of Maine IWP fishery in 1991. Every catch unloaded onto the processing vessel was inspected by a state observer. A total of 93 fish were taken as bycatch along with roughly 60,000,000 individual menhaden (D. Stevenson, Maine DMR, pers. comm.; as cited in ASMFC 1992).

1.4 HABITAT CONSIDERATIONS

1.4.1 Physical Description of Habitat

1.4.1.1 Gulf of Maine

The Gulf of Maine is a semi-enclosed sea of 36,300 mi^2 (90,700 km^2) bordered on the northeast, north and west by the coasts of Nova Scotia, New Brunswick, and the New England states. To the south and east, the Gulf is open to the North Atlantic Ocean; however, Georges Bank forms a partial southern boundary below about 165 ft (50 m). The interior of the Gulf of Maine is characterized by five major deep basins (>600 ft, 200 m) which are separated by irregular topography that includes shallow ridges, banks, and ledges. Basins make up about 30% of the floor area (Thompson, 2010). Retreating glaciers (18,000–14,000 years ago) left behind a variety of patchily distributed sediment types including silt, sand, clay, gravel, and boulders (NMFS, 2015). Major tributary rivers are the St. John in New Brunswick; St. Croix, Penobscot, Kennebec, Androscoggin, and Saco in Maine; and Merrimack in Massachusetts.

The predominantly rocky coast north of Portland, Maine is characterized by steep terrain and bathymetry, with numerous islands, embayments, pocket beaches, and relatively small estuaries. Tidal marshes and mud flats occur along the margins of these estuaries. Farther south, the coastline is more uniform with few sizable bays, inlets, or islands, but with many small coves. Extensive tidal marshes, mud flats, and sandy beaches along this portion of the coast are gently sloped. Marshes exist along the open coast and within the coves and estuaries.

The surface circulation of the Gulf of Maine is generally counterclockwise, with an offshore flow at Cape Cod which joins the secondary, clockwise gyre on the northern edge of Georges Bank. The Northeast and Great South Channels, which bookend Georges Bank, serve as the primary inflow and outflow channels of marine waters, respectively. Some of the water entering the Northeast Channel flows into the Bay of Fundy; another portion turns west to feed the Maine Coastal Current, initiating the counterclockwise direction of flow. The counterclockwise gyre is more pronounced in the spring when river runoff adds to the southwesterly flowing coastal current. Surface currents reach velocities of 1.5 knots (80 cm sec) in eastern Maine and the Bay of Fundy region under the influence of extreme tides, up to 52 ft (16 m) and gradually diminish to 0.2 knots (10-20 cm/sec) in Massachusetts Bay where tidal amplitude is about 10 ft (3 m) (Thompson, 2010).

There is great seasonal variation in sea surface temperature in the Gulf, ranging from 4°C in March throughout the Gulf to 18°C in the western Gulf and 14°C in the eastern Gulf in August. The Gulf of Maine sea surface temperature has been warming steadily over the last 35 years. In the most recent decade, the warming trend (0.23 °C /year) was faster than 99 percent of the global ocean (Pershing et al., 2015). The warming is related to a northward shift in the Gulf Stream and to changes in the Atlantic Multidecadal Oscillation and Pacific Decadal Oscillation (Pershing et al., 2015). The salinity of the surface layer also varies seasonally, with minimum values in the west occurring during summer, from the accumulated spring river runoff, and during winter in the east under the influence of runoff from the St. Lawrence River (from the previous spring). With the seasonal temperature and salinity changes, the density stratification in the upper water column also exhibits a seasonal cycle. From well mixed, vertically uniform conditions in winter, stratification develops through the spring and reaches a maximum in the summer. Stratification is more pronounced in the southwestern portion of the Gulf where tidal mixing is diminished.

1.4.1.2 Middle Atlantic Region

The coastal zone of the mid-Atlantic states varies from a glaciated coastline in southern New England to the flat and swampy coastal plain of North Carolina. Along the coastal plain, the beaches of the barrier islands are wide, gently sloped, and sandy, with gradually deepening offshore waters. The area is characterized by a series of sounds, broad estuaries, large river basins (e.g., Connecticut, Hudson, Delaware, and Susquehanna), and barrier islands. Conspicuous estuarine features are Narragansett Bay (Rhode Island), Long Island Sound and Hudson River (New York), Delaware Bay (New Jersey and Delaware), Chesapeake Bay (Maryland and Virginia), and the nearly continuous band of estuaries behind barrier islands along southern Long Island, New Jersey, Delaware, Maryland, Virginia, and North Carolina. The complex estuary of Currituck, Albemarle, and Pamlico Sounds behind the Outer Banks of North Carolina (covering an area of 2,500 square miles) is an important feature of the region. Coastal marshes border those estuaries along much of the glaciated coast from Cape Cod to Long Island Sound. Nearly continuous marshes occur along the shores of the estuaries behind the barrier islands.

At Cape Hatteras, the Continental Shelf extends seaward approximately 20 mi (33 km), and gradually widens northward to about 68 mi (113 km) off New Jersey and Rhode Island where it is intersected by numerous underwater canyons. Surface circulation north of Cape Hatteras is generally southwesterly during all seasons, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. Speeds of the drift north of Cape Hatteras are on the order of six miles (9.7 km) per day. There may be a shoreward component to this drift during the warmer half of the year and an offshore component during the colder half. The western edge of the Gulf Stream meanders in and out off Cape Hatteras, sometimes coming within 12 mi (20 km) of the shore, but it becomes less discrete and veers to the northeast north of Cape Cod. Surface currents as high as 4 knots (200 cm/sec) have been measured in the Gulf Stream off Cape Hatteras.

Hydrographic conditions in the mid-Atlantic region vary seasonally due to river runoff and changing water temperatures. The water column becomes increasingly stratified in the summer and homogeneous in the winter due to fall-winter cooling of surface waters. In winter, the mean range of sea surface temperatures is 0-7°C off Cape Cod and 1-14°C off Cape Charles (at the southern end of the Delmarva Peninsula); in summer, the mean range is 15-21°C off Cape

Cod and 20-27°C off Cape Charles. The tidal range averages slightly over 3 ft (1 m) on Cape Cod, decreasing to the west. Within Long Island Sound and along the south shore of Long Island, tide ranges gradually increase, reaching 6 ft (2 m) at the head of the Sound and in the New York Bight. South of the Bight, tide ranges decrease gradually to slightly over 3 ft (1 m) at Cape Hatteras. Prevailing southwest winds during the summer along the Outer Banks often lead to nearshore upwelling of colder bottom water from offshore, so that surface water temperatures can vary widely during that period (15-27°C over a period of a few days).

The waters of the coastal middle Atlantic region have a complex and seasonally dependent circulation pattern. Seasonally varying winds and irregularities in the coastline result in the formation of a complex system of local eddies and gyres. Surface currents tend to be strongest during the peak river discharge period in late spring and during periods of highest winds in the winter. In late summer, when winds are light and estuarine discharge is minimal, currents tend to be sluggish, and the water column is generally stratified.

1.4.1.3 South Atlantic Region

The south Atlantic coastal zone extends in a large oceanic bight from Cape Hatteras south to Biscayne Bay and the Florida Keys. North of Florida it is bordered by a coastal plain that stretches inland for a hundred miles and a broad continental shelf that reaches into the ocean for nearly an equal distance. This broad shelf tapers down to a very narrow and precipitous shelf off the southeastern coast of Florida. The irregular coastline of North Carolina, South Carolina, Georgia, and eastern Florida is generally endowed with extensive bays and estuarine waters, bordered by nutrient-rich marshlands. Barrier beaches and dunes protect much of the shoreline. Along much of the southern coast from central South Carolina to northern Florida estuarine salt-marsh is prominent. Most of the east coast of Florida varies little in general form. Sand beaches with dunes are sporadically interrupted by mangrove swamps and low banks of earth and rock.

The movements of oceanic waters along the South Atlantic coast have not been well defined. The surface currents, countercurrents, and eddies are all affected by environmental factors, particularly winds. The Gulf Stream flows along the coast at 6-7 miles per hour (10-11 km/hr). It is nearest to the coast off southern Florida and gradually moves away from the coast as it flows northward. A current that flows southward, inshore of the Gulf Stream, exists for most of the year north of Cape Canaveral.

Sea surface temperatures during the winter increase southward from Cape Hatteras to Fort Lauderdale, Florida, with mean minimums ranging from 2-20°C and maximums ranging from 17-26°C. In the summer, the increases are more gradual, ranging north to south from minimums of 21-27°C to maximums of 28-30°C. Mean sea-surface salinity is generally in the range of 34 to 36 ppt year round. Mean tidal range is just over 3 ft (1 m) at Cape Hatteras and increases gradually to about 6-7 ft (2 m) along the Georgia coast. Tides decrease south of Cape Canaveral to 3 ft (1 m) at Fort Lauderdale.

1.4.2 Environmental Requirements of Atlantic Menhaden

1.4.2.1 Temperature, Salinity and Dissolved Oxygen

Atlantic menhaden occur throughout a wide range of physicochemical conditions. Several studies have raised questions about the species' environmental limits and optimum conditions. June and Chamberlin (1959) and Reintjes and Pacheco (1966) reported that larval menhaden did not enter estuarine waters at temperatures below 3°C. Many studies have noted an affinity of young menhaden for low salinity waters. Wilkens and Lewis (1971) speculated that larval menhaden require low salinity water to metamorphose properly, and Lewis (1966) found that although larvae metamorphosed in salinities of 15-40 ppt, one-third of the juveniles developed slightly crooked vertebral columns. However, larvae held in the laboratory at 25-40 ppt metamorphosed completely with no abnormalities (Reintjes and Pacheco 1966; Hettler 1981), and larvae trapped in a natural cove at Beaufort, North Carolina, transformed into juveniles at 24-36 ppt (Kroger et al. 1974).

Salinity also affects temperature tolerance, activity, metabolism and growth. Low salinities decreased survival at temperatures below 5°C, and survival was poor at 6°C in freshwater (Lewis 1966). The effect of salinity on upper temperature tolerance was not significant (Lewis and Hettler 1968). Larvae that Hettler (1976) reared at 5-10 ppt exhibited significantly higher activity levels, metabolic rates, and growth rates than those reared at 28-34 ppt. Lewis (1966) also noted slower growth at high salinities. Subtle physiological adaptations to low salinity may be an evolutionary response to larvae "seeking" the food-rich estuarine environment. Rogers et al. (1984) noted that pre-juveniles of many fishes, including those of *Brevoortia* species, entered estuarine habitats during seasonal peaks of freshwater influx when the area of low salinity and fresh tidal water was greatest.

Salinities of 10-30 ppt did not affect developing embryos, though temperature did (Ferraro 1980). Mortality of embryos was complete at temperatures less than 7°C and was significantly higher at 10°C than at 15, 20, and 25°C. Time to hatching was significantly shorter at each progressively higher temperature. Surface temperature in the spawning areas of the South Atlantic Region during the months of highest egg capture were generally 12-20°C (Walford and Wicklund 1968). The lowest temperatures at which Atlantic menhaden eggs and larvae were collected in the North Atlantic region were between 10 and 13°C (Ferraro 1980). The temperature range for the Middle Atlantic region was 0-25°C, but most eggs and larvae were collected at 16-19°C (Kendall and Reintjes 1975).

The limits of larval temperature tolerance are affected by acclimation time. Survival above 30°C (Lewis and Hettler 1968) and below 5°C (Lewis 1965) was progressively extended by acclimation temperatures closer to test values, suggesting that rapid changes to extreme temperatures are more likely to be lethal than prolonged exposure to slowly changing values. Winter shutdown of power plant operations may result in rapid temperature decreases near the effluent discharge area. Mortality of juvenile Atlantic menhaden to a temperature decrease of 10°C (from 15 to 5°C) was less at rates of decrease of 6.7°C /h or lower than at faster rates. Winter menhaden kills can be minimized by reducing the rate of decrease as the power plant discharge is shut down (Burton et al. 1979).

A potential management consideration is that, historically, estuarine zones received freshwater from contiguous wetlands and riverine systems. However, channelization, diking of river courses, ditching and draining of marginal wetlands, and urbanization have reduced the freshwater retention capacities of coastal wetlands. Furthermore, extensive filling of estuarine marshlands has diminished the area receiving runoff in many locations. In combination, these changes cause rapid discharge of high volumes of freshwater during brief periods and reduced amounts of freshwater at other times. High inflows, particularly those that occur in early spring after the arrival of pre-juvenile menhaden, can expose fish to extreme fluctuations of temperature, turbidity, and other environmental conditions. Although the effects of altered freshwater flow regimes on Atlantic menhaden are not known, effects on other estuarine dependent, offshore spawned fishes range from disappearance (Rogers et al. 1984) to death (Nordlie et al. 1982).

Dissolved oxygen, particularly at low levels, can impact the survival of menhaden. Lewis and Hettler (1968) observed increased survival of juveniles at 35.5°C with increased dissolved oxygen (DO) saturation. Burton et al. (1980) reported a mean lethal DO concentration of 0.4 mg/l, but warned against interpretation of this value as "safe," in view of the interactive nature of environmental factors. Westman and Nigrelli (1955) observed mass mortalities from gas embolism only in areas with highly variable salinity and organic pollution sufficiently severe to make shellfish unfit for human consumption. Lewis and Hettler (1968) observed decreased survival at high temperatures by fish affected by gill parasites. The interaction of environmental factors must be considered when one defines healthy ranges for an organism.

1.4.2.2 Primary Production

Abundance of YOY juvenile menhaden is strongly and positively correlated with *chl-a* and primary production in Chesapeake Bay (Houde and Harding 2009). Furthermore, the relationship between *chl-a* and abundance of YOY recruits is principally generated in spring months during the period larvae are transitioning to the filter-feeding juvenile stage when menhaden become dependent on phytoplankton for food. Although recent research indicates that age-1+ menhaden may derive most energy from zooplankton food (Lynch et al. 2010; Friedland et al. 2011), it is apparent that YOY menhaden can efficiently filter small phytoplankton (Friedland et al. 2006) and that it is their primary food. The timing, intensity, quality, and spatial variability of the spring phytoplankton bloom in Chesapeake Bay show high interannual variability and are strongly affected by climate (Adolf et al. 2006; Miller and Harding 2007). This variability in primary production is probably a key factor controlling production potential of young menhaden in estuarine habitats.

Analysis of two decades of ichthyoplankton survey data (1977–1987 and 1999–2008) revealed a shift in the timing of larval occurrence on the Northeast US shelf ecosystem. Relative larval abundance occurred later in the fall, compared to the previous 10-yr sampling period (Walsh et al. 2015). These results are consistent with the hypothesis that warming in the NEUS Shelf (Friedland and Hare 2007) is causing changes to spawning times.

1.4.2.3 Environmental Factors and Recruitment Success

Relationships between recruitment success of YOY menhaden and factors other than variables associated with primary productivity were less clear. Numerous fish and avian predators are major consumers of young menhaden, but there are no estimates of predation rates or of variability in natural mortality rates of YOY menhaden. Bioenergetics and predation models indicate potential for predators to control abundances of YOY menhaden in the Chesapeake Bay (Annis et al. 2011).

There is evidence that the temperature experienced by YOY menhaden affects seasonal and inter-annual variability in growth within the Chesapeake Bay (Humphrey et al. 2014, Houde and Harding 2009), and is an important parameter in bioenergetics models that predict growth potential (Annis et al. 2011). Recent observations suggested that flow-related variables were important, but acted indirectly and in complex ways to exercise control over recruitment levels. Regional analyses supported the observation that menhaden recruitment, in general, is elevated in years of low late-winter precipitation and freshwater flow, when relatively warm and dry weather conditions, often described as “Bermuda High” patterns, prevail (Wood et al. 2004; Kimmel et al. 2009; Wood and Austin 2009).

1.4.2.4 Sediments and Turbidity

Forest clearing has led to changes in sediment loading as without the buffer provided by trees, shrubs, plants, and wetlands, storm water flows unchecked (Brush 1986). This results in erosion that brings increased sediment into estuaries, such as the Chesapeake Bay. In addition, the dramatic increase in impermeable surfaces has also increased runoff as impervious surfaces amplify storm water discharges into streams (Goetz and Jantz 2006). One consequence of these changes is that sediment grain size has changed over time so that very fine sediment now predominates, which reduces light penetration. Secchi disk readings from the Chesapeake Bay have steadily declined since 1985 from just over 2 meters to about 1 meter in 2008 (Greer 2008). Because filter feeding juvenile menhaden can retain particles as small as 5-7 µm, and to a minor extent particles <5 µm, there is a possibility that menhaden feeding could be compromised (Friedland et al. 1984).

Increased turbidity acts to shade submerged aquatic vegetation (SAV), thus decreasing the extent and composition of SAV beds. Loss of SAV may indirectly affect menhaden by increasing turbidity as a result of increased sediment resuspension (Orth et al., 2006) which in turn can lower phytoplankton productivity. SAV has also been shown to exercise control over ecosystem function through nutrient recycling and linkage to fish productivity (Orth et al., 2006; Hughes et al., 2009), which may impact menhaden abundance, although specific impacts are not known at present.

1.4.2.5 Water Movement

Currents and circulation features play an important role in cueing reproduction, and in controlling dispersal of larval stages, assuring that some larvae are transported to the coastal estuaries and embayments that serve as juvenile nurseries. Most larval menhaden are found shoreward of the Gulf Stream Front (GSF); those sampled in the GSF or seaward of it presumably are rapidly advected northeast and lost to the population, although it is possible that warm-core rings and onshore streamers could return some larvae to the shelf (Hare and Govoni 2005). There is ample evidence, based on observations and models, that coastward transport of larvae is supported by favorable winds and currents on the shelf (e.g., Checkley et al. 1988; Werner et al., 1999). Models and observations of advective mechanisms at estuary mouths present a less-clear picture of how menhaden larvae move into estuaries, although it is apparent that winds, tides, and larval behavior control the ingress.

Interannual variability in recruitment is believed to be, at least partly, controlled by variability in oceanographic conditions that affect hydrography, circulation, and possibly biological productivity. Weather and climate patterns are probable drivers of such variability. Wood et al. (2004) demonstrated that prevalence of a late-winter climate pattern designated a “Bermuda-Azores High” that brings dry and warm late-winter weather to the Mid-Atlantic region is associated with high recruitment of Atlantic menhaden. This weather pattern may promote favorable shoreward transport or feeding conditions for early-stage menhaden larvae while on the continental shelf.

The remarkable temperature tolerance of larval menhaden is notable in distribution statistics. Larvae have been collected at temperatures from 0 to 25 °C. The low-temperature observations are for late-stage menhaden larvae (usually >20 mm length) in winter that have been advected to the mouths of mid-Atlantic estuaries (e.g., Kendall and Reintjes 1975).

The mechanics and details of larval ingress to estuaries are poorly known, despite numerous studies to describe and explain it. Larval ingress may occur in pulses, supported by wind generated high-inflow events (Forward et al. 1999b). Wind forcing may play an important role, in combination with entrainment in up-estuary residual flow (Hare et al 2005).

1.4.2.6 Substrate and System Features

The association of Atlantic menhaden with estuarine and nearshore systems during all phases of its life cycle is well documented. It is evident that young menhaden require these food rich waters to survive and grow, and the fishery is concentrated near major estuarine systems. Filling of estuarine wetlands, in addition to exacerbating extremes in environmental conditions, has physically limited the nursery habitat available to Atlantic menhaden and other estuarine-dependent species. The relative importance, however, of different habitat types (i.e. sounds, channels, marshes) and salinity regimes has received little detailed attention (Rogers and Van Den Avyle 1989).

1.4.3 Identification and Distribution of Essential Habitat

Estuarine and nearshore waters along the Atlantic coast from Florida to Nova Scotia serve as important habitat for juvenile and/or adult Atlantic menhaden. Within this wide geographic range, hydrographic and circulation features constrain population distribution (MDSG 2009). Adult menhaden distribution is bounded by the Gulf Stream Front on the seaward side and usually within waters warmer than 10°C (MDSG 2009).

Adult Atlantic menhaden spawn in oceanic waters along the continental shelf, as well as in sounds and bays in the northern extent of their range (Judy and Lewis 1983). Around June, fish are stratified by age and size along the coast, with larger, spawning-age fish north of Long Island (Judy and Lewis 1983). Winds and tides transport larvae shoreward from the shelf (Checkley et al. 1988, Werner et al. 1999) toward nursery grounds in the estuaries. Larvae are between one and three months old, usually closer to two months, at first ingress into estuaries (Warlen et al. 2002, MDSG 2009). In the Chesapeake Bay monthly larval ingress was variable, but peaked between November and April (Lozano and Houde 2013), and peak ingress into North Carolina estuaries occurred from February through April (Lewis and Mann 1971, Hettler and Chester 1990, Hettler et al. 1997).

After entering the estuary, larvae congregate in large concentrations near the upstream limits of the tidal zone, where they metamorphose into juveniles (June and Chamberlin 1959, Houde 2011). The relative densities of juvenile menhaden have been positively correlated with higher chlorophyll *a* levels in the lower salinity zones of estuaries, resulting in highly patterned distributions (Friedland et al. 1989 & 1996, Houde and Harding 2009).

Many factors in the estuarine environment affect the behavior and well-being of menhaden. The combined influence of weather, tides, and river flow can expose estuarine fish to rapid changes in temperature and salinity. It has been reported that salinity affects menhaden temperature tolerance, activity and metabolic levels, and growth (Lewis 1966; Hettler 1976). Factors such as waves, currents, turbidity, and dissolved oxygen levels can impact the suitability of the habitat, as well as the distribution of fish and their feeding behavior (Reintjes and Pacheco 1966). As juvenile menhaden grow and develop, they form dense schools throughout the lower salinity portions of the estuary; most eventually migrate to the ocean in late fall-winter. Historical information suggests most spawning age menhaden move south of Cape Hatteras during the winter (Judy and Lewis 1983). However, there have been recent observations of dense concentrations of menhaden overwintering in 5-7°C waters adjacent to southern Long Island and Block Island, as well as winter fishery landings of menhaden harvested from these locations (John Manderson, NOAA, pers. comm.).

Historically, Chesapeake Bay was considered to be the most productive nursery area (contributing 69% of Atlantic menhaden recruits [age 1] to the coast wide population), followed by the south Atlantic (17%), and the Mid-Atlantic sections from Maryland to New York (12%) (Ahrenholz et al. 1989, ASMFC 2004, Anstead et al. 2017). However new research credits the Chesapeake Bay with 30% of age 1 recruits and New England and the southeast estuaries contributing equal portions to the population (Anstead et al. 2016). Furthermore, recruits from all three areas, in the same proportions, have been shown to persist in the population beyond the first year to ages 2-4, therefore becoming part of the reproductive population (Anstead et al. 2017).

Pollution and habitat degradation threaten the Atlantic menhaden population, particularly during the estuarine residency of larvae and juveniles. Important estuaries such as the Chesapeake Bay and the Albemarle-Pamlico system are especially susceptible to pollution because they are generally shallow, have a high total volume relative to freshwater inflow, limited tidal exchange, and a long retention time. Most tributaries of these systems originate in the Coastal Plain and have relatively little freshwater flow to remove pollutants, particularly during drier-than-average summers. Shorelines of most estuarine areas are becoming increasingly developed, even with existing habitat protection programs. Thus, nursery habitats of greatest long-term importance to the menhaden stock and fishery are increasingly at risk.

1.4.4 Anthropogenic Impacts on Atlantic Menhaden and Their Habitat

The human population along the coast is steadily increasing, and the average number of people per square mile in coastal counties has nearly doubled since 1960 (U.S Census Bureau 2010). Increasing human presence precipitates industrial and municipal expansion, thus intensifying anthropogenic pressure on resources and accelerating competition for use of land and water. Consequently, estuarine and coastal habitats have been significantly reduced and continue to be stressed by dredging, filling, coastal construction, energy plant development, pollution, waste disposal, nutrient loading, and other human-related activities.

Degraded water quality in estuaries threatens critical nursery habitat for young menhaden. Concern has been expressed (Ahrenholz et al. 1987) that the outbreaks of ulcerative mycosis in the 1980s may have been symptomatic of deteriorating water quality in estuarine waters along the east coast. Human population growth and increasing development in the coastal zone are expected to further reduce water quality unless steps are taken to ameliorate their effect on the environment (Cross et al. 1985). Altering habitats and water quality can affect menhaden habitat use and productivity - responses that are magnified in estuaries where human use and biological productivity heavily interact.
Perhaps the most significant physical alteration of the Chesapeake Bay watershed in recent decades has been the increase in impervious surfaces. More than 400,000 hectares are currently categorized as impervious surface and that value continues to climb (Brush 2009). These surfaces increase the nutrient, sediment, and contaminant flow rate to the Chesapeake Bay (Clagett 2007), and exacerbate eutrophication and expansion of hypoxic and anoxic zones. Although not well studied at present, reduced water quality associated with increases in impervious surfaces could diminish habitat quality for menhaden or their predators.

Menhaden fish kills, both human-caused and naturally occurring, are a persistent problem in bays and estuaries throughout the range. Most states keep records of fish kills, documenting water quality, number of fish killed, and likely causes. Localized die-offs often occur due to critically low dissolved oxygen (DO) levels, which may result from a variety of factors including high temperature, low flow, overcrowding, or algal blooms. Infectious diseases, parasites, toxicants, or miscellaneous human activity (e.g. thermal shock or fishing discards) may also cause localized mortality. In Maryland, nearly 50 years of records document annual menhaden kills ranging from tens to tens-of-millions of fish (max est. 47M fish in 1974), caused by a variety of factors from concussive explosions to disease to toxicants from spills or discharge (C. Poukish, MD DNR, pers. comm.). The most common factor was low DO in the presence of algal blooms, which causes an annual spring die-off. In the Neuse and Tar-Pamlico River estuaries in North Carolina low oxygen events cause significant mortality of Atlantic menhaden and other fish species nearly every summer (R. Wilson Laney, USFWS, pers. comm.; also see http://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/nc-fish-kill-activity/fish-kill-events, and NC Department of Environmental Quality 2015). In Florida, nutrient inputs, exacerbated by low flushing in the Indian River Lagoon, result in Harmful Algal Blooms (HABs) and, ultimately, menhaden kills (K. Smith, FL FWC, pers. comm.).

In recent years the menhaden population appears to be rebounding and expanding to reoccupy its historic geographic range. With more fish returning to areas heavily used and impacted by humans, the potential for fish kills increases. For example, in 2016, tens of thousands of menhaden were killed when a lock closure trapped them in the Shinnecock Canal in New York. As large numbers of menhaden start appearing in historic places, policies and practices should be adjusted to anticipate and avoid or minimize mortality events.

At one time, fish kills may have solely been a natural occurrence, but anthropogenic impacts to water quality and flow have certainly exacerbated the frequency and intensity of these mortality events. State efforts to track fish kills can provide information on patterns and trends. North Carolina, for example, instituted a fish kill investigation procedure in 1996 to collect and track fish kill information. Data is maintained in a central database and is reviewed as part of an effort to monitor water quality trends. As we better understand causes of fish kills, mediation and prevention policies and practices can be developed.

A growing body of literature is beginning to describe shifts in species distributions and spawning locations and seasons, possibly due to a changing climate on the Atlantic coast (e.g. Walsh et al. 2015, Kleisner et al. 2016). Menhaden ingress to estuaries is sensitive to changes in wind patterns and temperatures, which are known to be variable and may be influenced by climate change (Quinlan et al. 1999, Austin 2002). Moreover, nursery habitats within bays and estuaries are likely to be altered by the effects of climate change, in some cases potentially enhancing menhaden productivity and other cases resulting in lower production and recruitment. The effects of climate change are predicted to include: increased water temperatures, sea-level rise, and changes in precipitation patterns and climate variability (including increased storm and drought events), among other related phenomena (Sherman et al. 2009). These changes can influence salinity, temperature, and nutrients throughout nursery grounds.

In addition to long-term climate change, the Atlantic coast has also experienced shorter-term, decadal fluctuations in weather, shifting between cold-wet and warm-dry periods. Austin (2002) showed that the 1960s were warmer and wetter than the 1970s and 1990s in the Mid-Atlantic. Menhaden recruitment success tends to be relatively high in years when late winter-spring conditions are warm and dry (Wood 2000). Although menhaden recruitment has been correlated with the Atlantic Multidecadal Oscillation (Buchheister et al. 2016), the correlation between Chesapeake Bay and southern New England is reversed and the mechanisms of influence are unknown. The generally low recruitments of YOY menhaden in recent years appear to be constrained by frequent cool and wet winter-spring conditions that favor recruitment of anadromous spawners, but not offshore-spawning fishes such as menhaden (Kimmel et al. 2009). It is not certain whether climate change will have positive or negative impacts on the long-term abundance and productivity of menhaden.

1.4.5 Description of Programs to Protect, Restore, & Preserve Atlantic Menhaden Habitat

The federal Coastal Zone Management Act provides a framework under which individual coastal states have developed their own coastal habitat protection programs. In general, wholesale dredging and filling are not allowed. Individual development projects are subject to state and federal review and permit limitations. Every Atlantic coast state has a coastal habitat protection program in place (Table 11.27 in ASMFC 1992). These protection programs have greatly reduced the loss of vital coastal habitat to dredging and filling since the mid-1970s. Virtually all proposals affecting coastal habitat are now reviewed by a variety of local, state, and federal agencies, and wholesale destruction of coastal wetlands is rare. Many important estuarine habitats are now protected as part of various wildlife refuges, national and state parks, and public and private nature preserves. In addition, a federal permit program is conducted by the U.S. Army Corps of Engineers, generally in cooperation with the state programs. Every state also conducts water quality protection programs under the federal Clean Water Act. National Pollution Discharge Elimination System permits are required for point-source discharges.

Unfortunately, these programs provide much less control over non-point pollution, especially from agricultural and silvicultural activities, and excess nutrient inputs from diverse sources continue to contribute to hypoxic and anoxic conditions in estuarine menhaden habitat. A coast wide compilation and spatial analysis of menhaden mortality event data could be conducted to reveal patterns and trends. Additional work to more precisely define menhaden habitat parameters for all life stages and to develop accompanying map products is needed to inform diverse multi-agency and project applicant consultations and permitting processes so that further impacts to menhaden habitats are avoided or minimized.

1.5 IMPACTS OF THE FISHERY MANAGEMENT PROGRAM

1.5.1 Biological and Ecological Impacts

1.5.1.1 Reference Points

The adoption of ecosystem reference points (ERPs) will expand the focus of menhaden management from assessing the status of menhaden alone, to assessing the status of menhaden in relation to other prey and predator species. ERPs will seek to ensure maintenance of a forage base needed to support larger finfish (e.g. striped bass, bluefish, weakfish), coastal birds (e.g. osprey), and marine mammals (e.g. humpback whales). An ecosystem approach to setting reference points for menhaden may also increase the spawning biomass of the menhaden stock, promoting a higher stock abundance along the coast.

Continued use of the existing single-species reference points from the 2015 Stock Assessment will continue to provide a greater measure of sustainability than the reference points established in Amendment 2; however, these reference points consider the status of menhaden independent of other species. As a result, it is unclear if they are protecting a large enough forage base to support predator populations. Under the current reference points, the menhaden stock is not overfished and overfishing is not occurring.

1.5.1.2 Total Allowable Catch

Limiting menhaden catch through a Total Allowable Catch (TAC) is a way to maintain menhaden within in the limits of reference points. After the TAC is harvested in a given year, the directed fishing season closes. This allows for greater protection of the spawning biomass, as opposed to allowing fishing to continue without a TAC. If properly set and enforced, quotas will prevent overfishing and ensure a sustainable resource for the future. Maintenance of a sustainable resource will also increase the forage base of commercially and recreationally important predator species.

The intent of quota allocation under this Amendment is to identify a fair and equitable method through which to distribute quota to various fisheries, gear types and regions. An allocation method which addresses the needs of each user group and is flexible to respond to future changes in the fishery will provide stability for the fishery and resource. It may also reduce the need for other management tools, such as the incidental catch provision, which, under Amendment 2, allows for the harvest of menhaden outside of the TAC. Reducing harvest under the incidental catch provision will ensure a greater amount of harvest is counted towards the TAC and help support a sustainable resource.

1.5.1.3 Chesapeake Bay Reduction Fishery Cap

Maintenance of a Chesapeake Bay cap on the reduction fishery will ensure continued protection of this important nursery ground for menhaden. The cap prohibits harvest of menhaden by the reduction fishery when 100% of the cap has been reached. This protection helps support menhaden recruitment in the Bay and a forage base for predators in the Chesapeake Bay, such as striped bass.

The Chesapeake Bay Reduction Fishery Cap was originally implemented in 2005 to prevent localized depletion of menhaden. Given the concentrated harvest of menhaden within the Chesapeake Bay, there was concern regarding the potential for localized depletion. In 2005, the Board established the Atlantic Menhaden Research Program (AMRP) to evaluate the possibility of localized depletion. Results from the peer review report in 2009 were unable to conclude localized depletion is occurring in the Chesapeake Bay and noted that, given the high mobility of menhaden, the potential for localized depletion could only occur on a "relatively small scale for a relatively short time".

While the AMRP peer review report was not able to provide conclusive evidence that localized depletion is occurring, maintenance of the Chesapeake Bay reduction fishery cap does provide a greater level of protection in the region than the TAC alone.

1.5.1.4 Data Collection and Reporting Requirements

This Amendment requires states to implement timely quota monitoring programs so that the harvest of menhaden can stay within the TAC and the potential for overages is limited. Furthermore, purse seine or bait seine vessels are required to submit Captain's Daily Fishing Reports on a daily basis, and states must collect biological samples relative to their level of harvest. This level of reporting is necessary for the implementation of a quota management system, as lengthy delays could lead to quota overages or premature closures of the fishery. Furthermore, continued biological sampling will increase knowledge on the stock's age structure, improving the precision of menhaden abundance estimates in stock assessments.

1.5.2 Social and Economic Impacts

(Add text from Winnie and Andrew)

2.0 GOALS AND OBJECTIVES

2.1 HISTORY OF MANAGEMENT

The first coastwide fishery management plan (FMP) for Atlantic menhaden was passed in 1981 (ASMFC 1981). The 1981 FMP did not recommend or require specific management actions, but provided a suite of options should they be needed. After the FMP was approved, a combination of additional state restrictions, establishment of local land use rules, and changing economic conditions resulted in the closure of most reduction plants north of Virginia (ASMFC 1992). In 1988, the ASMFC concluded that the 1981 FMP had become obsolete and initiated a revision to the plan.

The 1992 Plan Revision included a suite of objectives to improve data collection and promote awareness of the fishery and its research needs (ASMFC 1992). Under this revision, the menhaden program was directed by the Board, which at the time was composed of up to five state directors, up to five industry representatives, one representative from the National Marine Fisheries Service, and on representative from the National Fish Meal and Oil Association.

Representation on the Board was revised in 2001 to include three representatives from each state in the management unit, including the state fisheries director, a legislator, and a governor's appointee. The reformatted Board has passed two amendments and six addenda to the 1992 FMP revision.

Amendment 1, passed in 2001, provided specific biological, social/economic, ecological, and management objectives for Atlantic menhaden. No recreational or commercial management measures were implemented as a result of Amendment 1.

Addendum I (2004) addressed biological reference points for menhaden, specified the frequency of stock assessments to be every three years, and updated the habitat section of the FMP.

Addendum II (2005) instituted a harvest cap on the reduction fishery in the Chesapeake Bay. This cap, based on average landings from 2000-2004 (see technical Addendum I), was established for the 2006 through 2010 fishing seasons. Addendum II also outlined a series of research priorities to examine the possibility of localized depletion of Atlantic menhaden in the Chesapeake Bay. They included: determining menhaden abundance in Chesapeake Bay; determining estimates of removal of menhaden by predators; exchanging of menhaden between bay and coastal systems; and conducting larval studies.

Addendum III (2006) revised the Chesapeake Bay Reduction Fishery Cap to 109,020 metric tons, which is an average of landings from 2001-2005. Implementation of the cap remained for the 2006 through 2010 fishing seasons. Addendum III also allowed a harvest underage in one year to be added to the next year's quota. As a result, the maximum cap in a given year was extended 122,740 metric tons.

Addendum IV (2009) extended the Chesapeake Bay harvest cap three additional years (2011-2013) at the same levels as established in Addendum III.

Addendum V (2011) establishes a new F threshold and target rate based on maximum spawning potential (MSP) with the goal of increasing abundance, spawning stock biomass, and menhaden availability as a forage species.

Amendment 2, approved in December 2012, established a 170,800 metric ton (mt) total allowable catch (TAC) for the commercial fishery beginning in 2013. This TAC represented a 20% reduction from average landings between 2009 and 2011. The 2009-2011 time period was also used to allocate the TAC among the jurisdictions. The Amendment also established requirements for timely reporting and required states to be accountable for their respective quotas by paying back any overages the following year. The amendment included provisions that allowed for the transfer of quota between jurisdictions and a bycatch allowance of 6,000 pounds per trip for non-directed fisheries that operated after a jurisdiction's quota has been landed. Further, it reduced the Chesapeake Bay reduction fishery harvest cap by 20% to 87,216 metric tons.

At its May 2015 meeting, the Board established a 187,880 mt TAC for the 2015 and 2016 fishing years. This represents a 10% increase from the 2013 and 2014 TAC. In October 2016, the Board approved a TAC of 200,000 mt for the 2017 fishing year, representing a 6.45% increase from the 2015 and 2016 fishing years.

In August 2016, the Board approved Addendum I which added flexibility to the current bycatch provision by allowing two licensed individuals to harvest up to 12,000 pounds of menhaden bycatch when working together from the same vessel using stationary multi-species gear. The intent of this Addendum was to accommodate cooperative fishing practices which traditionally take place in the Chesapeake Bay.

In May 2013, the Board approved Technical Addendum I which established an episodic events set aside program. This program set aside 1% of the coastwide TAC for the New England States (ME, NH, MA, RI, CT) to harvest Atlantic menhaden when they occur in higher abundance than normal. In order to participate in the program, a state must have reached its individual quota prior to September 1 before harvesting from the set aside. At its October 2013 meeting, the Board extended the episodic event set aside program through 2015, adding a re-allocation provision that re-allocated unused set aside as of October 31 to the coastwide states based on the same allocation percentages included in Amendment 2. At its May 2016 meeting, the Board again extended the episodic events program until final action on Amendment 3 and added New York as an eligible state to harvest under the program.

At its February 2014 meeting, the Board passed a motion to manage cast net fisheries for Atlantic menhaden under the bycatch allowance for 2014 and 2015, with the states bearing responsibility for reporting. At its November 2015 meeting, the Board approved a motion to continue the management of cast net fisheries under the bycatch allowance for 2016. In February 2017, the Board extended management of the cast net fishery under the bycatch provision until implementation of Amendment 3.

2.2 PURPOSE AND NEED FOR ACTION

The 2015 Atlantic Menhaden Benchmark Stock Assessment and Peer Review Report categorized the development of ERPs as a high priority for management of the species. Currently, the stock is assessed with single-species biological reference points, which were defined in the 2015 Stock Assessment. While the stock assessment accounts for natural mortality, that factor alone may not adequately account for the unique and significant ecological services that menhaden provide, or how changes in the population of predator species may impact the abundance of menhaden. ERPs are intended to consider the multiple roles that menhaden play, both in supporting fisheries for human use and the marine ecosystem. In addition, Amendment 2 requires quota allocations to be revisited every three years. The Atlantic menhaden quota is currently allocated to Atlantic coast jurisdictions based on average landings between 2009 and 2011. In revisiting the allocations, the Board decided to investigate different allocation methods and timeframes given concerns that the current allocation method does not strike a balance between gear types and regions, as well as current and future harvest opportunities. Some states have also expressed concerns about unreported landings during the baseline years and the administrative burden of managing small allocations, the cost of which may outweigh the value of the fishery they are allocated. In order to pursue the implementation of ERPs as well as changes to the allocation method and timeframe, the Board needs to consider changes in the management tools used to regulate the fishery.

2.3 GOAL

Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden replaces Amendment 2 to the 1981 FMP for Atlantic Menhaden.

The goal of Amendment 3 is to manage the Atlantic menhaden fishery in a manner which equitably allocates the resource between all user groups, including those who extract and utilize menhaden for human use, predators which rely on menhaden as a source of prey, and those whose livelihood depends on the health of the marine ecosystem. This will require holistic management and allocation of the resource that is biologically, economically, and socially sound in order to protect the resource and those who benefit from it.

2.4 OBJECTIVES

The following objectives are intended to support the goal of Amendment 3.

- Maintain the Atlantic menhaden stock at levels which sustain viable fisheries and support predators which depend on the forage base.
- Ensure sufficient menhaden spawning stock biomass to prevent stock depletion and recruitment failure.
- Construct regulations based on the best available science and coordinate management efforts among the Atlantic coast jurisdictions.
- Develop a management program which ensures fair and equitable access to the fishery for all regions and gear types.
- Improve understanding of menhaden biology and multi-species interactions that may bear upon predator-prey dynamics.
- Maintain existing culture and social features of the fishery to the extent possible.

2.5 MANAGEMENT UNIT

The management unit for Amendment 3 is defined as the range of Atlantic menhaden within U.S. waters of the northwest Atlantic Ocean, from the estuaries eastward to the offshore boundary of the Exclusive Economic Zone (EEZ). This definition is consistent with recent stock assessments which treat the entire resource in U.S. waters of the northwest Atlantic as a single stock.

2.5.1 Management Area

The management area for Amendment 3 shall be the entire Atlantic coast distribution of the resource from Maine through Florida.

2.6 REFERENCE POINTS

2.6.1 History of Reference Points

2.6.1.1 Amendment 1 Reference Points

The reference points in Amendment 1, adopted in 2001, were developed from the historic spawning stock per recruit (SSB/R) relationship. As such, F_{MED} was selected as $F_{threshold}$ (representing replacement level of stock, also known as F_{REP}) and was calculated by inverting the median value of R/SSB and comparing to the SSB/R curve following the method of Sissenwine and Shepherd (1987). The spawning stock biomass corresponding to $F_{threshold}$, was calculated as a product of median recruitment and SSB/R at F_{MED}, from equilibrium YPR analysis, which became the SSB_{target}. The threshold for SSB ($SSB_{threshold}$) was calculated to account for natural mortality [(1-M)*SSB-target, where M=0.45]. In Amendment 1, the F_{target} was based on F_{MAX} (maximum fishing mortality before the process of recruitment overfishing begins).

2.6.1.2 Addendum 1 Reference Points

Based on the 2003 benchmark stock assessment for Atlantic menhaden, the reference points were modified per the recommendation of the Technical Committee (TC) (ASMFC 2004). The TC recommended using population fecundity (number of maturing or ripe eggs) as a more direct measure of reproductive output of the population compared to spawning stock biomass (the weight of mature females). For Atlantic menhaden, older menhaden release more eggs than younger menhaden per unit of female biomass. By using the number of eggs released, more reproductive importance is given to older fish in the population. The TC also recommended modifications to the fishing mortality (F) target and threshold. Specifically, the TC recommended continued use of F_{MED} to represent F_{REP} as the $F_{threshold}$, but estimated it using fecundity per recruit rather the SSB per recruit. Because the analysis calculated an F_{MAX} (target) that was greater than *F*MED (and may be infinite), they recommended instead that F_{target} be based on the 75th percentile. This approach was consistent with the approach used for the $F_{threshold}$. For biomass (or egg) benchmarks, the TC recommended maintaining the approach used in Amendment 1.

2.6.1.3 Addendum V Reference Points

In November 2011, Addendum V was approved, which established an interim fishing mortality threshold of $F_{15\%MSP}$ and target of $F_{30\%MSP}$.

2.6.1.4 Amendment 2 Reference Points

The Board adopted an interim biomass threshold of $SSB_{30\%MSP}$ and target of $SSB_{30\%MSP}$ to match the interim fishing mortality reference points adopted through Addendum V.

2.6.1.5 2015 Benchmark Stock Assessment Reference Points

As a part of the 2015 Stock Assessment, the TC recommended that the Board adopt SPR reference points based on the maximum of the geometric mean F value experienced by ages 2 to 4 during the 1960-2012 time period as the threshold, and the median geometric mean F value experienced by ages 2 to 4 during the 1960-2012 time period as the target, along with the associated FEC values. The 1960-2012 time period represents a time with little to no restrictions on total harvest in which the population appears to have been sustainable given that the population did not experience collapse. Because the fisheries have dome-shaped selectivity, which varies by fleet over time, the age at full fishing mortality changes over time. Ages 2 to 4 represent the ages of fully selected fishing mortality rates depending upon the year and fishery (i.e., bait and reduction). Using these metrics, the maximum F experienced was $F_{26\%} = 1.26$, and the median was $F_{57\%} = 0.38$. The associated FEC reference points would be $FEC_{26\%} = 86,821$ and $FEC_{57\%} = 189,270$ (billions of eggs). The Board accepted these updated reference points following approval of the 2015 Stock Assessment for management use.

2.6.2 ASMFC Multi-Species Management Efforts

At the May 2010 Board meeting, the Multi-Species Technical Committee (MSTC) was tasked with collaborating with the Atlantic Menhaden TC to develop alternative reference points for menhaden that account for predation. These groups led to a reformation of the subcommittee that updated and refined the Multispecies Virtual Population Analysis (MSVPA). The MSPVA-X model generates a natural mortality matrix which can be input to the single-species menhaden assessment. While this approach was attempted for several Atlantic menhaden stock assessments, the Board tasked this group with developing ecological reference points (ERPs) for menhaden using multispecies models. This joint subcommittee was eventually renamed the Biological Ecological Reference Points Workgroup (BERP Workgroup) because model consideration for the Board task expanded beyond the MSVPA. The overarching goal of the BERP Workgroup is to develop menhaden-specific ecosystem reference points that account for the abundance of menhaden and the species role as a forage fish.

In the *Ecological Reference Points for Atlantic Menhaden* report, the BERP Workgroup presented suite of preliminary ERP models and ecosystem monitoring approaches for feedback as part of the 2015 Benchmark Stock Assessment (Appendix E, SEDAR 40 Stock Assessment Report). In this report, the BERP Workgroup recommended the use of facilitated workshops to develop specific ecosystem and fisheries objectives to drive further development of ERPs for Atlantic menhaden. This Ecosystem Management Objectives Workshop (EMOW) contained a broad range of representation including Commissioners, stakeholder representatives, and technical representatives to provide various perspectives on Atlantic menhaden management. The EMOW identified potential ecosystem goals and objectives that were reviewed and approved by the Board. The BERP Workgroup then assessed the ability of each preliminary ERP model to address EMOW-identified management objectives and performance measures, and selected models accordingly.

Currently, the BERP Workgroup is evaluating this suite of multispecies models to ensure they are able to generate ERPs which meet as many management objectives as possible. Some of the models under consideration are a Bayesian surplus production model with a time-varying population growth rate. This model estimates the trend in total Atlantic menhaden stock biomass and fishery exploitation rate by allowing the population growth rate to fluctuate annually in response to changing environmental conditions. The approach produces dynamic, maximum sustainable yield-based ecological reference points that implicitly account for the forage services menhaden provide. Another production model being evaluated by the BERP Workgroup is a Steele-Henderson model. This type of Steele-Henderson modeling permits non-fisheries effects (predation and environmental) to be quantified and incorporated into the single species stock assessments, allowing fixed and non-equilibrium (time-varying) ecological overfishing thresholds to be established. This approach is not intended to replace more complex multispecies ecosystem assessment models, but rather to expand the scope of the single species assessments to include the separate and joint effects of fishing, predation and environmental effects at the fish community level. Finally, a multispecies statistical catch-at-age modeling framework is being considered. This model uses standard statistical catch-at-age techniques and single species models are linked using trophic calculations to provide a predator-prey feedback between the population models. The statistical framework is believed to be an improvement from the existing MSVPA because using statistical techniques may help to estimate many of the model parameters while incorporating the inherent uncertainty in the data. An external model being considered is an Ecopath with Ecosystem model, however the application of this model is for strategic planning (to explore tradeoffs), not quota setting advice. The model is flexible and able to explore additional menhaden relevant scenarios, ERPs, and questions. This model could be used to evaluate the other models being developed.

The development of menhaden-specific ERPs is expected to continue over the next couple of years. In 2017, the BERP Workgroup will finish their review of the merits of each modeling approach currently being considered and decide which models are appropriate frameworks for menhaden ERPs. In 2018, the BERP Work Group will hold data workshops to collect, select, and standardize the data that will be input into the models. This will include data that pertains not only to menhaden abundance but also the abundance of species such as bluefish, striped bass, and other prey species. In early 2019, assessment workshops will be held to review preliminary model results and in the fall of 2019, the multi-species models will be peer-reviewed, along with the current single-species model, which has traditionally been used for menhaden management. This will allow for direct comparison between the two modeling approaches. Table 19 outlines the current schedule for the BERP Workgroup.

2.6.3 External Guidelines for Forage Fish

In addition to the menhaden-specific ecosystem reference points which are being developed by the BERP Workgroup, there also exists precautionary guidelines on developing ERPs for forage fish. These guidelines are based on a series of models which look at a variety of forage fish species across diverse ecosystems. An advantage of these guidelines is that they are readily available for use and provide a precautionary approach to the management of forage fish. However, given they are based on a variety of species and regions, the guidelines are not specific to the Atlantic menhaden stock and, as a result, make generalizations regarding stock recruit relationships and the prevalence of menhaden in predator diets.

One guideline for the management of forage fish species is the 75% rule-of-thumb, which recommends that forage fish populations be maintained at three-fourths of their unfished biomass levels in order to lower impacts on marine ecosystems (Smith et al., 2011). The peer-reviewed analysis investigated five regions around the world to determine the ecosystem impacts of fishing low trophic level species. The analysis found that, while results varied among forage fish species, in general, the proportion of ecological groups impacted increased with depletion of the forage fish. Relative abundance of the forage fish species in comparison to other prey species and food web connectivity were found to be important factors in determining the level of impact on other ecological groups. The study concluded that a target of 75% unfished biomass for forage fish species would reduce impacts on other species while maintaining fisheries yields at roughly 80% of their current levels. Menhaden was not a species included in this study.

The Lenfest Ocean Program, a grant-making program managed by The Pew Charitable Trusts, has also developed guidelines for the development of forage fish ERPs. In their 2012 report by Pikitch et al., Lenfest describes how they used a suite of 10 previously published Ecopath with Ecosim models to assess the impacts of forage fish harvest on a variety of ecosystems. The Chesapeake Bay was a region modeled in this analysis. Various management strategies which specify fishing mortality were run in the Ecopath with Ecosim models to determine impacts on predator populations. From these results, a general equation was developed to predict predator responses to forage fish harvest. The analysis recommends a hockey stick control rule in which fishing mortality does not exceed half of the forage species natural mortality rate (for menhaden, 1/2 M = 0.29) and that, when biomass falls below 40% of unfished biomass, fishing is prohibited. This report has not been peer-reviewed.

2.6.4 Definition of Overfishing and Overfished/Depleted

The Board will evaluate the current status of the Atlantic menhaden stock with respect to its reference points. Changes to the reference points can be made through Board action following a peer-reviewed stock assessment or through Adaptive Management (*Section 4.6*). The Board can adopt any advice of the stock assessment report or peer review report.

Threshold reference points are the basis for determining stock status (i.e., whether overfishing is occurring or if a stock is overfished). When the fishing mortality rate (F) exceeds the F-threshold, then overfishing is occurring. This means that the rate of removal of fish by the fishery exceeds the ability of the stock to replenish itself. When the biomass or reproductive output (measured as population fecundity) falls below the threshold, then the stock is overfished, meaning there is insufficient mature female biomass or egg production (population fecundity) to replenish the stock.

Reference points will direct the Board on when additional management measures are needed in the menhaden stock. If the current F exceeds the threshold level, the Board will take steps to reduce F to the target level. If current F exceeds the target, but is below the threshold, the Board should consider steps to reduce F to the target level. If current F is below the target F, then no action would be necessary to reduce F. Similarly, if the current biomass/fecundity is below the threshold level, the Board will take steps to increase biomass/fecundity to the target level; if current biomass/fecundity is below the target, but above the threshold, the Board should consider steps to increase biomass/fecundity to the target level. If current biomass/fecundity is above the target biomass/fecundity, then no action would be necessary to increase biomass/fecundity.

Option A: Single Species Reference

Single-species reference points are used to manage the Atlantic menhaden fishery. The fishing mortality target and threshold for Atlantic menhaden is $F_{57\%MSP}$ (0.38) and $F_{26\%MSP}$ (1.26) and the corresponding fecundity target and threshold for Atlantic menhaden is $FEC_{57\%MSP}$ (189,270 billion eggs) and $FEC_{26\%MSP}$ (86,821 billion eggs). As of the terminal year of the 2015 Benchmark Stock Assessment, the stock is not overfished and overfishing is not occurring. Under this option, the development of ERPs would not be pursued.

Option B: Menhaden-Specific ERPs with Interim Use of Single Species Reference Points

Under this option, single-species reference points would be used to manage the Atlantic menhaden fishery until menhaden-specific ERPs are developed by the BERP Workgroup. The fishing mortality target and threshold for Atlantic menhaden would be $F_{57\%MSP}$ (0.38) and $F_{26\%MSP}$ (1.26) and the corresponding fecundity target and threshold for Atlantic menhaden would be $FEC_{57\%MSP}$ (189,270 billion eggs) and $FEC_{26\%MSP}$ (86,821 billion eggs). As of the terminal year of the 2015 Benchmark Stock Assessment, the stock is not overfished and overfishing is not occurring.

Option C: Menhaden-Specific ERPs with Interim Use of 75% Rule of Thumb

Option D: Menhaden-Specific ERPs with Interim Use of Pikitch et al. Reference Points

Option E: Menhaden-Specific ERPs with Interim Use of 75% Target, 40% Threshold

(Add text regarding reference point management alternatives)

2.6.4 Stock Rebuilding Program

If it is determined that the Atlantic menhaden resource is experiencing overfishing or has become overfished, the Board will initiate and develop a rebuilding schedule.

3.0 MONITORING PROGRAM SPECIFICATION

In order to achieve the goals and objectives of Amendment 3, the collection and maintenance of quality data is necessary.

3.1 COMMERCIAL CATCH AND LANDINGS PROGRAM

The reporting requirements for the Atlantic menhaden fishery are based on Captains Daily Fishing Reports (CDFRs) and a Board approved method for timely quota monitoring (*Section 3.1.2*). The ASMFC, NMFS, US Fish & Wildlife Service, the New England, Mid-Atlantic, and South Atlantic Fishery Management Councils, and all the Atlantic coastal states have developed a coastwide fisheries statistics program called the Atlantic Coastal Cooperative Statistics Program. A minimum set of reporting requirements for fishermen and dealers has been developed as the standard for data collection on the Atlantic coast.

3.1.1 Reduction Fishery Catch Reporting Process

Daily vessel unloads (in thousands of standard fish) are emailed to the NMFS each day. Harvest by the Reedville menhaden fleet is reported through Captains Daily Fishing Reports (CDFRs), which are deck logbooks that are maintained by the Virginia reduction purse-seine vessels. CDFRs are an important tool to monitor reduction harvest in the Chesapeake Bay so that harvest does not exceed the Chesapeake Bay Reduction Fishery Cap (*Section 4.3.7*).

Total removals by area are calculated at the end of the fishing season. At-sea catches from the CDFRs are summed by vessel, and compared to total vessel unloads from company catch records. Individual at-sea sets are then multiplied by an adjustment factor (company records/ at-sea estimates). Adjusted catches by set are converted to metric tons, and accumulated by fishing area. Catch totals are reported by ocean fishing areas, while catches inside and outside Chesapeake Bay are delineated by the Chesapeake Bay Bridge Tunnel.

A NMFS port agent samples purse-seine catches at dockside in Reedville, VA throughout the fishing season (May through December) providing data for age composition determination.

3.1.2 Bait Fishery Catch Reporting Process

Quota monitoring, whether for a state, region, coast, season, fleet, or sector is dependent upon the strength of state specific monitoring programs. As a part of Amendment 2, each states was required to implement a timely quota monitoring system in order to maintain menhaden harvest within the TAC and minimize the potential for overages. Table 20 outlines the current reporting requirements of each jurisdiction.

In order to monitor the menhaden quota allocations prescribed in Amendment 3, states must, at a minimum, maintain the current quota monitoring system in place. States must require menhaden purse seine and bait seine vessels (or snapper rigs) to submit CDFR’s or similar daily trip level reports. Mandatory reporting requirements will be reviewed as a part of the annual fishery review (*Section 5.3 Compliance Reports*). States which habitually exceed their quota should assess the effectiveness of their current reporting program and make changes as necessary (e.g. Increase the frequency of reporting). It is recommended that states collect the following ACCSP data elements: (1) trip start date (2) vessel identifier (3) individual fisherman identifier (4) dealer identification (5) trip number (6) species (7) quantity (8) units of measurement (9) disposition (10) county or port landed (11) gear (12) quantity of gear (13) number of sets (14) fishing time (15) days/hours at sea (16) number of crew (17) area fished. See Tables 21 and 22 for details on these data elements.

If an allocation method is implemented which does not have a jurisdictional component, states must work to report landings via the Standard Atlantic Fisheries Information System (SAFIS). Specifically, menhaden landings must be reported through SAFIS so that regional, fleet, sector, or coastwide quotas may be monitored in near real-time. SAFIS is an electronic platform which allows fishermen and dealers to submit commercial landings reports into a single database. This system, which meets ACCSP data standards, allows managers to monitor landings and appropriately respond when a quota is met. It also fulfils state and federal reporting requirements, and allows fishermen and dealers to access previous data submissions. Should SAFIS be implemented, trip-level reports may be submitted on a weekly basis, but no later than 5 days after landing. States may choose to implement either a one ticket or two ticket system; however, all reports must include: date, species landed, quantity landed, units of measure, disposition (bait or reduction), state landed, and gear type. If a state is unable to implement SAFIS reporting by the start of the 2018 fishing year, that state must submit weekly landings reports to ASMFC so that a regional, fleet, sector, or coastwide quota may be monitored in 2018. All states must implement SAFIS reporting by 2019. Per *Section 4.5.3.1*, New Hampshire, South Carolina, and Georgia are exempt from timely quota monitoring and are not required to report through SAFIS.

Any changes to a state's current quota monitoring program must be reviewed by the PDT and approved by the Board.

3.1.2.1 Incidental Catch Reporting
Landings of menhaden under *Section 4.3.5: Incidental Catch and Small Scale Fisheries* must be reported through the timely reporting system specified in Section 3.1.2.

3.1.2.2 Episodic Events Reporting
States participating in the Episodic Events Program (*Section 4.3.6*) must implement daily trip level harvester reporting. Each state must track landings and submit weekly reports to ASMFC staff.

3.2 RECREATIONAL FISHERY CATCH REPORTING PROCESS

The Marine Recreational Information Program (MRIP) contains estimated Atlantic menhaden catches from 1981-2016. Recreational harvest of menhaden was previously collected through the Marine Recreational Fisheries Statistics Survey (MRFSS), which was a recreational data collection program used from 1981-2003. The MRFSS program was replaced by MRIP in 2004 and was designed to provide more accurate and timely reported as well as greater spatial coverage. The MRFSS and MRIP programs were simultaneously conducted in 2004-2006 and this information was used to calibration MFRSS recreational harvest estimates to MRIP recreational harvest estimates. Recreational catches of menhaden were downloaded from http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html using the query option.

An online description of MRIP survey methods can be found here: http://www.st.nmfs.noaa.gov/recreational-fisheries/index#meth

3.3 FOR-HIRE FISHERY CATCH REPORTING PROCESS

ACCSP standards allow for the use of MRIP for-hire sampling or a census system such as ACCSP's eTrips. For-hire sampling provides data by period, but eTrips can provide data within a 24-hour period.

3.4 SOCIAL AND ECONOMIC COLLECTION PROGRAMS

(Add text from Winnie and Andrew)

3.5 BIOLOGICAL DATA COLLECTION PROGRAMS

3.5.1 Fishery-Dependent Data Collection

3.5.1.1 Reduction Fishery

The Beaufort Laboratory of the Southeast Fisheries Science Center (NMFS) conducts biological sampling of the Atlantic menhaden reduction fishery (Smith 1991). The program began preliminary sampling in the Mid-Atlantic and Chesapeake Bay areas during 1952-1954 and has continued uninterrupted since 1955, sampling the entire range of the Atlantic menhaden purse-seine reduction fishery. Detailed descriptions of the sampling procedures and estimates gathered through the program are cited in Smith (1991).

The biological data, or port samples, for length- and weight-at-age are available from 1955 through 2016, and represent one of the longest and most complete time series of fishery data sets in the nation. The NMFS employs a full-time port agent at Reedville, VA to sample catches throughout the fishing season for age and size composition of the reduction catch (Table 23).

3.5.1.2 Bait Fishery

10 Fish Sampling

Each state in the New England (ME, NH, MA, RI, CT) and Mid-Atlantic (NY, NJ, DE) regions are required to collect one 10-fish sample (age and length) per 300 metric tons landed for bait purposes. The TC recommends collecting the samples by gear type. One 10-fish sample consists of 10 fish collected from a distinct landing event (e.g., purse seine trip, pound net set). Each collection of 10 fish is from an independent sampling event; therefore, multiple 10-fish samples should not be collected from the same landing event.

Each state in the Chesapeake Bay (MD, PRFC, VA) and South Atlantic (NC) regions are required to collect one 10-fish sample (age and length) per 200 metric tons landed for bait purposes. The TC recommends collecting the samples by gear type. One 10-fish sample consists of 10 fish collected from a distinct landing event (e.g., purse seine trip, pound net set). Each collection of 10 fish is an independent sampling event; therefore, multiple 10-fish samples should not be collected from the same landing event.

Table 24 shows the number of 10-fish samples collected by the jurisdictions in 2016 as well as the number of age and length samples collected.

Pound Net Monitoring
Catch information from pound net fisheries is critical to determine changes in the relative abundance of adult menhaden along the east coast. At a minimum, each state with a pound net fishery must collect catch and effort data elements for Atlantic menhaden including total pounds (lbs) landed per day and number of pound nets fished per day. A pound net fishery includes floating fish traps and fishing weirs. These are harvester trip level ACCSP data requirements. In order to characterize selectivity of this gear in each state, a goal of collecting five 10-fish samples annually is recommended. One 10-fish sample consists of 10 fish collected from a distinct landing event (e.g., pound net set). Each collection of 10 fish is an independent sampling event; therefore, multiple 10-fish samples should not be collected from the same landing event.

3.5.2 Fishery-Independent Data Collection

Assessment of the Atlantic menhaden stock requires information from a variety of fishery-independent surveys along the coast. As a part of the 2015 Stock Assessment, sixteen fishery-independent surveys were used to create a Juvenile Abundance Index, seven surveys were used to create a Northern Adult Index, and two surveys were used to create a Southern Adult Index. For many of the surveys used, the primary objective is to measure the abundance of species other than menhaden; however the bycatch of menhaden in these surveys can provide important information regarding stock conditions. Table 25 shows the surveys used to assess the status of Atlantic menhaden in the 2015 Stock Assessment.

3.5.3 Observer Programs

As a condition of state and/or federal permitting, vessels are required to carry at-sea observers when requested. A minimum set of standard data elements are to be collected through the ACCSP at-sea observer program (refer to the ACCSP Program Design document for details). Specific fisheries priorities will be determined by the Discard/Release Prioritization Committee of the ACCSP.

3.6 ASSESSMENT OF STOCK CONDITION

An Atlantic menhaden stock assessment will be performed every three years by the Stock Assessment Subcommittee (SASC). The TC and Advisory Panel (AP) will meet to review the stock assessment and all other relevant data sources. The stock assessment report shall follow the general outline as approved by the ISFMP Policy Board for all Commission-managed species. In addition to the general content of the report as specified in the outline, the stock assessment report will also address the specific topics detailed in the following sections.

3.6.1 Assessment of Population Age/Size Structure

Estimates of Atlantic menhaden age and size structure will be monitored based on results of the stock assessment. Improvements to data sources and modeling assumptions during the 2015 benchmark stock assessment, such as increased sampling of the bait fishery, addition of several surveys, and incorporation of dome shaped selectivity, greatly improved the understanding of size and age distribution of the menhaden stock.

3.6.2 Assessment of Annual Recruitment

Recruitment of Atlantic menhaden will be estimated through two primary methods. The first is the estimate of recruitment to age-1 from the stock assessment model. The second is the examination of various fishery-independent data sources, including the juvenile abundance indices that are integrated in to the statistical modeling process.

3.6.3 Assessment of Fecundity

Population fecundity, a measure of total egg production output of the population, is estimated from the stock assessment model every three years. Indices of egg production are considered better measures of reproductive output of a stock given that egg production is not linearly related to female weight. Additionally, fecundity better emphasizes the important contribution of older and larger individuals to the population’s egg production.

3.6.4 Assessment of Fishing Mortality

Fishing mortality (F) rates will be estimated by the stock assessment model every three years. Fishing mortality will be estimated for each age-class for examination, but the metric used for comparison to the reference point values will be full F, or the comprehensive fishing mortality rate for all ages of the entire coastwide stock. Currently, fishing mortality rates are estimated for the reduction fishery, the bait fishery, and the recreational fishery.

3.7 STOCKING PROGRAM

Given the current technology, stocking of menhaden is not cost-effective and should not be considered as a management tool.

4.0 MANAGEMENT PROGRAM

4.1 RECREATIONAL FISHERY MANAGEMENT MEASURES

No recreational fishery management measures are proposed in this amendment. Recreational landings of Atlantic menhaden are currently believed to be insignificant in terms of total harvest. Therefore, regulation of the recreational fishery is unnecessary at this time. The Board has the option of considering management changes to the recreational fishery through a future addendum, as detailed in Adaptive Management (*Section 4.6*).

4.2 FOR-HIRE FISHERIES MANAGEMENT MEASURES

No management measures for the for-hire fisheries are proposed in this amendment. The Board has the option of considering management changes to the recreational fishery through a future addendum, as detailed in Adaptive Management (*Section 4.6*).

4.3 COMMERCIAL FISHERY MANAGEMENT MEASURES

4.3.1 Total Allowable Catch

The Board will set an annual or multi-year TAC based on the following procedure.

The Atlantic Menhaden TC will annually review the best available data including, but not limited to, commercial and recreational catch/landing statistics, current estimates of fishing mortality, stock status, survey indices, assessment modeling results, and target mortality levels. The TC will calculate TAC options based on the Board selected method of setting a TAC (see *Section 4.3.1.1*). The Board will set an annual TAC through Board action with the option of setting a multi-year TAC, reviewed annually.

4.3.1.1 TAC Setting Method
The Board will set the TAC based on the best available science (e.g., projection analysis); however, if the projections are not recommended for use by the TC, the Board will set a quota based on the ad-hoc approach used by the Regional Fishery Management Councils (ORCS 2011).

<u>Ad-hoc Approach to Setting a TAC</u>
As an alternative to using projections to set TACs, ad hoc approaches are used by several regional Fishery Management Councils for species with poor assessment data or uncertain stock assessment results. Typically, in these situations, most Councils use their landings/catch data as the only reliable means of setting harvest limits. A document entitled “Calculating Acceptable Biological Catch for Stocks that have reliable Catch Data Only (Only Reliable Catch Stocks – ORCS)” was recently published, and serves as guidance to set interim removal levels under these conditions (ORCS 2011).

To summarize the ORCS report; generally an average of the last 3-5 years of landings are used as this reflects recent history. A precautionary multiplier is then applied to decrement the average landings and set a harvest limit. The appropriate multiplier is cautiously decided based on factors such as life history, ecological function, stock status, and an understanding of exploitation. Typically this multiplier can range from 0.85 to 0.25 (Table 26).

In the New England approach for Atlantic herring and red crab, the multiplier was chosen at 1.0 suggesting catch be maintained at current levels. The rationale was that the stock was not overfished and overfishing was not likely to be occurring. Other evidence, such as size at age, also indicated that the overall stock status was good. Further, landings were well monitored and discards of the target stock were low.

In the case of the Pacific Fishery Management Council the multiplier for coastal pelagics was set at 0.25. This number reflected the importance of herring as forage for stellar Sea Lions and other endangered mammals, the high level of exploitation, and the fact that Pacific Herring spawn in discreet and vulnerable aggregations (when they are targeted by the fishery).

It should be noted that the multiplier is never set at a value greater than 1.0; indicating that catch should not be allowed to increase in these uncertain situations. Table 27 provides some additional decision making framework information that goes into the choice of a multiplier.

4.3.1.2 Indecision Clause

If the Board is unable to approve a TAC for the subsequent fishing year by December 31st of the previous year, the TAC for the subsequent fishing year will be set at one half of the TAC from the previous year.

4.3.2 Quota Allocation

The Board must determine how to allocate the TAC among the different participants in the menhaden fishery. Once an allocation has been harvested, the fishery for that state, coast, season, region, sector, or fleet closes. Menhaden harvest for specific gear types or states may be permitted after an allocation has been reached, depending on the management options selected in *Section 4.3.5: Incidental Catch* and *Section 4.3.6: Episodic Events Set Aside Program*.

To account for the various combinations of allocation methods and timeframes, the management alternatives have been divided into three tiers. A management alternative must be selected in each tier to compile a single allocation method. The first tier asks whether allocation should be divided by sector, fleet, season, be based on the TAC level, or none of the above. The second tier asks if allocation should be further divided among jurisdictions or regions. The third tier asks which allocation timeframe should be used as the basis for the allocation methods. Allocation percentages for the various options can be found in Tables 1-12.

Should quota not be allocated by jurisdiction, states will be required to submit trip-level reports to SAFIS for near real-time monitoring of the quota. See *Section 3.1.2 Bait Fishery Catch Reporting Process* for additional information.

Tier 1: Allocation Based on Disposition, Fleet, Season, TAC Level, or None of the Above
The allocation strategy selected in this tier will decide if the fishery will be divided by sector (bait and reduction), fleet, season, if allocation should be based on TAC level, or if none of these options should be used. The TAC may be further subdivided in Tier 2.

<u>Option A: Status Quo</u>
The TAC is not divided by disposition, fleet, or season and the allocation strategy does not depend on the level of TAC. Any division of the quota by jurisdiction or region is considered in Tier 2.

<u>Option B: Disposition Quota</u>
Menhaden commercial TAC is divided between the bait and reduction fishery. The only current reduction fishery is located in Virginia. The bait allocation can be further divided by jurisdiction or region in Tier 2; however, the reduction fishery quota allocation will be assigned to Virginia or any region in which Virginia is placed. Should the bait quota not be further divided into jurisdictional quotas, SAFIS will be used to monitor landings in season. Once 80% of the bait allocation is reached (as indicated through SAFIS), a trip limit of 25,000 pounds will be implemented in the bait sector. A fisherman cannot land menhaden more than once in a single calendar day. The bait fishery will close when 95% of the allocation has been reached (as indicated through SAFIS) in order to minimize overages by the sector. Trip limits, a required fishery closure when 95% of the allocation has been reached, and reporting through SAFIS do not apply if disposition quotas are further allocated by state.

> <u>Sub-option 1:</u> Seventy percent of the overall Menhaden commercial TAC is allocated to the reduction fishery, and 30% of the overall TAC is allocated to the bait fishery. For reference, 30% of 200,000 metric tons is 60,000 mt or roughly 132 million pounds.
>
> <u>Sub-option 2:</u> The percentage of menhaden commercial TAC allocated to the reduction fishery and the bait fishery is dependent on historical landings from one of the timeframes selected in Tier 4 (Table 1).

<u>Option C: Fleet-Capacity Quota</u>
Menhaden commercial TAC is divided by fleet capacity without regard to the disposition of the catch. Allocations to each fleet can be further divided by jurisdiction or region in Tier 2. In addition, each fleet’s fishery will be closed when 95% of the quota is reported to be caught (as indicated through SAFIS). This fishery closure, as well as reporting through SAFIS, do not apply if fleet-capacity quotas are further allocated by state or if a fleet is operating under a soft cap. If a fleet-capacity allocation method is chosen, a small-scale fishery set aside (Option E) in *Section 4.3.6 Incidental Catch and Small Scale Fisheries* does not apply.

If a soft cap is chosen below, states will continue to monitor landings by gear types in the small-capacity fleet. Landings by gears subject to a soft cap will be reported to the Board as a part of the annual FMP Review (*Section 5.3: Compliance Report*). Should a gear type subject to a soft quota show a continued and significant increase in its proportion of landings relative to total landings in the fishery, the Board has the authority, through adaptive management, to reduce an existing trip limit or re-assign that gear type to another fleet.

<u>Sub-option 1: Two Fleets Based on Gear Type</u>
Quota is divided between two fleets (Table 2) which are defined as:

- Small-Capacity Fleet: cast net, traps (excluding floating fish traps), pots, haul seines, fyke nets, hook and line, trawls (excluding pair trawls), bag nets, hoop nets, hand lines, trammel nets, bait nets, pound nets, anchored/staked gill nets, drift gill nets, fishing weirs, and floating fish traps. Between 2007 and 2016, this fleet caught, on average, 5.16% of total landings in the commercial fishery.
- Large-Capacity Fleet: purse seines and pair-trawls. Between 2007 and 2016, this fleet caught, on average, 94.84% of total landings in the commercial fishery.

<u>Sub-option A:</u> All fleet quotas are hard caps, in which all fisheries within a fleet are closed when the quota is met.
<u>Sub-option B:</u> The Small-Capacity fleet operates on a soft cap, in which the fisheries within the Small-Capacity-fleet do not close. All gears in the small-capacity fleet operate under a 25,000 pound trip limit per day throughout the fishing year. The Large-Capacity fleet quota is a hard cap, in which all fisheries within the Large-Capacity fleet are closed when 95% of the quota is reported to be caught. There is no trip limit for the large-capacity fleet. If this option is chosen, the management alternatives in *Section 4.3.6 Incidental Catch and Small Scale Fisheries* do not apply.

<u>Sub-option 2:</u> Three Fleets Based on Gear Type
The commercial TAC is divided between three fleets (Table 3) which are defined as:

- Small-Capacity Fleet: cast net, traps (excluding floating fish traps), pots, haul seines, fyke nets, hook and line, bag nets, hoop nets, hand lines, trammel nets, and bait nets.
- Medium-Capacity Fleet: pound nets, anchored/staked gill nets, drift gill nets, fishing weirs, floating fish traps, trawls (excluding pair trawls), stop seines, and purse seines which have a capacity of no more than 120,000 lbs of menhaden.
- Large-Capacity Fleet: pair trawls and purse seines which have a capacity of more than 120,000 lbs of menhaden.

<u>Sub-option A:</u> All fleet quotas are hard caps, in which all fisheries within a fleet are closed when the quota is met.
<u>Sub-option B:</u> The Small-Capacity fleet operates on a soft cap, in which the fisheries within the Small-Capacity-fleet do not close. Gears in the small-capacity fleet operate under a 10,000 pound trip limit per day throughout the fishing year. The Large-Capacity and Medium Capacity fleet quotas are hard caps, in which all fisheries within each fleet

are closed when 95% of the quota is reported to be caught. There is no trip limit for the medium or large capacity fleets.

Option D: Seasonal Quota
The menhaden commercial TAC is divided between four seasons (Table 4). The seasons are defined as: (1) Winter, Jan-March, (2) Spring, April-June, (3) Summer, July-September, and (4) Fall, October-December. Allocations to each season can be further divided by jurisdiction or region in Tier 2. The commercial fishery for each season will close when 95% of that season's allocation has been met.

Option E: Allocation Based on TAC Level
The coastwide menhaden commercial TAC will be allocated using two different methods depending on the level at which the annual TAC is set. At or below the baseline annual TAC level of 212,500 mt, quotas will be allocated to jurisdictions based on average landings from 2009-2011 (i.e: the current allocation method, Table 7). If the annual TAC is set above the base level TAC, the difference between the annual TAC and 212,500 mt will be allocated using a strategy that is more favorable to the bait fishery. A sub-option below must be selected to determine the allocation method used when the TAC is greater than 212,500 mt. If an allocation strategy based on the TAC level is chosen, the management alternatives in Tier 2 do not apply and the Board can skip to management alternatives in Tier 3.

Sub-option 1: If the annual TAC is greater than 212,500 mt, the difference between the annual TAC and 212,500 mt will be distributed such that the reduction fishery gets 50% of the allocation (included in Virginia's quota) and the other 50% is distributed to jurisdictions based on bait landings during a timeframe chosen in Tier 3 (Table 5).

Sub-option 2: If the annual TAC is greater than 212,500 mt, the difference between the annual TAC and 212,500 mt will be distributed such that the reduction fishery gets 30% of the allocation (included in Virginia's quota) and the other 70% is distributed to jurisdictions based on bait landings during a timeframe chosen in Tier 3 (Table 6).

Tier 2: Allocation Based on Jurisdictions or Regions
The following section, in conjunction with the management alternative chosen in Tier 1, will determine how the commercial Atlantic menhaden TAC is distributed. The allocation strategy selected in Tier 1 will determine if the commercial TAC is already divided by sector, fleet, season, is based on the TAC level, or none of the above.

Option A: Coastwide Allocation. Under this option the quota will not be subdivided any further. All fisheries will operate within the allocation structure selected in Tier 1. If Option A was selected in Tier 1, there will be one coastwide TAC for the entire commercial fishery.

Option B: Jurisdictional Allocation. The coastwide commercial Atlantic menhaden TAC will be divided among the Atlantic coast jurisdictions that participate in the Atlantic menhaden commercial fishery (Table 7).

Option C: Jurisdiction Allocation with Minimum Base Allocation.
Menhaden commercial TAC is allocated to the Atlantic coast jurisdictions which participate in the menhaden fishery; however, each jurisdiction receives a minimum percentage of the coastwide TAC prior to the allocation being divided.

Sub-option 1: Each jurisdiction receives 1% of the coastwide TAC prior to the allocation being divided (Table 8). For reference 1% of a 200,000 mt TAC equals 4.4 million pounds and 15% of a 200,000 mt TAC (the sum of each jurisdictions 1%) equals 66.1 million pounds.

Sub-option 2: Each jurisdiction receives 0.5% of the coastwide TAC prior to the allocation being divided (Table 9). For reference 0.5% of a 200,000 mt TAC equals 2,204,623 pounds and 7.5% of a 200,000 mt TAC (the sum of each jurisdictions 0.5%) equals 33.1 million pounds.

Option D: Regional Allocation.
The coastwide commercial Atlantic menhaden TAC will be divided by region. The fishery in each region will be monitored through SAFIS and will be closed when 95% of the allocation is reached.

Sub-option 1: A two region split will be used to divide the coastwide commercial TAC, with the regions defined as (1) Chesapeake Bay, which includes Maryland, Potomac River Fisheries Commission, and Virginia, and (2) The Coast, which includes all other jurisdictions. Menhaden landed in a state are attributed to its respective region (Table 10).

Sub-option 2: A three region split will be used to divide the coastwide commercial TAC. The regions are defined as (1) New England, Maine through Connecticut, (2) Mid-Atlantic, New York through Delaware, and (3) South Atlantic, Maryland through Florida. Menhaden landed in a state are attributed to its respective region (Table 11).

Sub-option 3: A four region split will be used to divide the coastwide commercial TAC. The regions are defined as (1) New England, Maine through Connecticut, (2) Mid-Atlantic, New York through Delaware, (3) Chesapeake Bay, Maryland through Virginia and (4) South Atlantic, North Carolina through Florida. Menhaden landed in a state are attributed to its respective region (Table 12).

Tier 3: Allocation Timeframe
Option A: 2009-2011 (status quo)
The quota allocation is based on the three-year average landings from 2009 to 2011. All landings within this time period were subject to mandatory reporting. This time frame was selected when developing Amendment II in 2012, since it represented the most accurate bait landings available at the time.

Option B: 2012-2016

The quota allocation time frame is based on the five-year average landings from 2012 to 2016. This time frame includes the five most recent years of data and encompasses years prior to and after the implementation of a quota system. Total landings include transfers, bycatch, and landings under the episodic events program.

Option C: 1985-2016

The quota allocation time frame is based on average landings from 1985 to 2016. This time frame includes the longest range of years available with adequate landings data, and as such should capture more variability in landings. Bait landings going back to 1985 include more uncertainty, primarily due to voluntary reporting of bait landings in some states. Reduction fisheries in North Carolina, Florida, and Maine also existed during this time period, but have not been in operation since 2005, 1987, and 1993, respectively. Total landings between 2013 and 2016 include transfers, bycatch, and landings under the episodic events program.

Sub-Option A: Reduction landings from states which no longer have a reduction fishery do not count towards the state's average landings.

Sub-Option B: Reduction landings from states which no longer have a reduction fishery do count towards the state's average landings.

Option D: 1985-1995

The quota allocation time frame is based on the eleven-year average landings from 1985 to 1995. Bait landings from 1985 to 1995 include more uncertainty, primarily due to voluntary reporting of bait landings in some states. Reduction fisheries in North Carolina, Florida, and Maine also existed during this time period, but have not been in operation since 2005, 1987, and 1993, respectively.

Sub-Option A: Reduction landings from states which no longer have a reduction fishery do not count towards the state's average landings.

Sub-Option B: Reduction landings from states which no longer have a reduction fishery do count towards the state's average landings.

Option E: Weighted Allocation

The quota allocation time frame is based on a weighted average, using the 1985-1995 and 2012-2016 time frames. Each time frame is given 50% weight. This option takes into account a more historical time period and the most recent time period. All potential data concerns for the 1985 -1995 time period mentioned in Option D would still apply.

Sub-Option A: Reduction landings from states which no longer have a reduction fishery do not count towards the state's average landings.

Sub-Option B: Reduction landings from states which no longer have a reduction fishery do count towards the state's average landings.

Table 1: Percent of menhaden commercial TAC allocated to the reduction and bait fisheries based on historic landings. Landings under the bycatch program and episodic events set aside are included in the allocation percentages. The table on the left (a) is based on total reduction landings from all states which had, or have, a reduction fishery. The table on the right (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

a)

	% Bait	% Reduction
2009-2011	21.2%	78.8%
2012-2016	24.7%	75.3%
1985-2016	13.5%	86.5%
1985-1995	8.3%	91.7%
Weighted	16.5%	83.5%

b)

	% Bait	% Reduction
2009-2011	21.2%	78.8%
2012-2016	24.7%	75.3%
1985-2016	15.0%	85.0%
1985-1995	9.9%	90.1%
Weighted	17.3%	82.7%

Table 2: Percent of menhaden commercial TAC allocated to the small and large capacity fleets based on historic landings. Landings under the bycatch program and episodic events set aside are included in the allocation percentages. The table includes historic reduction landings from those states which no longer have a reduction plant. Given FL did not code landings by gear type prior to 1993, percent landings by gear type in 1993 and 1994 were used to estimate gear landings from 1988-1992. Florida reduction landings were available for 1985-1987.

	2009-2011	2012-2016	1985-2016	1985-1995	Weighted
Large Capacity (Purse Seine, Pair Trawl)	96.2%	94.3%	89.1%	87.2%	90.8%
Small Capacity (All Other Gears)	3.8%	5.7%	10.9%	12.8%	9.2%

Table 3: Three-fleet allocation strategy.

Allocations not yet calculated

Table 4: Season allocation strategy.

Allocations not yet calculated

Table 5: Percent of menhaden commercial TAC greater than 212,500 mt that is allocated to each jurisdiction based on historic bait landings (including landings under the bycatch program and episodic events set aside). Under this scenario, the Virginia reduction fishery gets 50% of the difference between the annual TAC and 212,500 mt (included in Virginia's percentage below) and the states bait fisheries are allocated the other 50%. These allocation percentages only apply if the annual TAC is greater than 212,500 mt.

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted TAC %
ME	0.04%	0.45%	0.22%	0.11%	0.32%
NH	0.00%	0.00%	0.01%	0.04%	0.01%
MA	1.99%	1.19%	1.99%	3.54%	2.10%
RI	0.05%	0.30%	2.16%	7.39%	3.03%
CT	0.04%	0.02%	0.10%	0.12%	0.06%
NY	0.17%	0.51%	0.41%	0.57%	0.53%
NJ	26.66%	25.52%	19.19%	12.04%	20.34%
DE	0.03%	0.06%	0.06%	0.10%	0.08%
MD	3.57%	3.98%	3.59%	3.22%	3.69%
PRFC	1.47%	1.73%	3.66%	7.06%	3.78%
VA	64.76%	65.75%	66.62%	61.53%	64.13%
NC	1.17%	0.36%	1.56%	3.04%	1.39%
SC	0.00%	0.00%	0.00%	0.00%	0.00%
GA	0.00%	0.00%	0.00%	0.00%	0.00%
FL	0.05%	0.12%	0.42%	1.24%	0.56%

Table 6: Percent of menhaden commercial TAC greater than 212,500 mt that is allocated to each jurisdiction based on historic bait landings (including landings under the bycatch program and episodic events set aside). Under this scenario, the Virginia reduction fishery gets 30% of the difference between the annual TAC and 212,500 mt (included in Virginia's percentage below) and the state's bait fisheries are allocated the other 70%. These allocation percentages only apply if the annual TAC is greater than 212,500 mt.

	2009-2011 % TAC	2012-2016 % TAC	1985-2016 % TAC	1985-1995 % TAC	Weighted % TAC
ME	0.06%	0.63%	0.30%	0.16%	0.45%
NH	0.00%	0.00%	0.01%	0.05%	0.02%
MA	2.79%	1.67%	2.79%	4.96%	2.94%
RI	0.06%	0.42%	3.02%	10.34%	4.24%
CT	0.06%	0.03%	0.14%	0.17%	0.09%
NY	0.24%	0.71%	0.58%	0.80%	0.74%
NJ	37.32%	35.73%	26.87%	16.86%	28.47%
DE	0.05%	0.09%	0.09%	0.14%	0.11%
MD	5.00%	5.57%	5.03%	4.51%	5.16%
PRFC	2.06%	2.42%	5.12%	9.88%	5.29%
VA	50.66%	52.06%	53.26%	46.14%	49.78%
NC	1.64%	0.50%	2.18%	4.25%	1.94%
SC	0.00%	0.00%	0.00%	0.00%	0.00%
GA	0.00%	0.00%	0.00%	0.00%	0.00%
FL	0.07%	0.17%	0.59%	1.74%	0.78%

Table 7: Percent of menhaden commercial TAC allocated to each jurisdiction based on historic landings (including bycatch and episodic event landings). Table (a) is based on total reduction landings from all states which had, or have, a reduction fishery. Table (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

(a)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME	0.02%	0.22%	0.89%	1.88%	1.28%
NH	0.00%	0.00%	0.00%	0.01%	0.00%
MA	0.84%	0.59%	0.55%	0.62%	0.61%
RI	0.02%	0.15%	0.60%	1.29%	0.88%
CT	0.02%	0.01%	0.03%	0.02%	0.02%
NY	0.07%	0.25%	0.11%	0.10%	0.15%
NJ	11.29%	12.63%	5.31%	2.10%	5.91%
DE	0.01%	0.03%	0.02%	0.02%	0.02%
MD	1.51%	1.97%	0.99%	0.56%	1.07%
PRFC	0.62%	0.85%	1.01%	1.23%	1.10%
VA	85.08%	83.05%	82.74%	81.82%	82.26%
NC	0.50%	0.18%	7.54%	9.94%	6.41%
SC	0.00%	0.00%	0.00%	0.00%	0.00%
GA	0.00%	0.00%	0.00%	0.00%	0.00%
FL	0.02%	0.06%	0.20%	0.41%	0.28%

(b)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME	0.02%	0.22%	0.06%	0.02%	0.10%
NH	0.00%	0.00%	0.01%	0.01%	0.01%
MA	0.84%	0.59%	0.60%	0.70%	0.66%
RI	0.02%	0.15%	0.65%	1.46%	0.95%
CT	0.02%	0.01%	0.03%	0.02%	0.02%
NY	0.07%	0.25%	0.12%	0.11%	0.17%
NJ	11.29%	12.63%	5.77%	2.38%	6.37%
DE	0.01%	0.03%	0.02%	0.02%	0.02%
MD	1.51%	1.97%	1.08%	0.64%	1.15%
PRFC	0.62%	0.85%	1.10%	1.39%	1.18%
VA	85.08%	83.05%	89.95%	92.40%	88.76%
NC	0.50%	0.18%	0.47%	0.60%	0.44%
SC	0.00%	0.00%	0.00%	0.00%	0.00%
GA	0.00%	0.00%	0.00%	0.00%	0.00%
FL	0.02%	0.06%	0.13%	0.25%	0.17%

Table 8: Percent of menhaden commercial TAC allocated to each jurisdiction based on historic landings, with each jurisdiction receiving, at a minimum, a 1% quota allocation. Table (a) is based on total reduction landings from all states which had, or have, a reduction fishery. Table (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

(a)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME	1.02%	1.19%	1.75%	2.60%	2.09%
NH	1.00%	1.00%	1.00%	1.01%	1.00%
MA	1.72%	1.50%	1.47%	1.53%	1.52%
RI	1.02%	1.13%	1.51%	2.10%	1.75%
CT	1.01%	1.01%	1.02%	1.02%	1.02%
NY	1.06%	1.21%	1.10%	1.08%	1.13%
NJ	10.60%	11.74%	5.51%	2.79%	6.02%
DE	1.01%	1.03%	1.02%	1.01%	1.02%
MD	2.28%	2.67%	1.84%	1.48%	1.91%
PRFC	1.53%	1.73%	1.86%	2.05%	1.93%
VA	73.31%	71.59%	71.33%	70.55%	70.92%
NC	1.42%	1.15%	7.41%	9.45%	6.45%
SC	1.00%	1.00%	1.00%	1.00%	1.00%
GA	1.00%	1.00%	1.00%	1.00%	1.00%
FL	1.02%	1.05%	1.17%	1.35%	1.24%

(b)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME	1.02%	1.19%	1.06%	1.02%	1.09%
NH	1.00%	1.00%	1.01%	1.01%	1.01%
MA	1.72%	1.50%	1.51%	1.59%	1.56%
RI	1.02%	1.13%	1.55%	2.24%	1.81%
CT	1.01%	1.01%	1.03%	1.02%	1.02%
NY	1.06%	1.21%	1.11%	1.10%	1.14%
NJ	10.60%	11.74%	5.91%	3.02%	6.42%
DE	1.01%	1.03%	1.02%	1.02%	1.02%
MD	2.28%	2.67%	1.92%	1.54%	1.98%
PRFC	1.53%	1.73%	1.94%	2.18%	2.01%
VA	73.31%	71.59%	77.46%	79.54%	76.44%
NC	1.42%	1.15%	1.40%	1.51%	1.37%
SC	1.00%	1.00%	1.00%	1.00%	1.00%
GA	1.00%	1.00%	1.00%	1.00%	1.00%
FL	1.02%	1.05%	1.11%	1.21%	1.15%

Table 9: Percent of menhaden commercial TAC allocated to each jurisdiction based on historic landings, with each jurisdiction receiving, at a minimum, a 0.5% quota allocation. Table (a) is based on total reduction landings from all states which had, or have, a reduction fishery. Table (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

(a)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME	0.52%	0.70%	1.32%	2.24%	1.68%
NH	0.50%	0.50%	0.50%	0.51%	0.50%
MA	1.28%	1.05%	1.01%	1.07%	1.06%
RI	0.52%	0.64%	1.05%	1.69%	1.31%
CT	0.52%	0.51%	0.53%	0.52%	0.52%
NY	0.57%	0.73%	0.61%	0.59%	0.64%
NJ	10.94%	12.18%	5.41%	2.45%	5.96%
DE	0.51%	0.53%	0.52%	0.52%	0.52%
MD	1.90%	2.32%	1.42%	1.02%	1.49%
PRFC	1.08%	1.29%	1.44%	1.64%	1.51%
VA	79.19%	77.32%	77.04%	76.18%	76.59%
NC	0.96%	0.66%	7.47%	9.69%	6.43%
SC	0.50%	0.50%	0.50%	0.50%	0.50%
GA	0.50%	0.50%	0.50%	0.50%	0.50%
FL	0.52%	0.56%	0.69%	0.88%	0.76%

(b)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME	0.52%	0.70%	0.56%	0.52%	0.59%
NH	0.50%	0.50%	0.51%	0.51%	0.51%
MA	1.28%	1.05%	1.06%	1.15%	1.11%
RI	0.52%	0.64%	1.10%	1.85%	1.38%
CT	0.52%	0.51%	0.53%	0.52%	0.52%
NY	0.57%	0.73%	0.61%	0.60%	0.65%
NJ	10.94%	12.18%	5.84%	2.70%	6.39%
DE	0.51%	0.53%	0.52%	0.52%	0.52%
MD	1.90%	2.32%	1.50%	1.09%	1.57%
PRFC	1.08%	1.29%	1.52%	1.79%	1.59%
VA	79.19%	77.32%	83.71%	85.97%	82.60%
NC	0.96%	0.66%	0.93%	1.05%	0.90%
SC	0.50%	0.50%	0.50%	0.50%	0.50%
GA	0.50%	0.50%	0.50%	0.50%	0.50%
FL	0.52%	0.56%	0.62%	0.73%	0.66%

Table 10: Percent of menhaden commercial TAC allocated to two regions based on historic landings. Table (a) is based on total reduction landings from all states which had, or have, a reduction fishery. Table (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

(a)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
MD, PRFC, VA	87.21%	85.87%	84.75%	83.61%	84.43%
All Other States	12.79%	14.13%	15.25%	16.39%	15.57%

(b)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
MD, PRFC, VA	87.21%	85.87%	92.13%	94.43%	91.10%
All Other States	12.79%	14.13%	7.87%	5.57%	8.90%

Table 11: Percent of menhaden commercial TAC allocated to three regions based on historic landings. Table (a) is based on total reduction landings from all states which had, or have, a reduction fishery. Table (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

(a)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME, NH, MA, RI, CT	0.90%	0.97%	2.07%	3.82%	2.79%
NY, NJ, DE	11.38%	12.91%	5.44%	2.22%	6.08%
MD, PRFC, VA, NC, SC, GA, FL	87.73%	86.11%	92.49%	93.96%	91.13%

(b)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME, NH, MA, RI, CT	0.90%	0.97%	1.35%	2.22%	1.73%
NY, NJ, DE	11.38%	12.91%	5.92%	2.51%	6.56%
MD, PRFC, VA, NC, SC, GA, FL	87.73%	86.11%	92.73%	95.27%	91.70%

Table 12: Percent of menhaden commercial TAC allocated to four regions based on historic landings. Table (a) is based on total reduction landings from all states which had, or have, a reduction fishery. Table (b) only includes reduction landings from Virginia, the sole Atlantic coast state which still has an active reduction plant.

(a)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME, NH, MA, RI, CT	0.90%	0.97%	2.07%	3.82%	2.79%
NY, NJ, DE	11.38%	12.91%	5.44%	2.22%	6.08%
MD, PRFC, VA	87.21%	85.87%	84.75%	83.61%	84.43%
NC, SC, GA, FL	0.52%	0.24%	7.74%	10.35%	6.70%

(b)

	2009-2011 TAC %	2012-2016 TAC %	1985-2016 TAC %	1985-1995 TAC %	Weighted
ME, NH, MA, RI, CT	0.90%	0.97%	1.35%	2.22%	1.73%
NY, NJ, DE	11.38%	12.91%	5.92%	2.51%	6.56%
MD, PRFC, VA	87.21%	85.87%	92.13%	94.43%	91.10%
NC, SC, GA, FL	0.52%	0.24%	0.60%	0.85%	0.61%

4.3.2.1 Overage Payback

Any overage of a quota allocation is subtracted for that specific quota allocation in the subsequent year on a pound for pound basis. The exception to this rule is if overage reconciliation is implemented under *Section 4.3.3: Quota Transfers* whereby, if the overall TAC is not exceeded in a specific year, any state or region-specific quota overage is automatically forgiven in its entirety. Overage determination is based on final allocations, including transfers if applicable.

4.3.2.2 Allocation Revisit Provision

Quota allocations will be revisited every three years following implementation of Amendment 3, or may be revisited at any time through the adaptive management process (*Section 4.6*).

4.3.3 Quota Transfers

The option to transfer quota only applies if the Board selects regional or state-based quotas, including state-specific quotas with a fixed minimum and an allocation strategy based on the TAC level. If a regional or state-based allocation option is not selected, no quota transfers are permitted.

All transfers require a donor region or state (giving the quota) and a receiving region or state (receiving the quota). Transfers cannot be greater than the amount of quota allocated to the donor region or state for that fishing year. In order to initiate a transfer, a member of each state agency involved must submit a signed letter to the Commission identifying the involved parties, the pounds of quota to be transferred, and justification for the transfer (i.e.: an expected quota overage, safe harbor landings, etc). Letters regarding regional quotas must indicate that all states in the region agree to the transfer and may be signed by multiple state agencies. The Executive Director or designated ASMFC staff will review all transfer requests. The transfer becomes final upon receipt of signed letters from the Commission to the donor and receiving parties. In the event that the donor or receiving member of a transaction subsequently wishes to change the amount of the transfer, both parties have to agree to the change and submit letters to the Commission which are signed by a member of the state agency. Parties participating in a quota transfer may add a provision which states that if the donor state or region incurs an overage in the current fishing year due to the transfer, the overage will be accommodated and paid back by the receiving state in the subsequent year.

If a region or state receives multiple requests to transfer quota at the same time, it is recommended that the state or region considers the requests in the order in which they were received. Transfer requests intended to resolve issues other than quota overages (i.e. safe harbor) may need to be addressed ahead of the order in which they were received.

Transfers do not permanently affect the region or state-specific shares of the coastwide quota, i.e., the region or state-specific shares remain fixed. Regions or states have the responsibility to close the Atlantic menhaden commercial fishery in their jurisdiction once the quota (or a percentage thereof) is reached. Once quota has been transferred, the region or state receiving quota becomes responsible for any overages of their new quota (the receiving region or state's original quota plus any quota transferred). Overages will be deducted from the corresponding region or state's quota the following fishing season.

Option A: Quota Transfers Permitted
Two or more regions or states, under mutual agreement, may transfer or combine their Atlantic menhaden quota.

Option B: Quota Transfers Permitted with Accountability Measures for Overages
Two or more regions or states, under mutual agreement, may transfer or combine their Atlantic menhaden quota. If a state or region exceeds its quota allocation (comprised of the allocation distributed at the beginning of year plus the distribution of unused episodic set aside) by more than 5% in two consecutive years, it may not receive a quota transfer in the third year.

Option C: Quota Reconciliation
In a year where the coastwide TAC is not exceeded, any state or region-specific quota overage is automatically forgiven in its entirety. As a result, quota overages are not deducted in the subsequent fishing year. The intent of this option is to streamline the quota transfer process as quota transfers are not needed to address quota overages. Quota transfers can still be made between two or more regions or states, under mutual agreement, to address concerns

unrelated to quota overages; quota transfers cannot be made to address remaining quota overages after quota reconciliation.

If the coastwide TAC is exceeded and a state(s) or region(s) exceeds its quota allocation, regions or states with an underage automatically have their unused quota transferred to a “common pool” that is re-distributed to states with overages. The common pool quota is redistributed based on the number of jurisdictions with an overage (Table 13). Any overage that remains after the redistribution of the common pool quota is deducted from a region or state’s quota the subsequent year. Quota rollovers are not permitted under quota reconciliation (*Section 4.3.4*).

Table 13: Process for re-distribution of “common pool” quota when the coastwide TAC is exceeded (Option C). The redistribution process can be repeated until all 100,000 lbs of unused quota are distributed. For this example, the amount of available common pool quota is 100,000 lbs. Two rounds of common pool allocation are needed to distribute the full 100,000 lbs.

	Available Common Pool Quota Round 1: 100,000		
	Overage (lbs)	**Quota Allocated from Common Pool (lbs)**	**Remaining Overage**
Region/State 1	100,000	33,333	66,667
Region/State2	50,000	33,333	16,667
Region/State 3	10,000	33,333 (accept 10,000)	0

	Available Common Pool Quota Round 2: 23,333		
	Overage (lbs)	**Quota Allocated from Common Pool (lbs)**	**Remaining Overage**
Region/State 1	66,667	11,667	55,000
Region/State 2	16,667	11,667	5,000

<u>Option D: Quota Reconciliation with Accountability Measures for Overages</u>

In a year where the coastwide TAC is not exceeded, a portion of the state or region’s quota overage is forgiven. The portion of the overage forgiven is dependent on the state or region’s history of overages (Table 14). For example, if a state or region had an overage in the two previous consecutive years, 50% of the current quota overage is forgiven. States or regions must pay back the remaining portion of the overage in the subsequent year. The intent of this option is to dissuade states or regions from habitually exceeding their quota. Quota transfers can still be made between two or more regions or states, under mutual agreement, to address concerns unrelated to quota overages; quota transfers cannot be made to address remaining quota overages after quota reconciliation.

Table 14: The percentage of overage forgiven based on the number of consecutive years a state or region has had an overage. For example, a state or region which had an overage in the previous year gets 70% of its quota overage in the current year forgiven. If a state or region exceeds its quota in three consecutive years or more, it must pay back in full its overage.

Number of Consecutive Years of Overage	% of Overage Forgiven
0	85%
1	70%
2	50%
3 or more	0%

If the coastwide TAC is exceeded and a state(s) or region(s) exceeds its quota allocation, regions or states with an underage automatically have their unused quota transferred to a "common pool" that is re-distributed to states with overages. The common pool quota is redistributed based on the number of jurisdictions with an overage (Table 15). The amount of redistributed common pool quota a state or region can receive is dependent on a state or region's history of overages and cannot exceed the percentages outlined in Table 14. For example, a state or region which had overages in the two previous years cannot received an amount of redistributed common pool quota greater than the 50% of their overage. This process can be repeated until all common pool quota is distributed. Any overage that remains after the redistribution of the common pool quota is deducted from a region or state's quota the subsequent year. Quota rollovers are not permitted under quota reconciliation (*Section 4.3.4*).

Table 15: Process for re-distribution of "common pool" quota when the coastwide TAC is exceeded and there are accountability measures for overages (Option D). The redistribution process can be repeated until either all 100,000 lbs of unused quota are distributed or each state reaches the maximum amount of quota it can accept due to a history of overages. In this example, there is 100,000 lbs of unused quota available for redistribution and it takes three rounds for each state to accept the maximum amount of quota it can receive.

	Available Common Pool Quota Round 1: 100,000					
	Overage (lbs)	# of Previous Years With an Overage	Max Quota that Can Be Accepted (lbs)	Quota Allocated from Common Pool (lbs)	Quota Accepted from Common Pool (lbs)	Remaining Overage
Region/ State 1	100,000	2	50,000	33,333	33,333	66,667
Region/ State2	50,000	0	42,500	33,333	33,333	16,667
Region/ State 3	10,000	1	7,000	33,333	7,000	3,000

	Available Common Pool Quota Round 2: 26,334					
	Overage (lbs)	# of Previous Years With an Overage	Max Quota that Can Be Accepted (lbs)	Quota Allocated from Common Pool (lbs)	Quota Accepted from Common Pool (lbs)	Remaining Overage
Region/ State 1	66,667	2	16,667	13,167	13,167	53,500
Region/ State2	16,667	0	9,167	13,167	9,167	7,500

	Available Common Pool Quota Round 3: 4,000					
	Overage (lbs)	# of Previous Years With an Overage	Max Quota that Can Be Accepted (lbs)	Quota Allocated from Common Pool (lbs)	Quota Accepted from Common Pool (lbs)	Remaining Overage
Region/ State 1	53,500	2	3,500	4,000	3,500	50,000

4.3.4 Quota Rollovers

The option for quota rollovers only applies if the stock status is not overfished and overfishing is not occurring. Any quota that is rolled over must be used in the subsequent fishing year. If the rolled over quota is not used, it cannot be carried into a second fishing year. Quota rollovers are applicable to all allocation methods described in *Section 4.3.2*. If a state or region based allocation is adopted, unused quota from a specific state or region is rolled over to that state or region. If a coastwide allocation is adopted and there is no further allocation by state or region, unused quota is rolled over into the subsequent year's TAC. If a fleet-capacity allocation is adopted and there is no further allocation by state or region, unused quota from a specific fleet is rolled over to that fleet. If a disposition allocation is adopted and there is no further allocation by state or region, unused quota from a specific sector (bait vs. reduction) is rolled over to that sector. If a seasonal allocation is adopted and there is no further allocation by state or region, unused quota from the four seasons will be added together and that value will be rolled over into the TAC for the subsequent year. Quota rollovers are not permitted if quota reconciliation is implemented (*Section 4.3.3 Options C and D).* Therefore, if a reconciliation option is selected, Option A in this section is selected by default. Unused quota allocated to set aside programs, such a small-scale fishery set aside or the episodic events set aside, cannot be rolled over into the subsequent year.

<u>Option A: Unused Quota May Not Be Rolled Over</u>
Unused quota may not be rolled over from one fishing year to the next.

<u>Option B: 100% Quota Rollover</u>
Any unused portion of a quota allocation may be rolled over into the subsequent fishing year only. Unused quota that was received as part of a transfer may not be rolled over.

<u>Option C: 10% Total Quota Rollover</u>
Up to 10% of a quota allocation may be carried over into the subsequent fishing year only. For example, if a quota allocation is 1 million pounds, up to 100,000 pounds of unused quota may be rolled over into the subsequent fishing year. Unused quota that was received as part of a transfer may not be rolled over.

<u>Option D: 5% Total Quota Rollover</u>
Up to 5% of a quota allocation may be carried over into the subsequent fishing year only. For example, if a quota allocation is 1 million pounds, up to 50,000 pounds of unused quota may be rolled over into the subsequent fishing year. Unused quota that was received as part of a transfer may not be rolled over.

Option E: 50% Unused Quota Rollover

Up to 50% of the unused portion or a quota allocation may be rolled over into the subsequent fishing year only. For example, if a quota allocation is 1 million pounds and 600,000 pounds were harvested, up to 200,000 pounds of unused quota could be rolled over into the subsequent year. Unused quota that was received as part of a transfer may not be rolled over.

4.3.5 Incidental Catch and Small Scale Fisheries

4.3.6 Incidental Catch and Small Scale Fisheries

The Board may establish provisions for small-scales gears and non-directed gear types. Tables 28 and 29 show landings under the current bycatch provision from 2013-2016. For the purposes of this Amendment, small-scale gears include cast nets, traps (excluding floating fish traps), pots, haul seines, fyke nets, hook and line, bag nets, hoop nets, hand lines, trammel nets, and bait nets. Non-directed gear types include pound nets, anchored/stake gillnets, drift gill net, trawls, fishing weirs, fyke nets, and floating fish traps. Stationary multi-species gears are defined as pound nets, anchored/stake gill nets, fishing weirs, floating fish traps, and fyke nets.

Landings under the incidental catch provision will be reported to the Board as a part of the annual FMP Review (*Section 5.3: Compliance Report*). Should a specific gear type show a continued and significant increase in landings under the incidental catch provision, or it becomes clear that a non-directed gear type is directing on menhaden under the incidental catch provision, the Board has the authority, through adaptive management, to alter the trip limit or remove that gear from the incidental catch provision.

If a fleet-based allocation method is chosen in *Section 4.3.2 Quota Allocation*, Option E: Small-Scale Fishery Set Aside does not apply. If a two-fleet allocation method with a soft quota for the small-capacity fleet is chosen in *Section 4.3.2 Quota Allocation*, the management alternatives in this section do not apply. If a three-fleet allocation method with a soft quota for the small-capacity fleet is chosen in *Section 4.3.2 Quota Allocation*, the management alternatives in this section would only apply to non-directed gear types.

Option A: Catch Limit for Non-Directed Gear Types

After a quota allocation is met for a given jurisdiction, region, season, sector, or fleet, the fishery moves to an incidental catch fishery in which **non-directed gear types** may land up to 6,000 pounds of menhaden per trip/day. Two permitted individuals, working from the same vessel fishing stationary multi-species gear, are authorized to work together and land up to 12,000 pounds from a single vessel – limited to one vessel trip per day. A trip is based on a calendar day such that no vessel may land menhaden more than once in a single calendar day. The use of multiple carrier vessels per trip to offload any bycatch exceeding 6,000 pounds of Atlantic menhaden is prohibited. Incidental catch landings are reported by states to the Commission as a part of annual Compliance Reports. Under this option, landings in the incidental catch fishery do not count towards the TAC.

Option B: Catch Limit for Small Scale Fisheries and Non-Directed Gear Types

After a quota allocation is met for a given jurisdiction, region, season, sector, or fleet, the fishery moves to an incidental catch fishery in which **small-scale gears** and **non-directed gear types** may land up to 6,000 pounds of menhaden per trip/day. Two authorized individuals, working from the same vessel fishing stationary multi-species gear, are permitted to work together and land up to 12,000 pounds from a single vessel – limited to one vessel trip per day. A trip is based on a calendar day such that no vessel may land menhaden more than once in a single calendar day. The use of multiple carrier vessels per trip to offload any bycatch exceeding 6,000 pounds of Atlantic menhaden is prohibited. Incidental catch landings are reported by states to the Commission as a part of annual Compliance Reports. Under this option, landings in the incidental catch fishery do not count towards the TAC.

Option C: Catch Cap and Trigger

After a quota allocation is met for a given jurisdiction, region, season, sector, or fleet, the fishery moves to an incidental catch fishery in which **small-scale gears** and **non-directed gear types** may land up to 6,000 pounds of menhaden per trip/day. Two authorized individuals, working from the same vessel fishing stationary multi-species gear, are permitted to work together and land up to 12,000 pounds from a single vessel – limited to one vessel trip per day. A trip is based on a calendar day such that no vessel may land menhaden more than once in a single calendar day. The use of multiple carrier vessels per trip to offload any bycatch exceeding 6,000 pounds of Atlantic menhaden is prohibited.

A catch cap for the incidental catch fishery is set at 2% of the TAC. For 2017, this represents approximately 8.8 million pounds, which is 148% higher than the maximum bycatch landing of 6.6 million pounds in a single year between 2013 and 2016. Incidental catch landings are reported by states to the Commission as a part of annual Compliance Reports. If reported incidental catch exceeds the Cap by more than 10% in a single year or exceeds the Cap two years in a row, regardless of the percent overage, management action is triggered by the Board to reduce incidental landings in the fishery. Under this option, landings in the incidental catch fishery do not count towards the TAC.

Option D: Incidental Catch Fishery Set Aside

2% of the overall TAC is set aside for an incidental catch fishery, which occurs after a quota allocation is met for a given jurisdiction, region, season, sector, or fleet. Under an incidental catch fishery, there is a 6,000 pound/trip/day menhaden allowance for **small-scale gears and non-directed gear types.** All landings by these gear types which occur after a quota allocation has been met, are counted towards the set aside. Two authorized individuals, working from the same vessel fishing stationary multi-species gear, are permitted to work together and land up to 12,000 pounds from a single vessel – limited to one vessel trip per day. A trip is based on a calendar day such that no vessel may land menhaden more than once in a single calendar day. The use of multiple carrier vessels per trip to offload any bycatch exceeding 6,000 pounds of Atlantic menhaden is prohibited.

Landings made by small-scale fisheries and non-directed fisheries following the closure of the directed fishery are reported by states to the Commission as a part of annual Compliance Reports. If the set aside is exceeded in a given year, the overage is deducted from the subsequent year's set aside. The percentage of TAC set aside for the incidental catch fishery can by altered under Adaptive Management (*Section 4.5*). Under this option, landings in the incidental catch fishery do count towards the TAC.

Option E: Small-Scale Fishery Set Aside

1% of the overall TAC is set aside for **small-scale gears**. Trips by these gears types are limited to 3,000 pounds of Atlantic menhaden per trip/day. A trip is defined by a calendar day such that a fisherman cannot land menhaden more than once in a single calendar day. Landings by small-scale fisheries are reported by states to the Commission as a part of annual Compliance Reports. If the coastwide set aside is exceeded in a given year, the overage is deducted from the subsequent year's set aside. The percentage of TAC set aside for small-scale fisheries can by altered under Adaptive Management (*Section 4.5*).

If a jurisdictional allocation method is chosen in *Section 4.3.2* and a state which only has landings by small-scale gears is allocated quota, that state may choose to add its jurisdictional quota to the small-scale fishery set aside. For example, if Florida, a state which exclusively has a cast net fishery, is allocated 0.5% of quota, the state may aggregate its state quota with the small-scale fishery set aside, making the set aside allocation 1.5%.

Landings by all other gear types' count towards the quota allocated to either states, regions, seasons, sectors, or fleets. Once the respective quota allocation is met, the menhaden fishery is closed and no landings of menhaden are permitted by those gear types. Under this option, landings in the small scale fishery do count towards the TAC. This option does not apply if a two-fleet allocation method is chosen with a soft cap for the small-capacity fleet.

Option F: All Catch Included in TAC

All catch of menhaden, including incidental catch, counts towards the directed fishery TAC. Once the quota allocation for a specific state, region, season, sector, or fleet is reached, the menhaden fishery is closed and no landings of menhaden are permitted by that state, region, sector, fleet, or in that season which has met is quota allocation.

4.3.6 Episodic Events Set Aside Program

The Board may set aside a portion of the TAC for episodic events. Episodic events are defined by any instance in which a qualified state has reached its annual quota allocation available to them prior to September 1 and the state can prove the presence of unusually large amounts of menhaden in its state waters. The goal of the set aside is to add flexibility to the management of the species so that states can harvest menhaden during episodic events, reduce discards, and prevent fish kills. Eligibility to participate in the episodic events set aside program is reserved for the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York. Landings per year under the set aside can be found in Table 29.

4.3.6.1 TAC Set Aside

A percentage of the TAC is set aside for use in the episodic events program.

<u>Option A: 1% of TAC Set Aside (Status quo)</u>
1% of the overall TAC is set aside for episodic events.

<u>Option B: 3% of TAC Set Aside</u>
3% of the overall TAC is set aside for episodic events.

<u>Option C: 0% of TAC Set Aside</u>
No portion of the overall TAC is set aside for episodic events. Under this option, there is no episodic events program.

4.3.6.2 Mandatory Provisions

In order for an eligible state to participate in the episodic events set aside program, states must implement the following provisions.

A. Participating states must implement daily trip level harvester reporting. Each state must track landings and submit weekly reports to ASMFC staff. Should several states be approved to participate in the episodic event set aside program, ASMFC staff may require more frequent reporting to ensure the set aside is not exceeded.
B. Episodic events harvest and landings must be restricted to state waters of the jurisdiction approved to participate in the set aside.
C. Participating states must implement a maximum daily trip limit no greater than 120,000 pounds/vessel. A daily trip is defined by a calendar day such that no vessel harvesting under the episodic events program may land menhaden twice in a single calendar day.

4.3.6.3 Declaring Participation

A state must apply to participate in the episodic events program prior to September 1st. In order to apply, a state must send a letter to ASMFC declaring interest in harvesting under the set aside. The letter must demonstrate the following:

A. The state has implemented the mandatory provisions stated in Section 4.3.6.2.
B. The applying state has fully harvested its annual quota allocation prior to September 1.
    I. If a jurisdictional quota is implemented, a state must reach its quota prior to September 1.
    II. If a coastwide quota is implemented, the coastwide quota must be reached prior to September 1.
    III. If a seasonal quota is implemented:
        - The current seasonal quota must be reached;
        - The state's eligibility to harvest under the set aside would only apply until the start of the next season or October 31, whichever occurs first;
        - There is no limit on the number of times a state may apply to participate in the episodic events program provided they can demonstrate that they meet the

provisions of the program at the time of application and the requirements above have been satisfied.

IV. If a regional quota is implemented, the regional quota in which the state participates must be reached prior to September 1. A state within a region may apply to participate without the other states/jurisdictions within its region applying.
V. If disposition quotas are implemented, the quota allocated to the bait sector must be reached prior to September 1.
VI. If fleet capacity quotas are implemented, only gear types which have reached their quota prior to September 1 are eligible to harvest under the set aside program. A state must declare in their letter to ASMFC, prior to approval to participate, which gear types will be allowed to harvest under the set aside program.

C. The state has unusually large amounts of menhaden in its state waters. This can be demonstrated through:
   I. Surveys (aerial, seine) which indicate high biomass;
   II. Landings reports which indicate an unusually high rate of menhaden harvest at the time of declaration into the set aside;
   III. Or information highlighting the potential for fish kills, associated human health concerns, and the ability of harvest under the set aside to reduce or eliminate the fish kill.
D. The state has not declared de minimis status. If a qualifying state was previously granted de minimis status, it will lose that status and will need to collect biological data and catch and effort data for an adult index as required by Section 3.5: Biological Data Collection Programs.

Once the application letter is received by ASMFC staff, the PRT will review the state's compliance with the requirements of the episodic events set aside program. Once verified, ASMFC will send a letter notifying the state that it can harvest menhaden under the set aside. Only harvest that occurs on or after the date of the aforementioned notification letter, and prior to the states eligibility ending, will be considered episodic event set aside harvest. ASMFC staff will also notify the Board when any state is approved to harvest under the set aside.

4.3.6.4 Procedure for Unused Set Aside
If an episodic event is not triggered by September 1 in any state, the unused set aside quota will be rolled into the overall TAC on September 1 and redistributed based on the allocation method and timeframe selected in *Section 4.3.2*. If an episodic event is triggered, any unused set aside as of October 31st of each year will be redistributed based on the allocation method and timeframe selected in *Section 4.3.2*.

4.3.6.5 Procedure for Set Aside Overages
If the episodic event set aside is exceeded, any overages will be deducted from the next year's episodic event set aside amount.

4.3.7 Chesapeake Bay Reduction Fishery Cap

The Chesapeake Bay Reduction Fishery Cap limits allowable harvest from the Chesapeake Bay by the reduction fishery. The intent of the Cap is to prevent all of the reduction fishery harvest from occurring in the Chesapeake Bay, a critical nursery area for Atlantic menhaden. Harvest for reduction purposes shall be prohibited within the Chesapeake Bay when 100% of the cap is harvested from Chesapeake Bay, which is defined as areas shoreward of the Chesapeake Bay Bridge Tunnel. Harvest above the Cap in any given year will be deducted from the next year's allowable harvest. In recent years reduction harvest in the Chesapeake Bay has consistently underperformed the 87,216 mt cap, with less than 45,000 mt harvest in 2014 and 2016 and less than 50,000 mt harvested in 2015.

<u>Option A: Cap Set At 87,216 mt</u>
The Chesapeake Bay Reduction Fishery Cap is maintained as 87,216 metric tons.

> <u>Sub-Option A: Limited Rollover of Unused Cap Permitted</u>
> A maximum of 10,976 metric tons of un-landed fish under the Cap can be rolled over into the subsequent year. This rollover amount equals 12.58% of the Cap. Unused landings under the Cap cannot be rolled over for multiple years and under no circumstances can the allowable harvest under the Cap in a given year exceed 98,192 metric tons.
>
> <u>Sub-Option B: No Rollover of Unused Cap Permitted</u>
> Any amount of un-landed fished under the Cap cannot be rolled over into the subsequent year. As a result, under no circumstances can the allowable harvest under the Cap in a given year exceed 87,216 metric tons.

<u>Option B: Cap Set At Average Ches. Bay Reduction Landings from 2012-2016 (~51,000 mt)</u>
The Chesapeake Bay Reduction Fishery Cap is reduced to 51,000 metric tons. This value represents an approximation of the five-year average of reduction harvest from the Chesapeake Bay between 2012 and 2016. An approximate value is used given reduction landings in the Chesapeake Bay are confidential.

> <u>Sub-Option A: Limited Rollover of Unused Cap Permitted</u>
> A maximum of 6,418 metric tons of un-landed fish under the Cap can be rolled over into the subsequent year. This rollover amount equals 12.58% of the Cap. Unused landings under the Cap cannot be rolled over for multiple years and under no circumstances can the allowable harvest under the Cap in a given year exceed 57,418 metric tons.
>
> <u>Sub-Option B: No Rollover of Unused Cap Permitted</u>
> Any amount of un-landed fished under the Cap cannot be rolled over into the subsequent year. As a result, under no circumstances can the allowable harvest under the Cap in a given year exceed 51,000 metric tons.

<u>Option C: Remove Cap</u>
The Chesapeake Bay Reduction Fishery Cap. Under this option, there is no limit on harvest by the reduction fishery in the Chesapeake Bay.

4.4 HABITAT CONSERVATION AND RESTORATION RECOMMENDATIONS

In order to ensure the productivity of populations, each state should identify and protect critical nursery areas for Atlantic menhaden within its boundaries. Such efforts should inventory historical habitats, identify habitats presently used by menhaden, and impose or encourage measures to retain or increase the quantity and quality of Atlantic menhaden habitat.

4.4.1 Preservation of Existing Habitat

States should provide inventories and locations of critical Atlantic menhaden habitat to other state and federal regulatory agencies. Regulatory agencies should be advised on the types of threats to Atlantic menhaden populations and recommended measures that should be employed to avoid, minimize or eliminate any threat to current habitat extent or quality.

4.4.2 Habitat Restoration and Improvement

While Atlantic menhaden appear to be utilizing the bulk of their historic nursery areas, water quality in these areas should be maintained or improved, if impaired, to prevent hypoxic fish kills and minimize the threat of increased mortality due to disease and parasitism. Protection of wetlands will protect and improve menhaden habitat.

4.4.3 Avoidance of Incompatible Activities

Federal and state fishery management agencies should take steps to limit the introduction of compounds which are known, or suspected, to accumulate in any animal species' tissue and which pose a threat to human health or any animals' health.

Each state should establish windows of compatibility for activities known or suspected to adversely affect Atlantic menhaden life stages and their habitats, such as navigational dredging, inlet modifications, and dredged material disposal, and notify the appropriate construction or regulatory agencies in writing.

Projects involving water withdrawal from nursery habitats (e.g. power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from larval/juvenile impingement, entrainment, and/or modification of flow, temperature and salinity regimes due to water removal, will not adversely impact estuarine dependent species, including Atlantic menhaden, especially early life stages.

Each state which contains Atlantic menhaden nursery areas within its jurisdiction should develop water use and flow regime guidelines which are protective of these nursery areas and which will ensure to the extent possible, the long-term health and sustainability of the stock.

4.4.4 Fishery Practices

The use of any fishing gear or practice which is documented by management agencies to have an unacceptable impact on Atlantic menhaden (e.g. habitat damage, bycatch mortality) should be prohibited within the effected essential habitats.

4.5 ALTERNATIVE STATE MANAGEMENT REGIMES

States are required to obtain prior approval from the Board of any changes to their management program for which a compliance requirement is in effect. Changes to non-compliance measures must be reported to the Board but may be implemented without prior Board approval. A state can request permission to implement an alternative management measure to any mandatory compliance measure only if that state can show, to the Board's satisfaction, that its alternative proposal will have the same conservation value as the measure contained in this amendment or any addenda prepared under Adaptive Management (*Section 4.6*). States submitting alternative proposals must demonstrate that the proposed action will not contribute to overfishing of the resource. All changes to a state's plan must be submitted in writing to the Board and to the Commission as part of the Annual Compliance Reports.

4.5.1 General Procedures

A state may submit a proposal for a change to its regulatory program or any mandatory compliance measure under this amendment to the Commission, including a proposal for *de minimis* status. Such changes shall be submitted to the Chair of the Plan Review Team (PRT), who shall distribute the proposal to the Board, the PRT, the TC, and the AP.

The PRT is responsible for gathering the comments of the TC and the AP. The PRT is also responsible for presenting these comments as soon as possible to the Board for decision.

The Board will decide whether to approve the state proposal for an alternative management program if it determines that it is consistent with the target fishing mortality rate applicable as well as the goals and objectives of this amendment.

In order to maintain consistency within a fishing season, new rules should be implemented prior to the start of the fishing season. Given the time needed for the TC, AP, and Board to review the proposed regulations, as well as the time required by an individual state to promulgate new regulations, it may not be possible to implement new regulations for the current fishing season. In this case, new regulations should be effective at the start of the following season after a determination to do so has been made.

4.5.2 Management Program Equivalency

The TC, under the direction of the PRT, will review any alternative state proposals under this section and provide its evaluation of the adequacy of such proposals to the Board. The PRT can also ask for reviews by the Law Enforcement Committee or the AP.

4.5.3 *De Minimis* Fishery Guidelines

The ASMFC Interstate Fisheries Management Program Charter defines *de minimis* as "a situation in which, under the existing condition of the stock and scope of the fishery, the conservation and enforcement actions taken by an individual states would be expected to contribute insignificantly to a coastwide conservation program required by a Fishery Management plan or amendment," (ASMFC 2016).

A state can apply annually for *de minimis* status if a state does not have a reduction fishery, following the procedure in *Section 4.5.3.2.* To be eligible for *de minimis* consideration in the bait fishery, a state must prove that its commercial bait landings in the most recent two years for which data are available did not exceed 1% of the coastwide bait landings.

4.5.3.1 Plan Requirements if De Minimis Status is Granted

If *de minimis* status is granted, the *de minimis* state is required to implement, at a minimum, the coastwide management requirements contained in *Section 4.0*. Additionally all *de minimis* states except New Hampshire, South Carolina, and Georgia must adhere to timely quota monitoring as approved by the Board (*Section 3.1.2*).

States granted *de minimis* status are exempt from collecting biological data and the adult CPUE index data (*Section 3.5.1.2*).

If the coastwide fishery is closed for any reason through Emergency Procedures (*Section 4.7*), *de minimis* states must close their fisheries as well.

Any additional components of the FMP, which the Board determines necessary for a *de minimis* state to implement, can be defined at the time *de minimis* status is granted.

4.5.3.2 Procedure to Apply for De Minimis Status

States must specifically request *de minimis* status each year. Requests for *de minimis* status will be reviewed by the PRT as part of the annual FMP review process (*Section 5.3: Compliance Report*). Requests for *de minimis* must be submitted to the ASMFC Atlantic Menhaden FMP Coordinator as a part of the state's yearly compliance report. The request must contain the following information: all available commercial landings data for the current and 2 previous full years of data, commercial regulations for the current year, and the proposed management measures the state plans to implement for the year *de minimis* status is requested. The FMP Coordinator will then forward the information to the PRT and, if necessary, the TC and SASC.

In determining whether or not a state meets the *de minimis* criteria, the PRT will consider the information provided with the request, the most recent available coastwide landings data, any information provided by the TC and SASC, and projections of future landings. The PRT will make a recommendation to the Board to either accept or deny the *de minimis* request. The Board will then review the PRT recommendation and either grant or deny the *de minimis* classification.

The Board must make a specific motion to grant a state *de minimis* status. By deeming a given state *de minimis*, the Board is recognizing that: the state has a minimal Atlantic menhaden fishery; there is little risk to the health of the menhaden stock if the state does not implement the full suite of management measures; and the overall burden of implementing the complete management and monitoring requirements of the FMP outweigh the conservation benefits of implementing those measures in the particular state.

If commercial landings in a *de minimis* state exceed the *de minimis* threshold, the state will lose its *de minimis* classification, will be ineligible for *de minimis* in the following year, and will be required to implement all provisions of the FMP. If the Board denies a state's *de minimis* request, the state will be required to implement all the provisions of the FMP. When a state rescinds or loses its *de minimis* status, the Board will set a compliance date by which the state must implement the required regulations.

4.6 ADAPTIVE MANAGEMENT

The Board may vary the requirements specified in this Amendment as a part of adaptive management in order to conserve the Atlantic menhaden resource. The elements that can be modified by adaptive management are listed in *Section 4.6.2*. The process under which adaptive management can occur is provided below.

4.6.1 General Procedures

The PRT will monitor the status of the fishery and the resource and report on that status to the Board annually or when directed to do so by the Board. The PRT will consult with TC, the SASC, and the AP in making such review and report.

The Board will review the report of the PRT, and may consult further with the TC, SASC, or AP. The Board may, based on the PRT report or on its own discretion, direct the PDT to prepare an addendum to make any changes it deems necessary. The addendum shall contain a schedule for the states to implement the new provisions.

The PDT will prepare a draft addendum as directed by the Board, and shall distribute it to all states for review and comment. A public hearing will be held in any state that requests one. The PDT will also request comment from federal agencies and the public at large. After a 30-day review period, staff, in consultation with the PDT, will summarize the comments received and prepare a final version of the addendum for the Board.

The Board shall review the final version of the addendum prepared by the PDT, and shall also consider the public comments received and the recommendations of the TC, SASC, and AP. The Board shall then decide whether to adopt, or revise and then adopt, the addendum.

Upon adoption of an addendum by the Board, states shall prepare plans to carry out the addendum, and submit them to the Board for approval according to the schedule contained in the addendum.

4.6.2 Measures Subject to Change

The following measures are subject to change under adaptive management upon approval by the Board:

(1) Management areas and unit
(2) Reference points, including an overfishing and overfished definition
(3) Rebuilding targets and schedules
(4) TAC specification and quota allocation
(5) Episodic events set aside program
(6) Small scale fishery set aside
(7) Incidental catch fishery set aside
(8) Incidental catch provision
(9) *De minimis* specifications
(10) Chesapeake Bay reduction fishery cap
(11) Effort controls
(12) Fishing year and/or seasons
(13) Trip limits
(14) Limited entry
(15) Area closures
(16) Gears assigned to fleets
(17) Gear restrictions including mesh sizes
(18) Recreational fishery management measures
(19) For-hire fishery management measures
(20) Research set aside programs
(21) Research or monitoring requirements
(22) Frequency of stock assessments
(23) Reporting requirements
(24) Measures to reduce or monitor bycatch
(25) Observer requirements
(26) Recommendations to the Secretaries for complementary actions in federal jurisdictions
(27) Any other management measures currently included in Amendment 3

4.7 EMERGENCY PROCEDURES

Emergency procedures may be used by the Board to require any emergency action that is not covered by, is an exception to, or a change to any provision in Amendment 3. Procedures for implementation are addressed in the ASMFC Interstate Fisheries Management Program Charter, Section Six (c)(10) (ASMFC 2016).

4.8 MANAGEMENT INSTITUTIONS

The management institutions for Atlantic menhaden shall be subject to the provisions of the ISFMP Charter (ASMFC 2016). The following is not intended to replace any or all of the provisions of the ISFMP Charter. All committee roles and responsibilities are included in detail in the ISFMP Charter and are only summarized here.

4.8.1 Atlantic States Marine Fisheries Commission and ISFMP Policy Board

The ASMFC (Commission) and the ISFMP Policy Board are generally responsible for the oversight and management of the Commission's fisheries management activities. The Commission must approve all fishery management plans and amendments, including Amendment 3. The ISFMP Policy Board reviews any non-compliance recommendations of the various Boards and Sections and, if it concurs, forwards them to the Commission for action.

4.8.2 Atlantic Menhaden Management Board

The Board was established under the provisions of the Commission's ISFMP Charter (Section Four; ASMFC 2016) and is generally responsible for carrying out all activities under this Amendment.

The Board establishes and oversees the activities of the PDT, PRT, TC, SASC, BERP Workgroup, and the AP. In addition, the Board makes changes to the management program under adaptive management, reviews state programs implementing the amendment, and approves alternative state programs through conservation equivalency. The Board reviews the status of state compliance with the management program annually, and if it determines that a state is out of compliance, reports that determination to the ISFMP Policy Board under the terms of the ISFMP Charter.

4.8.3. Atlantic Menhaden Plan Development Team

The Plan Development Team (PDT) is composed of personnel from state and federal agencies who have scientific knowledge of Atlantic menhaden and management abilities. The PDT is responsible for preparing and developing management documents, including addenda and amendments, using the best scientific information available and the most current stock assessment information. The ASMFC FMP Coordinator chairs the PDT. The PDT will either disband or assume inactive status upon completion of Amendment 3.

4.8.4 Atlantic Menhaden Plan Review Team

The Plan Review Team (PRT) is composed of personnel from state and federal agencies who have scientific and management ability and knowledge of Atlantic menhaden. The PRT is responsible for providing annual advice concerning the implementation, review, monitoring, and enforcement of Amendment 3 once it has been adopted by the Commission. After final action on Amendment 3, the Board may elect to retain members of the PDT as members of the PRT, or appoint new members.

4.8.5 Atlantic Menhaden Technical Committee

The Atlantic Menhaden Technical Committee (TC) consists of representatives from state or federal agencies, Regional Fishery Management Councils, the Commission, a university, or other specialized personnel with scientific and technical expertise and knowledge of the Atlantic menhaden fishery. The Board appoints the members of the TC and may authorize additional seats as it sees fit. The role of the TC is to assess the species' population, provide scientific advice concerning the implications of proposed or potential management alternatives, and respond to other scientific questions from the Board, PDT, or PRT. The SASC reports to the TC.

4.8.6 Atlantic Menhaden Stock Assessment Subcommittee

The Atlantic Menhaden Stock Assessment Subcommittee (SASC) is appointed and approved by the Board, with consultation from the Atlantic Menhaden TC, and consists of scientists with expertise in the assessment of the Atlantic menhaden population. Its role is to assess the Atlantic menhaden population and provide scientific advice concerning the implications of proposed or potential management alternatives, and to respond to other scientific questions from the Board, TC, PDT or PRT. The SASC reports to the TC.

4.8.7 Biological Ecological Reference Point Work Group

The Biological Ecological Reference Point Work Group (BERP Workgroup) is comprised of representatives from each technical committee for weakfish, striped bass, bluefish, and menhaden, in addition to state and federal biologists with expertise on multispecies modeling approaches. The intent of the BERP Work Group is to assist the Commission with its multispecies modeling efforts and facilitate the use of multispecies model results in management decisions. More specifically, the BERP Work Group is tasked with identifying potential ecological reference points that account for Atlantic menhaden's role as a forage fish.

4.8.8 Atlantic Menhaden Advisory Panel

The Atlantic Menhaden Advisory Panel (AP) is established according to the Commission's Advisory Committee Charter. Members of the AP are citizens who represent a cross-section of commercial and recreational fishing interests and others who are concerned about Atlantic menhaden conservation and management. The AP provides the Board with advice directly concerning the Commission's Atlantic menhaden management program.

4.8.9 Federal Agencies

4.8.9.1 Management in the Exclusive Economic Zone

Management of Atlantic menhaden in the EEZ is within the jurisdiction of the three Regional Fishery Management Councils under the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.). In the absence of a Council Fishery Management Plan, management is the responsibility of the

National Marine Fisheries Service as mandated by the Atlantic Coastal Fishery Conservation and Management Act (16 U.S.C. 5105 et seq.).

4.8.9.2 Federal Agency Participation in the Management Process
The Commission has accorded the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service voting status on the ISFMP Policy Board and the Atlantic Menhaden Management Board in accordance with the Commission's ISFMP Charter. The National Marine Fisheries Service can also participate on the Atlantic Menhaden PDT, PRT, TC and SASC.

4.8.9.3 Consultation with Fishery Management Councils
At the time of adoption of Amendment 3, none of the Regional Fishery Management Councils had implemented a management plan for Atlantic menhaden, nor had they indicated an intent to develop a plan.

4.9 RECOMMENDATION TO THE SECRETARY OF COMMERCE FOR COMPLEMENTARY MEASURES IN FEDERAL WATERS

The quota management approach adopted can be implemented and monitored within the jurisdictions of the Atlantic states. Therefore, a specific recommendation to the Secretary for complimentary action in federal jurisdictions is unnecessary at this time. The Board may consider further recommendations to the Secretary if changes to Amendment 3 occur through the adaptive management process (*Section 4.6*).

4.10 COOPERATION WITH OTHER MANAGEMENT INSTITUTIONS

The Board will cooperate, when necessary, with other management institutions during the implementation of this amendment, including the National Marine Fisheries Service and the New England, Mid-Atlantic, and South Atlantic Fishery Management Council.

5.0 COMPLIANCE

Full implementation of the provisions included in this amendment is necessary for the management program to be equitable, efficient and effective. States are expected to implement these measures faithfully under state laws. Although ASMFC does not have authority to directly compel states to implement these measures, it will continually monitor the effectiveness of state implementation and determine whether states are in compliance with the provisions of this fishery management plan. The Board sets forth specific elements that the Commission will consider in determining state compliance with this fishery management plan, and the procedures that will govern the evaluation of compliance. Additional details of the procedures are found in the ASMFC Interstate Fishery Management Program Charter (ASMFC 2016).

5.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES

A state will be determined to be out of compliance with the provision of this fishery management plan according to the terms of Section Seven of the ISFMP Charter if:

- It fails to meet any schedule required by Section 5.2, or any addendum prepared under adaptive management (*Section 4.6*); or
- It has failed to implement a change to its program when determined necessary by the Board; or
- It makes a change to its regulations required under *Section 4* or any addendum prepared under adaptive management (*Section 4.6*), without prior approval of the Board.

5.1.1 Regulatory Requirements

To be considered in compliance with this fishery management plan, all state programs must include a regime of restrictions on Atlantic menhaden fisheries consistent with the requirements of *Section 3.1: Commercial Catch and Landings Programs; Section 3.5.1: Fishery-Dependent Data;* and *Section 4.3: Commercial Fishery Management Measures*. A state may propose an alternative management program under *Section 4.5: Alternative State Management Regimes*, which, if approved by the Board, may be implemented as an alternative regulatory requirement for compliance.

States may begin to implement Amendment 3 after final approval by the Commission. Each state must submit its required Atlantic menhaden regulatory program to the Commission through the ASMFC staff for approval by the Board. During the period between submission and Board approval of the state's program, a state may not adopt a less protective management program than contained in this Amendment or contained in current state law. The following lists the specific compliance criteria that a state/jurisdiction must implement in order to be in compliance with Amendment 3:

- Commercial fishery management measures as specified in *Section 4.3* including the Total Allowable Catch (*Section 4.3.1*), Overage Payback (*Section 4.3.2.1*) Quota Allocation (*Section 4.3.2*), Quota Transfers (*Section 4.3.3*), Quota Rollovers (*Section 4.3.4*), Incidental Catch Provision (*Section 4.3.5*), Episodic Events Set Aside (*Section 4.3.6*), and the Chesapeake Bay Reduction Fishery Harvest Cap (*Section 4.3.7*).
- Monitoring requirements as specified in Section 3.1
- All state programs must include law enforcement capabilities adequate for successfully implemented the compliance measures contained in this Amendment.
- There are no mandatory research requirements at this time; however, mandatory research requirements may be added in the future under Adaptive Management, *Section 4.6*.
- There are no mandatory habitat requirements in Amendment 3. See *Section 4.4* for habitat recommendations.

5.2 COMPLIANCE SCHEDULE

States must implement this Amendment according to the following schedule:

Month Day, 201X:	Submission of state programs to implement Amendment 3 for approval by the Board. Programs must be implemented upon approval by the Board.
Month Day, 201X:	States with approved management programs must implement Amendment 3. States may begin implementing management programs prior to this deadline if approved by the Board.

5.3 COMPLIANCE REPORTS

Each state must submit to the Commission an annual report concerning its Atlantic menhaden fisheries and management program for the previous year, no later than April 1st. A standard compliance report format has been prepared and adopted by the ISFMP Policy Board. States should follow this format in completing the annual compliance report.

The report shall cover:

- the previous calendar year's fishery and management program including mandatory reporting programs (including frequency of reporting and data elements collected), fishery dependent data collection, fishery independent data collection, regulations in effect, total harvest (including directed landings, bycatch landings, landings under a soft cap, and landings under the episodic events program), de minimis requests, and future regulatory changes.
- the planned management program for the current calendar year summarizing regulations that will be in effect and monitoring programs that will be performed, highlighting any changes from the previous year.

5.4 PROCEDURES FOR DETERMINING COMPLIANCE

Detailed procedures regarding compliance determinations are contained in the ISFMP Charter, Section Seven (ASMFC 2016). In brief, all states are responsible for the full and effective implementation and enforcement of fishery management plans in areas subject to their jurisdiction. Written compliance reports as specified in the Amendment must be submitted annually by each state with a declared interest. Compliance with Amendment 3 will be reviewed at least annually; however, the Board, ISFMP Policy Board or the Commission may request the PRT to conduct a review of state's implementation and compliance with Amendment 3 at any time.

The Board will review the written findings of the PRT within 60 days of receipt of a State's compliance report. Should the Board recommend to the Policy Board that a state be determined out of compliance, a rationale for the recommended noncompliance finding will be addressed in a report. The report will include the required measures of Amendment 3 that the state has not implemented or enforced, a statement of how failure to implement or enforce required measures jeopardizes Atlantic menhaden conservation, and the actions a state must take in order to comply with Amendment 3 requirements.

The ISFMP Policy Board will review any recommendation of noncompliance from the Board within 30 days. If it concurs with the recommendation, it shall recommend to the Commission that a state be found out of compliance.

The Commission shall consider any noncompliance recommendation from the ISFMP Policy Board within 30 days. Any state that is the subject of a recommendation for a noncompliance finding is given an opportunity to present written and/or oral testimony concerning whether it should be found out of compliance. If the Commission agrees with the recommendation of the ISFMP Policy Board, it may determine that a state is not in compliance with Amendment 3, and specify the actions the state must take to come into compliance.

Any state that has been determined to be out of compliance may request that the Commission rescind its noncompliance findings, provided the state has revised its Atlantic menhaden conservation measures.

5.5. ANALYSIS OF THE ENFORCEABILITY OF PROPOSED MEASURES

The Law Enforcement Committee with, during the implementation of this amendment, analyze the enforceability of management measures as they are proposed.

6.0 RESEARCH NEEDS

The following list of research needs have been identified in order to enhance the state of knowledge of the Atlantic menhaden resource. Research recommendations are broken down into several categories: data; assessment methodology, habitat, and socio-economic. Each category is further broken down into recommendations that can be completed in the short term (within 5 years) and recommendations that will require long term commitment (6+ years).

6.1 STOCK ASSESSMENT AND POPULATION DYNAMICS RESEARCH NEEDS

6.1.1 Annual Data Collection

<u>Short Term:</u>

1. Continue current level of sampling from bait fisheries, particularly in the mid-Atlantic and New England. Analyze sampling adequacy of the reduction fishery and work with industry and states to effectively sample areas outside of that fishery.
2. Conduct ageing validation study to confirm scale to otolith comparisons. Use archived scales to do radio isotope analysis.
3. Conduct a comprehensive fecundity study.
4. Place observers on boats to collect at-sea samples from purse-seine sets.
5. Investigate relationship between fish size and school size in order to address selectivity.

6. Investigate relationship between fish size and distance from shore.
7. Evaluate alternative fleet configurations for the removal and catch-at-age data.
8. Investigate interannual variability in the maturity of menhaden via collection of annual samples along the Atlantic coast.

Long Term:

1. Develop a menhaden specific coastwide fishery independent index of adult abundance at age.
2. Conduct studies on spatial and temporal dynamics of spawning.
3. Conduct studies on the productivity of estuarine environments related to recruitment.
4. Investigation of environmental covariates related to recruitment.
5. Validate multispecies/ecosystem model parameters through the development and implementation of stomach sampling program that will cover major menhaden predators along the Atlantic coast. Validation of prey preferences, size selectivity and spatial overlap is critically important to the appropriate use of such model results.

6.1.2 Assessment Methodology

Short Term:

1. Conduct Management Strategy Evaluation (MSE) on the various reference point options (single species, multi-species) for menhaden.
2. Continue to develop an integrated length and age based model.
3. Continue to improve methods for incorporation of natural mortality.
4. Consider estimating (time-varying) growth within the assessment model.
5. Account for co-variation among parameters and inputs in future uncertainty analyses of the assessment model.
6. Examine the variance assumption and weighting factors of all the likelihood components in the model.

Long Term:

1. Develop a seasonal spatially-explicit model, once sufficient age-specific data on movement rates of menhaden are available.
2. Continue exploring the development of multispecies models that can take predator-prey interactions into account. This should inform and be linked to the development of assessment models that allow natural mortality to vary over time.
3. Evaluate the sensitivity of reference points to recent productivity trends.
4. Reconsider models that allow natural mortality to vary over time.
5. Collect age-specific data on movement rates of menhaden to develop regional abundance trends.
6. Investigate the effects of global climate change on distribution, movement, and behavior of menhaden.

6.2 HABITAT RESEARCH NEEDS

1. Study specific habitat requirements for all life history stages.
2. Develop habitat maps for all life history stages.
3. Identify migration routes of adults.
4. Study the effects of large-scale climatic events and the impacts on Atlantic menhaden.
5. Evaluate effects of habitat loss/degradation on Atlantic menhaden.

6.3 SOCIO-ECONOMIC RESEARCH NEEDS

1. Due to the fact that there is only a single reduction company, data on the reduction fleet and all matters related to costs are nearly impossible to obtain. Some other mechanism for estimating or obtaining data for appropriate economic analysis should be undertaken.

2. Studies should be conducted to fully recognize the linkages between the menhaden fishery and the numerous other fisheries which it supports and sustains. Menhaden oil, chum, and several other types of bait are used in a number of fisheries ranging from crayfish to crab to sharks. This includes both commercial and recreational fisheries. Despite knowing that these links exist, no clear analysis has taken place.

3. Studies on the recreational component of the menhaden fishery should be undertaken to better understand what gear is being used, where it is being prosecuted, disposition of the catch, and who the users may be in terms of socioeconomic issues and other factors.

4. Social aspects of the non-consumptive sector have not been analyzed due to budge and time limitations. This would include components of the bird watching and whale watching industries, including where they live and what their particular interests are in menhaden.

7.0 PROTECTED SPECIES

In the fall of 1995, Commission member states, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) began discussing ways to improve implementation of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) in state waters. Historically, these policies had been only minimally implemented and enforced in state waters (0-3 miles). In November 1995, the Commission, through its Interstate Fisheries Management Program (ISFMP) Policy Board, approved an amendment to its ISFMP Charter (Section Six (b)(2)) so that protected species/fishery interactions are addressed in the Commission's fisheries management planning process. As a result, the Commission's fishery management plans describe impacts of state fisheries on certain marine mammals and endangered species, collectively termed "protected species”. The following section outlines: (1) the federal legislation which guides protection of marine mammals and sea turtles, (2) the protected species with potential fishery interactions; (3) the specific type(s) of fishery interaction; (4) population status of the affected protected species; and (5) potential impacts to

Atlantic coastal state and interstate fisheries.

7.1 MARINE MAMMAL PROTECTION ACT (MMPA) REQUIREMENTS

Since its passage in 1972, one of the underlying goals of the MMPA has been to reduce incidental serious injury and mortality of marine mammals in the course of commercial fishing operations to insignificant levels approaching a zero mortality and zero serious injury rate. Under the 1994 Amendments, the Act requires the National Marine Fisheries Service (NMFS) to develop and implement a take reduction plan to assist in the recovery of, or prevent the depletion of, each strategic stock that interacts with a Category I or II fishery. Specifically, a strategic stock is defined as a stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal (PBR)[1] level; (2) which is declining and is likely to be listed under the Endangered Species Act (ESA) in the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA. Category I and II fisheries are those that have frequent or occasional incidental mortality and serious injury of marine mammals, whereas Category III fisheries have a remote likelihood of incidental mortality and serious injury of marine mammals. Each year NMFS publishes a List of Fisheries (LOF), which classifies commercial fisheries into one of these three categories.

Under 1994 mandates, the MMPA also requires fishermen in Category I and II to register under the Marine Mammal Authorization Program (MMAP). The purpose of this is to provide an exception for commercial fishermen from the general taking prohibitions of the MMPA. All fishermen, regardless of the category of fishery in which they participate, must report all incidental injuries and mortalities caused by commercial fishing operations within 48 hours.

Section 101(a)(5)(E) of the MMPA allows for the authorization of incidental taking of ESA-listed marine mammals in the course of commercial fishing operations if it is determined that: (1) incidental mortality and serious injury will have a negligible impact on the affected species or stock; (2) a recovery plan has been developed or is being developed for such species or stock under the ESA; and (3) where required under MMPA Section 118, a monitoring program has been established, vessels engaged in such fisheries are registered, and a take reduction plan has been developed or is being developed for such species or stock. MMPA Section 101(a)(5)(E) permits are not required for Category III fisheries, but any serious injury or mortality of a marine mammal must be reported.

[1] PBR is the number of human-caused deaths per year each stock can withstand and still reach an optimum population level. This is calculated by multiplying the minimum population estimate by the stock's net productivity rate and a recovery factor ranging from 0.1 for endangered species to 1.0 for healthy stocks.

7.2 ENDANGERED SPECIES ACT (ESA) REQUIREMENTS

The taking of endangered sea turtles and marine mammals is prohibited and considered unlawful under Section 9(a)(1) of the ESA. In addition, NMFS or the USFWS may determine Section 4(d) protective regulations to be necessary and advisable to provide for the conservation of threatened species. There are several mechanisms established in the ESA to allow for exceptions to the prohibited take of protected species listed under the ESA. Section 10(a)(1)(A) of the ESA authorizes NMFS to allow the taking of listed species through the issuance of research permits for scientific purposes or to enhance the propagation or survival of the species. Section 10(a)(1)(B) authorizes NMFS to permit, under prescribed terms and conditions, any taking otherwise prohibited by Section 9(a)(1)(B) of the ESA if the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. In recent years, some Atlantic state fisheries have obtained section 10(a)(1)(B) permits for state fisheries. Recent examples are at http://www.nmfs.noaa.gov/pr/permits/esa_review.htm#esa10a1b.

Finally, Section 7(a)(2) requires federal agencies to consult with NMFS to ensure that any action that is authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species. If, following completion of consultation, an action is found to jeopardize the continued existence of any listed species or cause adverse modification to critical habitat of such species, reasonable and prudent alternatives will be identified so that jeopardy or adverse modification to the species does not occur. Section (7)(o) provides the actual exemption from the take prohibitions established in Section 9(a)(1), which includes Incidental Take Statements that are provided at the end of consultation via the ESA Section 7 Biological Opinions.

7.3 PROTECTED SPECIES WITH POTENTIAL FISHERY INTERACTIONS

A number of protected species inhabit the management unit, which includes inshore and nearshore waters, for Atlantic Menhaden. Ten are classified as endangered or threatened under the ESA; the remainder are protected under provisions of the MMPA. The species found in coastal Northwest Atlantic waters are listed below.

<u>Endangered</u>	
Right whale	(*Eubalaena glacialis*)
Blue Whale	*(Balaenoptera musculus)*
Fin whale	(*Balaenoptera physalus*)
Leatherback turtle	(*Dermochelys coriacea*)
Kemp’s ridley	(*Lepidochelys kempii*)
Hawksbill turtle	*(Eretmochelys imbricata)*
Shortnose sturgeon	(*Acipenser brevirostrum*)
Atlantic sturgeon	*(Acipenser oxyrinchus oxyrinchus)*

Threatened

Loggerhead turtle	(*Caretta caretta*)
North Atlantic Green turtle dps	*(Chelonia mydas)*

MMPA

Includes all marine mammals above in addition to:

Minke whale	(*Balaenoptera acutorostrata*)
Humpback whale	*(Megaptera novaeangliae)*
Bottlenose dolphin	(*Tursiops truncatus*)
Atlantic-white sided dolphin	*(Lagenorhynchus acutus)*
Harbor seal	(*Phoca vitulina*)
Grey seal	(*Halichoerus grypus*)
Harp seal	(*Phoca groenlandica*)
Harbor porpoise	*(Phocoena phocoena)*

In the Northwest Atlantic waters, protected species utilize marine habitats for feeding, reproduction, as nursery areas and as migratory corridors. For several stocks of marine mammals, including humpback whales, menhaden are an important prey species. Some species occupy the area year round while others use the region only seasonally or move intermittently nearshore, inshore and offshore. Interactions may occur whenever fishing gear and marine mammals overlap spatially and temporally.

For sea turtles, the Atlantic seaboard provides important developmental habitat for post-pelagic juveniles, as well as foraging and nesting habitat for adults. The distribution and abundance of sea turtles along the Atlantic coast is related to geographic location and seasonal variations in water temperatures. Water temperatures dictate how early northward migrations begin each year and is a useful factor for assessing when turtles will be found in certain areas. Interactions may occur whenever fishing gear and sea turtles overlap spatially and temporally.

7.3.1 Marine Mammals

Five marine mammal species are primarily known to co-occur with or become entangled in gear used by the Atlantic menhaden fishery. They include the Atlantic right whale, humpback whale, fin whale, coastal bottlenose dolphin, and harbor porpoise.

North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is among the most endangered large whale species in the world. Despite decades of conservation measures, the population remains at low numbers. In 2012, 440 individually recognized whales were known to be alive (Corkeron et al., 2016). Modeling work using data collected through the mid-1990s indicated that if the conditions that existed at that time were to continue, western North Atlantic right whales would be extinct within 200 years (Caswell et al. 1999).

North Atlantic right whales have a wide distribution through the Atlantic Ocean but are generally found west of the Gulf Stream, from the southeast U.S. to Canada (e.g., Bay of Fundy and Scotian Shelf) (Kenney 2002; Waring et al. 2009). North Atlantic right whales also frequent Stellwagen Bank and Jeffreys Ledge, as well as Canadian waters including the Bay of Fundy and Browns Banks, in the spring through fall. The distribution of right whales in the summer and fall is linked to the distribution of their principal zooplankton prey (Winn et al. 1986). Right whales feed by swimming continuously with their mouths open, filtering large amounts of water through their baleen and capturing zooplankton on the baleen's inner surface. Calving occurs in the winter months in coastal waters off of Georgia and Florida (Kraus et al. 1988). Mid-Atlantic waters are used as a migratory pathway from the spring and summer feeding/nursery areas to the winter calving grounds off the coast of Georgia and Florida.

The North Atlantic Right Whale is listed as endangered throughout its range. Ship strikes and fishing gear entanglements are the principal factors believed to be retarding recovery of western North Atlantic right whales population (NMFS, 2012). Data collected from 1970 through 1999 indicate that anthropogenic interactions in the form of ship strikes and gear entanglements were responsible 19 out of 45 reported right whale deaths (Knowlton and Kraus, 2001).

Humpback Whale

Humpback whales, known for their displays of breeching and bubble net feeding, can be found in all major oceans. In the western North Atlantic, humpback whales calve and mate in the West Indies during the winter and migrate to northern feeding areas during the summer months. Calves are recruited to the feeding grounds of their mothers in a practice referred to as maternal philopatry (Clapham and Mayo 1987; Katona and Beard 1990). In the Gulf of Maine, sightings are most frequent from mid-March through November, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffrey's Ledge (CETAP 1982). They feed on a number of species of small schooling fish, particularly sand lance, mackerel, and Atlantic herring. Humpback whales have also been observed feeding on krill (Wynne and Schwartz 1999).

In the western Atlantic Ocean, humpback whales have become increasingly more abundant. The overall North Atlantic population, derived from genetic tagging data collected by the Years of the North Atlantic Humpback (YONAH) project was estimated to be 4,894 males and 2,804 females. As a result, the West Indies population of humpback whales, which migrates up to New England, was not considered at risk of extinction or likely to become so within the foreseeable future (81 FR 62259, September 8, 2016). While not listed as endangered or threatened, the major known sources of anthropogenic mortality and injury of humpback whales are commercial fishing gear entanglements and ship strikes.

Fin Whale

Fin whales inhabit a wide range of latitudes between 20 to 75 degrees north and 20 to 75 degrees south (Perry et al. 1999). Like right and humpback whales, fin whales are believed to use high latitude waters primarily for feeding, and low latitude waters for calving. However, evidence regarding where the majority of fin whales winter, calve, and mate is still scarce. Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda and into the West Indies, but also noted strandings along the U.S. Mid-Atlantic coast from October through January. This could suggest the possibility of an offshore calving area (Clark 1995; Hain et al. 1992). The predominant prey of fin whales varies greatly in different areas depending on what is locally available (IWC 1992). In the western North Atlantic, fin whales feed on a variety of small schooling fish (e.g., herring, capelin, and sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz 1999).

The fin whale is listed as endangered throughout its range. Like right whales and humpback whales, anthropogenic mortality of fin whales includes entanglement in commercial fishing gear and ship strikes (NMFS, 2011). Of 12 fin whale mortalities recorded between 2009 and 2013, nine were associated with vessel interactions (Waring et al., 2016). Experts believe that fin whales are struck by large vessels more frequently than any other cetacean (Laist et al. 2001).

Bottlenose Dolphin

Common bottlenose dolphins are found throughout the western Atlantic coast, with primary habitat along the U.S. ranging from New York through Florida. The distribution of the species changes seasonally, with a greater abundance of bottlenose dolphins found in the Mid-Atlantic waters in the summer (NMFS, 2008). In the winter, most bottlenose dolphins are found south of the Virginia-North Carolina border (NMFS, 2008). The species is often aggregated in groups, ranging up to 15 individuals along the coast, but can be found in larger herds offshore. Bottlenose dolphins eat a variety of prey including invertebrates and fish.

On the Atlantic coast, five stocks of common bottlenose dolphins are considered depleted under the MMPA, meaning that the population stock is below its optimum sustainable level (Waring et al., 2016). The primary source of human-induced mortality is interactions with fishing gear, particularly coastal gillnets. Between 1995 and 2000, 12 bottlenose dolphin mortalities were reported in gillnets targeting dogfish shark species, striped bass, Spanish mackerel, kingfish, and weakfish (NMFS, 2008). Four more mortalities were observed in 2003-2006 (NMFS, 2008). In response, a Bottlenose Dolphin Take Reduction Plan was implemented in May 2006 to reduce the incidental mortality and serious injury of bottlenose dolphins in commercial fishing gear (71 FR 24776, April 26, 2006).

Harbor Porpoise

The harbor porpoise ranges from Labrador to North Carolina. The southern-most stock of harbor porpoise is referred to as the Gulf of Maine/Bay of Fundy stock and spends its winters in the Mid-Atlantic region. Harbor porpoises are generally found in coastal and inshore waters, but will also travel to deeper, offshore waters. There are insufficient data to determine population trends for this species because harbor porpoises are widely dispersed in small groups, they spend little time at the surface, and their distribution varies unpredictably from year to year depending on environmental conditions (NMFS, 2002). Shipboard line transect sighting surveys have been conducted to estimate population size of the harbor porpoise stock. The best estimate of abundance for the Gulf of Maine/Bay of Fundy harbor porpoise stock is 79,883 from a 2011 survey (NMFS, 2016).

The Gulf of Maine harbor porpoise was proposed to be listed as threatened under the ESA on January 7, 1993, but NMFS determined this listing was not warranted (NMFS, 1999). NMFS removed this stock from the ESA candidate species list in 2001. The primary threat to the harbor porpoise is incidental catch in fishing gear, such as gillnets and trawls. The Harbor Porpoise Take Reduction Plan was implemented to reduce incidental mortality and serious injury in gillnet fisheries in the Gulf of Maine and mid-Atlantic.

7.3.1.1 Gear Interactions with Marine Mammals

Marine mammal interactions have been documented in the primary fisheries that target menhaden, including the purse seine, pound net, and gillnet fisheries, and in those fisheries for which menhaden is bycatch, including trawl, haul seine, pound net and gillnet fisheries. The bycatch reports included below do not represent a complete list but rather available records. It should be noted that without an observer program for many of these fisheries, actual numbers of interactions are difficult to obtain.

<u>Purse Seine</u>

The U.S. mid-Atlantic menhaden purse seine fishery is currently listed as a Category II fishery while the Gulf of Maine menhaden purse seine fishery is listed as a Category III fishery. In the 2017 LOF (82 FR 3655, January 12, 2017), the Gulf of Maine menhaden purse seine fishery is listed as having a remote likelihood or no incidental mortality or injury of marine mammals, and the U.S. mid-Atlantic menhaden purse seine fishery is documented as having incidental mortality or injury of bottlenose dolphin.

Historically, Atlantic menhaden purse seine fishermen have reported an annual incidental take of one to five coastal bottlenose dolphins (NMFS, 1991). This information comes from reports required under a small take exemption issued under the then Section 101(a)(4) of the MMPA. The Atlantic purse seine fishery reported the lethal incidental take of one minke whale in 1990 (NMFS, 1993); however, the target species of the purse seine (i.e. tuna or menhaden) is unknown. In addition, an incidental take of a humpback whale in the mid-Atlantic menhaden purse seine fishery was reported in 2001 (66 FR 6545, January 22. 2001); however, in 2005 humpback whales were removed from the list species killed or injured in the fishery because an interaction had not been reported in subsequent years. In 2006, the mid-Atlantic menhaden purse seine fishery was elevated from a Category III fishery to a Category II fishery (71 FR 48802, August 22, 2006). This change was made after interactions with bottlenose dolphins in other purse seine fisheries, such as those in the Gulf of Mexico. This required the fishery to comply with registration requirements, applicable take reduction plan requirements, and observer coverage. Limited observer coverage has occurred in the fishery since 2008.

<u>Pound Nets</u>

The Virginia pound net fishery is listed as a Category II fishery in the 2017 LOF due to documented interactions with bottlenose dolphins (82 FR 3655, January 12, 2017). Between 2004 and 2008, there were 17 bottlenose dolphins killed in pound net gear and 3 bottlenose dolphins were released alive (76 FR 37716, June 28, 2011). There is no formal observer coverage for the Virginia pound net fishery but there has been sporadic monitoring by the Northeast Fishery Observer Program. All other Atlantic coast pound net fisheries are listed as a Category III fishery.

<u>Gillnets</u>

The mid-Atlantic gillnet fishery is listed as a Category I fishery in the 2017 LOF (82 FR 3655, January 12, 2017). The fishery was originally listed as a Category II fishery but in 2003, it was elevated to a Category I fishery after stranding and observer data documented the incidental mortality and serious injury of bottlenose dolphins (68 FR 41725, July 15, 2003). Other species with documented interactions include the harbor porpoise, common dolphin, harbor seal, harp seal, long-finned pilot whale, short-finned pilot whale, and white-sided dolphin; however, since gillnet fisheries target many species, not all incidents may have occurred while harvesting menhaden. Between 1995 and 2013, observer coverage has ranged from 1% to 5%.

The Chesapeake Bay inshore gillnet, the North Carolina inshore gillnet, the northeast anchored float gillnet, the northeast drift gillnet, and the southeast Atlantic gillnet fisheries are all listed as Category II fisheries in the 2017 LOF (82 FR 3655, January 12, 2017). The primary species reported interacting with these gears is the bottlenose dolphin; however, the harbor seal, humpback whale, and white-sided dolphin have been documented in the northeast anchored float gillnet. Both the Chesapeake Bay inshore gillnet and the North Carolina inshore gillnet fisheries were elevated from a Category III fishery to a Category II fishery in the 2006 and 2001 LOFs, respectively (66 FR 42780, August 15, 2001; 71 FR 48802, August 22, 2006).

The Delaware River inshore gillnet, the Long Island Sound inshore gillnet, the southeast Atlantic inshore gillnet, and the Rhode Island/Southern Massachusetts/New York Bight inshore gillnet fisheries are listed as Category III fisheries in the 2017 LOF (82 FR 3655, January 12, 2017). There have been no documented interactions with marine mammals in the past five years with the exception of the southeast Atlantic inshore gillnet fishery which has documented an interaction with a bottlenose dolphin.

<u>Haul/Beach Seine</u>

The Mid-Atlantic haul/beach seine fishery is listed as a Category II fishery in the 2017 LOF due to interactions with coastal bottlenose dolphin (82 FR 3655, January 12, 2017). NMFS has recorded one observed take of a bottlenose dolphin in this fishery in 1998 (Waring and Quintal 2000). Harbor porpoise was deleted from the list of species killed or injured in the Mid-Atlantic haul/beach seine fishery due to no other interactions between 1999 and 2003. The fishery was observed from 1998-2001 but there has been limited observer coverage since 2001.

<u>Fyke Net, Floating Fish Trap, Fish Weir</u>

Floating fish traps, northeast and Mid-Atlantic fyke nets, and fish weirs are listed as a Category III fishery in the 2017 LOF (82 FR 3655, January 12, 2017). There are no documented interactions between marine mammals and the northeast/mid-Atlantic fyke net fishery nor the floating fish trap fisheries. In the Mid-Atlantic mixed species weir fishery there have been documented interactions with bottlenose dolphins.

Trawls
The mid-Atlantic mid-water trawl fishery is listed as a Category II fishery in the 2017 LOF (82 FR 3655, January 12, 2017). In 2001, the mid-Atlantic mid-water trawl fishery was elevated to Category I based on mortality and injury of common dolphins and pilot whales. In 2007, the fishery was down-graded to a Category II fishery due to reductions in the interactions with common dolphins and pilot whales (72 FR 14466, March 28, 2007). The mid-Atlantic mid-water trawl fishery continues to be listed as a Category II fishery due to interactions with white-sided dolphins. Interactions with other species include the gray seal and the harbor seal. Observer coverage in the fishery has ranged from 0% to 13.33% between 1997 and 2008.

The northeast mid-water trawl fishery is also listed as a Category II fishery in the 2017 LOF (82 FR 3655, January 12, 2017). The fishery has had documented interactions with the common dolphin, gray seal, harbor seal, long-finned pilot whale, short-finned pilot whales, and minke whale. Importantly, not all mid-water trawls target menhaden as this is the primary gear used in the northeast groundfish fisheries. Observer coverage in the fishery has ranged from 0% to 19.9% between 1997 and 2008.

Cast Net
Currently, cast net is listed as a Category III fishery in the 2017 LOF (82 FR 3655, January 12, 2017). There are no documented marine mammal species incidentally injured or killed in the cast net fishery.

Traps/Pots
The Atlantic mixed species trap/pot fishery is listed as a Category II fishery in the 2017 LOF (82 FR 3655, January 12, 2017). The gear is primarily involved in entanglement events with species such as the fin whale and the humpback whale. Historically, the minke whale and the harbor porpoise were also listed as species injured or killed by the Atlantic mixed species trap/pot fishery but these species were removed in 2005 because interactions had not been documented in recent years. There is no observer program for this fishery.

7.3.2 Sea Turtles

All sea turtles that occur in U.S. waters are listed as either endangered or threatened under the Endangered Species Act of 1973 (ESA). Five species occur along the U.S. Atlantic coast, namely, loggerhead (*Caretta caretta*), Kemp's Ridley (*Lepidochelys kempi*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*).

Loggerhead Turtle
The loggerhead turtle is the most abundant species of sea turtle in U.S. waters, commonly occurring throughout the inner continental shelf from Florida through Cape Cod,

Massachusetts. This species is found in a wide range of habitats throughout the temperate and tropical regions of the globe, including the open ocean, continental shelves, bays, lagoons, and estuaries (NMFS, 2013). NOAA Fisheries and USFWS have identified five nesting sub-populations along the northwest Atlantic Ocean. They include 1) southern Florida through Georgia; 2) Florida through Key West; 3) the Dry Tortugas; 4) the northern Gulf of Mexico; 5) and the greater Caribbean (76 FR 58867, September 22, 2011). Nesting sites along the coast of the U.S. primarily occur from Virginia through Alabama (76 FR 58867, September 22, 2011). The activity of the loggerhead is limited by temperature, with loggerhead turtles not appearing in the Gulf of Maine before June and generally leaving by mid-September. Loggerhead sea turtles are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks. Under certain conditions they also feed on finfish, particularly if they are easy to catch (*e.g.,* caught in gillnets or inside pound nets where the fish are accessible to turtles).

The northwest Atlantic population of loggerhead turtles is listed as threatened under ESA. Threats to the population include destruction of nesting habitat as the result of development and erosion, sand dredging, fishing practices, and marine pollution (76 FR 58867, September 22, 2011).

<u>Kemp's Ridley</u>

Kemp's ridley sea turtles are found throughout the Gulf of Mexico and North Atlantic coast; however their only major nesting site is in Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). Juvenile Kemp's ridleys use northeastern and mid-Atlantic waters of the U.S. Atlantic coastline as primary developmental habitat, with shallow coastal embayments serving as important foraging grounds during the summer months. Juvenile ridleys migrate south as water temperatures cool in fall, and are predominantly found in shallow coastal embayments along the Gulf Coast during the fall and winter months. Kemp's ridleys can be found from New England to Florida, and are the second most abundant sea turtle in Virginia and Maryland waters (Keinath *et al.* 1987; Musick and Limpus 1997). In the Chesapeake Bay, ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation (Lutcavage and Musick 1985; Bellmund *et al.* 1987; Keinath *et al.* 1987; Musick and Limpus 1997). These turtles primarily feed on crabs, but also consume mollusks, shrimp, and fish (Bjorndal 1997).

Kemp's ridley are listed as endangered primarily as the result of the destruction of habitat, particularly nesting habitat in Mexico, bycatch in fisheries, the harvesting of eggs and nesting turtles, and vessel collisions.

<u>Green Turtle</u>

Green turtles are distributed throughout the world's oceans, primarily between the northern and southern 20^{o} isotherms (Hirth 1971). Most green turtle nesting in the continental United States occurs on the Atlantic Coast of Florida, with documented nests also along the Gulf coast of Florida and the Florida Panhandle. While nesting activity is important in determining population distributions, the availability and location of foraging grounds also plays an important role in their spatial distribution. Juvenile green sea turtles occupy pelagic habitats after leaving the nesting beach and are primarily omnivorous (Bjorndal 1985). At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas, shifting to an herbivorous diet (Bjorndal 1997). Post-pelagic green turtles feed primarily on sea grasses and benthic algae (Bjorndal 1985). Known feeding habitats along U.S. coasts of the western Atlantic include shallow lagoons and embayments in Florida, such as the Indian River Lagoon (Ehrhart et al. 1986). Along the Atlantic coast, green turtles can be found from Florida up to Massachusetts.

Green turtles are listed as threatened along the North Atlantic. Threats to the North Atlantic population of green turtles includes the degradation of nesting beaches due to coastal development, the degradation of forage habitat due to pollution, the illegal harvest of green turtles and their eggs, entanglement in fishing gear, such as gillnets, trawls, longlines, and traps, vessel strikes, and the persistence of an often lethal disease known as fibropapillomatosis (81 FR 20057, May 6, 2016).

Leatherback Turtle

The leatherback is the largest living turtle and its range is farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS 2013). Leatherback turtles are often found in association with jellyfish, with the species primarily feeding on Cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas). While these turtles are predominantly found in the open ocean, they do occur in coastal water bodies such as Cape Cod Bay and Narragansett Bay, particularly the fall. The most significant nesting in the U.S. occurs in southeast Florida (NMFS, 2013).

The leatherback turtle is listed as endangered throughout its range. Primary causes of this population decline include the degradation of nesting beaches as the result of coastal development and beach sand mining, the poaching of eggs on nesting beaches, increased human pollution in pelagic waters, the presence of disease and parasites, and the entanglement of leatherbacks in active and abandoned fishing gear (NMFS, 2013).

Hawksbill Turtle

The hawksbill turtle is found throughout the world's oceans, primarily between 30^{o}N and 30^{o}S latitude. In the continental U.S., hawksbill turtles commonly occur in southern Florida and the Gulf of Mexico, with a preferred habitat being coral reefs and other hard bottom habitats (NMFS 2007). Nesting sites in the Atlantic are typically found in Mexico, Puerto Rico, and the U.S. Virgin Islands (NMFS 2007). During their juvenile life stage, hawksbill turtles occupy the pelagic environment, floating with algal mats in the Atlantic (NMFS 2007). The diet of hawksbill turtles primarily consists of sponges, invertebrates, and algae (NMFS 2007).

The hawksbill turtle is listed as endangered throughout its range. Primary threats to the population include loss of coral reef habitat, the illegal harvest of eggs and nesting females, increased recreational and commercial use of beaches, and the incidental capture of hawksbill turtles in fishing gear (NMFS 2007).

7.3.2.1 Potential Impacts of Menhaden Fishery on Sea Turtles

The Atlantic seaboard provides important developmental habitat for post-pelagic juveniles, as well as foraging and nesting habitat for adult sea turtles. The distribution and abundance of sea turtles along the Atlantic coast is related to geographic location and seasonal variations in water temperatures. Water temperatures dictate how early northward migration begins each year and is a useful factor for assessing when turtles will be found in certain areas. Moderate to high abundances of sea turtles have been observed both offshore and nearshore when water temperatures are greater than or equal to 21^{o} C. As a result, sea turtles do not usually appear on the summer foraging grounds in the Gulf of Maine until June, but are found in Virginia as early as April. As water temperatures decline below 11^{o} C, abundance declines and turtles typically move from cold inshore waters in the late fall to warmer waters in the Gulf Stream, generally south of Cape Hatteras, North Carolina.

The effect of water temperature on the distribution of sea turtles is important in assessing possible interactions with the menhaden fishery. Menhaden are also affected by water temperatures and similarly migrate north in the spring and south in the fall. Thus, the menhaden purse seine fishery exhibits seasonal changes, with the fishery ramping up off North Carolina in April and extending into New England in June. Observer data indicates minimal interaction between these purse seines and sea turtles. From September 1978 through early 1980, approximately 40 sea days were observed for fish sampling aboard menhaden purse seiners fishing from Maine south to North Carolina. No sea turtles were recorded as bycatch (S. Epperly, NMFS SEFSC, pers. comm.). Other gears used to catch menhaden include trawls, fixed nets, gillnets, haul/beach seines, pound nets, and cast nets. Several states have indicated that sea turtles have been incidentally captured in menhaden fixed nets and trawls, but not seine nets (ASMFC, Atlantic Coastal Fisheries Characterization Database, unpubl. data). An observer program for protected species has not been established for the menhaden fishery. However, under the ESA Annual Determination to Implement Sea Turtle Observer Requirement (80 FR 14319, April 18, 2015), two fisheries that target menhaden are included. These include the Chesapeake Bay Inshore Gillnet Fishery and Mid-Atlantic menhaden purse seine fishery,

7.3.3 Atlantic Sturgeon

The Atlantic sturgeon is an ancient anadromous fish that can live up to 60 years. Historically, sturgeon were found from Canada through Florida; however, the species currently extends through Georgia (ASMFC 1998). As adults, Atlantic sturgeon live in the ocean and migrate from the south Atlantic in the winter to New England waters in the summer (ASMFC 1998). Precise spawning locations of sturgeon are not known but it is thought that they prefer hard substrates such as rock or hard clay (Gilbert, 1989). As juveniles, sturgeon reside in brackish water near river mouths before moving into the coastal ocean waters. The diet of this species is primarily composed of mussels, shrimp, and small fish (ASMFC 1998).

Since 1998, there has been a moratorium on the harvest of Atlantic Sturgeon in both state and federal waters; however, the population has continued to decline and, in 2012, Atlantic sturgeon became listed under the ESA. The listing identifies five distinct population segments, which include the Gulf of Maine, the New York Bight, the Chesapeake Bay, Carolina, and the South Atlantic (77 FR 5914 and 77 FR 5880, February 6, 2012). All population segments are listed as endangered except for the Gulf of Maine population, which is listed as threatened. Primary threats to the species include historic overfishing, the bycatch of sturgeon in other fisheries, habitat destruction from dredging, dams, and development, and vessel strikes (77 FR 5914; 77 FR 5880).

Impacts on the Atlantic sturgeon population as a result of the menhaden fishery would likely occur through bycatch in gear types such as gillnets, pound nets, and purse seines. There has been no reported or observed bycatch of Atlantic sturgeon in the menhaden gillnet fisheries (77 FR 5880). Furthermore, some states have implemented measures to reduce the bycatch of sturgeon by restricting the use of gillnet gear in coastal waters and instituting seasonal closures for anchored or staked gillnets when sturgeon may be present (77 FR 5880). As a result, impacts to the sturgeon population from the menhaden fishery are thought to be limited.

7.3.4 Seabirds

Like marine mammals, seabirds are vulnerable to entanglement in commercial fishing gear. Under the Migratory Bird Treaty Act, it is unlawful "by any means or in any manner, to pursue, hunt, take, capture, [or] kill" any migratory birds except as permitted by regulation (16 U.S.C. 703). Given that an interaction has not been quantified in the Atlantic menhaden fishery, impacts to seabirds are not considered to be significant. Endangered and threatened bird species, such as the piping plover, are unlikely to be impacted by the gear types employed in the menhaden fishery. Other human activities such as coastal development, habitat degradation and destruction, and the presence of organochlorine contaminants are considered to be the major threats to some seabird populations.

7.4 PROPOSED FEDERAL REGULATIONS/ACTIONS PERTAINING TO THE RELEVANT PROTECTED SPECIES

In May 2016, the National Marine Fisheries Service proposed areas of Atlantic Sturgeon critical habitat along the Atlantic coast. The proposed critical habitat primarily consisted of rivers including the Penobscot River in Maine, the Hudson River in New York, the Potomac River in Maryland, and the Neuse River in North Carolina (81 FR 36077; 81 FR 35701). Comments on the proposal were accepted through the fall of 2016; however, a final rule has not yet been released.

7.5 POTENTIAL IMPACTS TO ATLANTIC COASTAL STATE AND INTERSTATE FISHERIES

There are several take reduction teams, whose management actions have potential impacts to coastal menhaden fisheries. The Northeast sink and Mid-Atlantic coastal gillnet fisheries are the two fisheries regulated by the Harbor Porpoise Take Reduction Plan (50 CFR 229.33 and 229.34). Amongst other measures, the plan uses time area closures in combination with pingers in Northeast waters, and time area closures along with gear modifications for both small and large mesh gillnets in mid-Atlantic waters. Although the plan predominately impacts the dogfish and monkfish fisheries due to higher porpoise bycatch rates, other gillnet fisheries are also affected.

The Atlantic Large Whale Take Reduction Plan (50 CFR 229.32) addresses the incidental bycatch of large baleen whales, primarily the northern right whale and the humpback whale, in several fisheries including the Northeast sink gillnet and Mid-Atlantic coastal gillnet. Amongst other measures, the plan closes right whale critical habitat areas to specific types of fishing gear during certain seasons and modifies fishing gear and practices. The Atlantic Large Whale Take Reduction Team continues to identify ways to reduce possible interactions between large whales and commercial gear. In 2014 and 2015, the Atlantic Large Whale Take Reduction Plan was modified to reduce the number of vertical lines associated with trap/pot fisheries and require expanded gear markings for gillnets and traps in Jeffrey's Ledge and Jordan Basin, respectively (79 FR 35686, June 27, 2014; 80 FR 30367, May 28, 2015).

The Bottlenose Dolphin Take Reduction Team first convened in 2001 to discuss incidental catch of coastal bottlenose dolphins in Category I and II fisheries. In 2006, a Bottlenose Dolphin Take Reduction Plan was established, which created gear regulations for the mid-Atlantic coastal gillnet fishery, the Virginia pound net fishery, the mid-Atlantic beach seine fishery, and the North Carolina inshore gillnet fishery, among others. Specifically, the plan established mesh sizes for the gill net fisheries and prohibited night fishing for some regions and gear types (71 FR 24776, April 26, 2006).

8.0 REFERENCES

Adolf, J. E., C. L. Yeager, W. D. Miller, M. E. Mallonee, and L. W. Harding. 2006. Environmental forcing of phytoplankton floral composition, biomass, and primary productivity in Chesapeake Bay, USA. Estuarine, Coastal and Shelf Science 67(1-2):108- 122.

Ahrenholz, D.W. 1991. Population biology and life history of the North American menhadens, Brevoortia spp. Mar. Fish. Rev. 53: 3-19.

Ahrenholz, D.W., J.F. Guthrie, and R.M. Clayton. 1987. Observations of ulcerative mycosis infections on Atlantic menhaden (*Brevoortia tyrannus*). U.S. NMFS Tech. Mem. NMFS-SEFC 196. 28 p.

Ahrenholz, D.W., W.R. Nelson, and S.P. Epperly. 1987. Population and fishery characteristics of Atlantic menhaden, Brevoortia tyrannus. Fish. Bull. 85: 569-600.

AMAC. 2000. Atlantic Menhaden Management Review, 2000. Report to ASMFC Atlantic Menhaden Board. 18 p.

Anderson, J.D. 2007. Systematics of the North American menhadens: molecular evolutionary reconstructions in the genus Brevoortia (Clupeiformes: Clupeidae). Fishery Bulletin 205:368-378.

Annis, E. A., E. D. Houde, L. W. Harding, Jr., M.E. Mallonee, and M. J. Wilberg. 2011. Calibration of a bioenergetics model linking primary production to Atlantic Menhaden,Brevoortia tyrannus, growth in Chesapeake Bay. Mar. Ecol. Prog. Ser. Vol. 437: 253-267.

Anstead, K.A., J.J. Schaffler, and C.M. Jones. 2016. Coast-wide nursery contribution of new recruits to the population of Atlantic menhaden. Trans. Am. Fish. Soc. 145: 627-636.

Anstead, K.A., J.J. Schaffler, and C.M. Jones. 2017. Contribution of nursery areas to the adult population of Atlantic menhaden. Trans. Am. Fish. Soc. 146: 36-46.

Atlantic Large Whale Take Reduction Plan Regulations. 1999. 64 Fed. Reg. 7529 (February 16, 1999).

Atlantic Large Whale Take Reduction Plan Regulations. 2015. 80 Fed. Reg. 30367 (May 28, 2015).

Atlantic States Marine Fisheries Commission (ASMFC). 1992. Fishery Management Plan for Atlantic Menhaden: 1992 revision. FMR No. 22. ASMFC, Washington, D.C. 159 p.

Atlantic States Marine Fisheries Commission. 1981. Fishery Management Plan for Atlantic Menhaden. ASMFC, Washington, D.C. 146 p.

Atlantic States Marine Fisheries Commission. 1992. Fishery Management Plan for Atlantic Menhaden: 1992 revision. FMR No. 22. ASMFC, Washington, D.C. 159 p.

Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon.

Atlantic States Marine Fisheries Commission. 2001. Amendment 1 to The Interstate Fishery Management Plan for Atlantic Menhaden. ASMFC, Washington, D.C. 146 p.

Atlantic States Marine Fisheries Commission. 2004. Addendum I to Amendment I to the Atlantic Menhaden Fishery Management Plan. ASMFC, Washington DC 52 p.

Atlantic States Marine Fisheries Commission. 2004. Atlantic Menhaden Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 04-01 (supplement). ASMFC, Washington, D.C. 145 p. 2007.06.001 WOS:000250912300003.

Atlantic States Marine Fisheries Commission. 2005. Addendum II to Amendment 1 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Washington, D.C. 30 p.

Atlantic States Marine Fisheries Commission. 2006. Addendum III to Amendment 1 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Washington, D.C. 6 p.

Atlantic States Marine Fisheries Commission. 2009. Addendum IV to Amendment 1 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Washington, D.C. 5 p.

Atlantic States Marine Fisheries Commission. 2011. Addendum V to Amendment 1 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Arlington, VA 17 p.

Atlantic States Marine Fisheries Commission. 2012. Amendment 2 to The Interstate Fishery Management Plan for Atlantic Menhaden. ASMFC, Arlington, VA 114 p.

Atlantic States Marine Fisheries Commission. 2013. Technical Addendum I: Episodic Events Set Aside Program to Amendment 2 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Arlington, VA 4 p.

Atlantic States Marine Fisheries Commission. 2015. Atlantic Menhaden Southeast Data, Assessment, and Review (SEDAR) 40 Stock Assessment Report. 146 p.

Atlantic States Marine Fisheries Commission. 2016. Addendum I to Amendment 2 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Arlington, VA 12 p.

Atlantic States Marine Fisheries Commission. 2016. Interstate Fisheries Management Program Charter. ASMFC, Arlington VA. 29 p.

Austin, H. 2002. Decadal oscillations and regime shifts, a characterization of the Chesapeake Bay Marine Climate. *In*: Fisheries in a Changing Climate. Amer. Fish. Soc. Symp. 32: 155-170.

Austin, H. M., J. Kirkley, and J. Jucy. 1994. By-catch and the fishery for Atlantic menhaden (Brevoortia tyrannus) in the mid-Atlantic bight: AN assessment of the nature and extent of by-catch. VIMS, Va. Mar. Resour. Advisory No. 53, Va. Sea Grant College Prog. Publ. No. VSG-94-06, 39 p.

Bellmund, S.A., J.A. Musick, R.C. Klinger, R.A. Byles, J.A. Keinath, and D.E. Barnard. 1987. Ecology of sea turtles in Virginia. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia.

Berrien, P., and J. Sibunka. 1999. Distribution patterns of fish eggs in the U.S. northeast continental shelf ecosystem, 1977–1987. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 145, 310 p.

Best, P.B., A. Branadâo, and D.S. Butterworth. (2001). Demographic parameters of southern right whales off South Africa. J. Cetacean Res. Manage. (Special issue) 2: 161- 169.

Bjorndal KA. 1985. Nutritional ecology of sea turtles. Copeia 3:736– 751. doi:10.2307/1444767

Bjorndal, K. A. 1997. Foraging ecology and nutrition of sea turtles. Pages 199-231 in P. L. Lutz and J. A. Musick, editors. The biology of sea turtles. CRC Press, Boca Raton, Florida, USA.

Blazer, V. S., C. A. Ottinger and C. L. Densmore. 2007. Chapter 13. Factors affecting fish health. pp.54-59. In: Phillips, S. W. (ed.). Synthesis of U.S. Geological Survey science for the Chesapeake Bay ecosystem and implications for environmental management. U.S. Geological Survey Circular 1316.

Bottlenose Dolphin Take Reduction Plan Regulations. 2006. 71 Fed. Reg. 24776 (April 26, 2006).

Brandt, S. B., and D. M. Mason. 2003. Effect of nutrient loading on Atlantic menhaden (Brevoortia tyrannus) growth rate potential in the Patuxent River. Estuaries 26(2A):298- 309.

Brush, G. S. 1986. Geology and paleoecology of Chesapeake Bay: A long-term monitoring tool for management. J. Wash. Acad. Sciences 76: 146-160.

Brush, G.S. 2009. Historical land use, nitrogen, and coastal eutrophication: A paleoecological perspective. Estuar. Coast. 32: 18-28.

Buchheister, A., T.J. Miller, E.D. Houde, D.H. Secor, and R.J. Latour. 2016. Spatial and temporal dynamics of Atlantic menhaden (*Brevoortia tyrannus*) recruitment along the Northwest Atlantic Ocean. ICES J. Mar. Sci. 73: 1147-1159.

Burkholder, J. M., A. S. Gordon, P. D. Moeller, J. M. Law, K. J. Coyne, A. J. Lewitus, J. S. Ramsdell, H. G. Marshall, N. J. Deamer, S. C. Cary, J. W. Kempton, S. L. Morton, and P. A. Rublee. 2005. Demonstration of toxicity to fish and to mammalian cells by Pfiesteria species: Comparison of assay methods.

Burkholder, J. M., E. J. Noga, C. W. Hobbs, H. B. Glasgow, and S. A. Smith. 1992. New “phantom” dinoflagellate is the causative agent of major estuarine fish kills. Nature 358:407-410 (see correction in Nature 360:768).

Burnett, L. E. (1997). The challenge of living in hypoxic and hypercapnic aquatic environments. American Zoology 37: 633-640.

Burton, D. T., L. B. Richardson, and C. J. Moore. 1980. Effect of oxygen reduction rate and constant low dissolved oxygen concentration on two estuarine fish. Trans. Am. Fish. SOC. 109:552-557.

Burton, D. T., P. R. Abell, and T. P. Capizzi. 1979. Cold Shock effect of rate of thermal decrease on Atlantic menhaden, *Brevoortia tyrannus.* Mar. Pollut. Bull. 10:347-349.

Carr, A. 1963. Panspecific reproductive convergence in Lepidochelys kempii. Ergebnisse der Biologie 26:298-303.

Caswell, H., M. Fujiwara and S. Brault. (1999). Declining survival probability threatens the north Atlantic right whale. Proc. Nat. Acad. Sci. 96:3308-3313.

CETAP. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode

Island. Final Report #AA551- CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp.

Checkley, D.M., Jr., S. Raman, G.L. Maillet and K.M. Mason. 1988. Winter storm effects on the spawning and larval drift of a pelagic fish. Nature 335(6188): 346-348.

Christmas, J.Y., G. Gunter, and E.C. Whatley. 1960. Fishes taken in the menhaden fishery of Alabama, Mississippi and eastern Louisiana. U.S. FWS., Spec. Sci. Rep. Fish. No. 339, 10 p.

Clagett, P.R. 2007. Human population growth and land-use change. *In*: Phillips, S.W. (ed). Synthesis of U.S. Geological Survey Science for the Chesapeake Bay Ecosystem and Implications for Environmental Management: U.S. Geological Survey Circular 1316. 63 p.

Clapham, P.J. & Mayo, C.A. 1987. Reproduction and recruitment of individually identified humpback whales, Megaptera novaeangliae, observed in Massachusetts Bay, 1979-1985. Can.. J. of Zool. 65: 2853-2863.

Clark, C. W. 1995. Application of US Navy underwater hydrophone arrays for scientific research on whales. *Reports of the International Whaling Commission* 45: 210-212.

Cooper, R. A. 1965. An unusually large menhaden, *Brevoortia tyrannus* (Latrobe), from Rhode Island. Transactions of the American Fisheries Society, 94:412.

Corkeron, P., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2016. Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stocks Assessments, 2016. NOAA Technical Memorandum NOAA-NE-xxx. 343 p.

Critical Habitat for the Endangered Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon. 2016. 81 Fed. Reg. 36077 (June 3, 2016).

Cross, F.A., D.S. Peters, and W.E. Schaaf. 1985. Implications of waste disposal in coastal waters on fish populations, pp. 383-399 *In*: Cardwell, R.D., R. Purdy, and R.C. Bahner (eds). Aquatic Toxicology and Hazard Assessment: Seventh Symposium. ASTM STP854. Amer. Soc. for Testing and Materials, Philadelphia.

Designation of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic Sturgeon. 2016. 81 Fed. Reg. 35701 (June 3, 2016).

Determination of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened; Final Rule. 76 Fed. Reg. 58868 (September 22, 2011).

Dryfoos, Robert L., Randall P. Cheek, and Richard L. Kroger. 1973. Preliminary analyses of Atlantic menhaden, Brevoortia tyrannus, migrations, population structure, survival and exploitation rates, and availability as indicated from tag returns. Fishery Bulletin 71(3):719-734.

Durbin, A.G. and E.G. Durbin. 1998. Effects of menhaden predation on plankton populations in Narragansett Bay, Rhode Island. Estuaries 21(3): 449-465.

Durbin, A.G., and E.G. Durbin. 1975. Grazing rates of the Atlantic menhaden, Brevoortia tyrannus, as a function of particle size and concentration. Mar. Biol. (Berl.) 33: 265-277.

Dykstra, M., and A. S. Kane. 2000. Pfiesteria piscicida and ulcerative mycosis of Atlantic Menhaden — Current status of understanding. J. of Aquatic Animal Health 12: 18-25.

Edward, J.L. 2009. An RNA:DNA-based index of growth in juvenile Atlantic menhaden (Brevoortia tyrannus): laboratory calibration and field assessment. University of Maryland, Marine-Estuarine Environmental Sciencies, Masters Sci. thesis.

Ehrhart, L.M., R.B. Sindler, and B.E. Witherington. 1986. Preliminary investigation of papillomatosis in green turtles: phase I--frequency and effects on turtles in the wild and in captivity. Final report to U.S. Department Commerce; NOAA, NMFS, Miami Laboratory. Contract No. 40-GENF-6-0060l.

Endangered Species Act of 1973, Pub L. No. 93-205, 16 U.S.C. § 1531, 87 Stat. 884 (1973).

Ferraro, S. P. 1980. Embryonic development of Atlantic menhaden, Brevoortia tyrannus, and a fish embryo age estimation method. U.S. Natl. Mar. Fish. Serv. Fish. Bull. 77:943-949.

Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon *(Acipenser oxyrinchus)* in the Southeast. 77 Fed. Reg. 5914 (February 6, 2012).

Final rule to List Eleven Distinct Population Segments of the Green Sea Turtle (Chelonia mydas) as Endangered or Threatened and Revision of Current Listings Under the Endangered Species Act; Final Rule. 81 Fed. Reg. 20057 (April 6, 2016).

Forward, Jr., R.B., M.C. De Vries, R.A. Tankersley, D. Rittschof, W.F. Hettler, J.S. Burke, J.M. Welch and D.E. Hoss. 1999. Behaviour and sensory physiology of Atlantic menhaden larvae, Brevoortia tyrannus, during horizontal transport. In: Crowder, L.B. and F.E. Werner (eds.) Fisheries Oceanography of the Estuarine-Dependent Fishes of the South Atlantic Bight. Fish. Oceanogr. 8(suppl. 2): 37-56.

Friedland KD, Hare JA. 2007. Long-term trends and regime shifts in sea surface temperature on the continental shelf of the northeast United States. Cont Shelf Res. 27(18):2313–28. doi: 10.1016/J.Csr.

Friedland, K. D., D. W. Ahrenholz, J. W. Smith, M. Manning, and J. Ryan. 2006. Sieving functional morphology of the gill raker feeding apparatus of Atlantic menhaden. J. Exp. Zool. 305A:974-985.

Friedland, K. D., Patrick D. Lynch, and Christopher J. Gobler. 2011. Time Series Mesoscale Response of Atlantic Menhaden Brevoortia tyrannus to Variation in Plankton Abundances. Journal of Coastal Research: Volume 27, Issue 6: pp. 1148 – 1158.

Friedland, K.D., D.W. Ahrenholz, and J.F. Guthrie. 1989. Influence of plankton on distribution patterns of the filter-feeder *Brevoortia tyrannus* (Pisces, Clupeidae). Mar. Ecol. Prog. Ser. 54: 1-11.

Friedland, K.D., D.W. Ahrenholz, and J.F. Guthrie. 1996. Formation and seasonal evolution of Atlantic menhaden juvenile nurseries in coastal estuaries. Estuaries 19(1): 105-114.

Friedland, K.D., L.W. Haas, and J.V. Merriner. 1984. Filtering rates of the juvenile Atlantic menhaden Brevoortia tyrannus (Pisces: Clupeidae), with consideration of the effects of detritus and swimming speed. Mar. Biol. (Berl.) 84: 109-117.

Geer, R.L. 2008. Shadow on the Chesapeake. Chesapeake Quarterly 7(3): 4-13.

Gilbert, R.J., and AR. Heidt. 1979. Movements of the short nose sturgeon, Acipenser brevirostrum, in the Altamaha River. Assoc. Southeastern Biol. Bull. 26:35.

Goetz, S. J., and P. Jantz. 2006. Sattelite maps show Chesapeake Bay urban development. EOS 87(15): 149, 152.

Goshorn, D., J. Deeds, P. Tango, C. Poukish, A. Place, M. McGinty, W. Butler, C. Luckett, and R. Magnien. 2004. Occurrence of Karlodinium micrum and its association with fish kills in Maryland Estuaries. In Proceedings of the Tenth International Conference on Harmful Algae, St. Petersburg, FL.

Gottlieb, S.J. 1998. Ecological role of Atlantic menhaden (Brevoortia tyrannus) in Chesapeake Bay and implications for management of the fishery. MS Thesis, U. of MD, MEES Program. 112 p.

Greer, R.L. 1915. The menhaden fishing industry of the Atlantic coast. Rep. U.S. Comm. Fish., 1914, Append. 3, 27 p.

Hain, J. H. W., M. J. Ratnaswamy, R. D. Kenney, and H. E. Winn. 1992. The fin whale, Balaenoptera physalus, in waters of the northeastern United States continental shelf. Rep. Int. Whal. Commn. 42: 653-669.

Hall Jr., L.W., S.A. Fisher, and J.A. Sullivan. 1991. A synthesis of water quality and contaminants data for the Atlantic menhaden, *Brevoortia tyrannus*: implications for Chesapeake Bay. J. Environ. Sci. Health Part A Environ. Sci. Eng. 26: 1513-1544.

Harbor Porpoise Take Reduction Plan Regulations. 1998. 63 Fed. Reg. 66464 (December 2, 1998).

Harbor Porpoise Take Reduction Plan Regulations. 2013. 78 Fed. Reg. 61821 (October 4, 2013).

Hare, J. A. and J. J. Govoni. 2005. Comparison of average larval fish vertical distributions among species exhibiting different transport pathways on the southeast United States continental shelf. Fish. Bull., U.S. 103:728-736.

Hare, J. A., S. Thorrold, H. Walsh, C. Reiss, A. Valle-Levinson and C. Jones. 2005. Biophysical mechanisms of larval fish ingress into Chesapeake Bay. Marine Ecology Progress Series 303:295-310.

Harrison, R.W. 1931. The menhaden industry. U.S. Bur. Fish., Invest. Rep. 1, 113 p.

Hettler Jr., W.F., and A.J. Chester. 1990. Temporal distribution of ichthyoplankton near Beaufort Inlet, North Carolina. Mar. Ecol. Prog. Ser. 68: 157-168.

Hettler, W. F., and D. R. Colby. 1979. A1 teration of heat resistance of Atlantic menhaden, Brevoortia tyrannus, by photoperiod. J. Comp. Biochem. Physiol. 63A: 141-143.

Hettler, W. F., Jr., D. S. Peters, D. R. Colby, and L. H. Laban. 1997. Daily variability in abundance of larval fishes inside Beaufort Inlet. Fish. Bull. 95:477–493.

Hettler, W.F. 1976. Influence of temperature and salinity on routine metabolic rate and growth of young Atlantic menhaden. J. Fish. Biol. 8: 55-65.

Hettler, W.F. 1981 Spawning and rearing Atlantic menhaden. Prog. Fish-Cult. 43:80-84.

Higham, J.R., and W.R. Nicholson. 1964. Sexual maturation and spawning of Atlantic menhaden. Fish. Bull. 63: 255-271.

Hilgartner, W. B. and G.S. Brush. 2006. Prehistoric habitat stability and post-settlement habitat change in a Chesapeake Bay freshwater tidal wetland, USA. Holocene 16:479-494.

Hirth, H.F. 1971. Synopsis of biological data on the green turtle Chelonia & (Linnaeus) 1758. FA0 Fish. Synop. 85:l-8, 19.

Houde unpublished. 2011. Unpublished data. Larval ingress research supported by NOAA Chesapeake Bay Office, Maryland DNR, and Atlantic States Marine Fisheries Commission. University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, Solomons, MD.

Houde, E. D. and L. W. Harding, Jr. 2009. Menhaden abundance and productivity in Chesapeake Bay: linking the environment and primary production to variability in fish recruitment. Final Report to NOAA Chesapeake Bay Office, Annapolis, MD. Grant No. NA04NMF4570359. Ref. No.

Houde, E. D., Annis, E. R., Harding, L. W., Mallonee, M. E., and M. J. Wilberg. 2016. Factors affecting the abundance of age-0 Atlantic menhaden (*Brevoortia tyrannus)* in Chesapeake Bay. ICES Journal of Marine Science, 73(9):2238-2251.

Hughes, A. R., S. L. Williams, C. M. Duarte, K. L. Heck, Jr., and M. Waycott. 2009. Associations of concern: declining seagrasses and threatened dependent species. Front. Ecol. Environ. 7(5): 242-246.

Humphrey, J., Wilberg, M.J., Houde E.D. & M. C. Fabrizio. 2014. Effects of Temperature on Age-0 Atlantic Menhaden Growth in Chesapeake Bay. Transactions of the American Fisheries Society. Vol. 143. Pages 1255-1265.

Identification of 14 Distinct Population Segments of the Humpback Whale *(Megaptera novaeangliea)* and Revision of Species-Wide Listing; Final Rule. 81 Fed. Reg. 62259 (September 8, 2016).

International Whaling Commission. 1992. Report of the comprehensive assessment special meeting on North Atlantic fin whales. Rep. int. Whal. Commn 42:595B644.

Judy, M.H., and R.M. Lewis. 1983. Distribution of eggs and larvae of Atlantic menhaden, Brevoortia tyrannus, along the Atlantic coast of the United States. U.S. NMFS. Spec. Sci. Rep. Fish. 774. 23 p.

June, F.C., and J.L. Chamberlin. 1959. The role of the estuary in the life history and biology of Atlantic menhaden. Proc. Gulf Carib. Fish. Inst. 11: 41-45.

Katona, S. K., and J. A. Beard. 1990. Population size, migrations, and feeding aggregations of the humpback whale (Megaptera novaeangliae) in the western North Atlantic Ocean. Rep. int. Whal. Commn. Special Issue 12: 295- 306.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginia sea turtles: 1979-1986. Virginia Journal of Science 38(2):81.

Kendall, A.W. and J.W. Reintjes. 1975. Geographic and hydrographic distribution of Atlantic menhaden eggs and larvae along the middle Atlantic coast from R/V Dolphin cruises, 1965-1966. NMFS Fish. Bull. 73: 317-355.

Kenney, R. D. 2002. North Atlantic, North Pacific and southern right whales. Pages 806- 813 In W. F. Perrin, B. Wursig, J. G. M. Thewissen (eds.), Encyclopedia of marine mammals. Academic Press, San Diego, CA.

Kimmel, D. G., W. D. Miller, L. W. Harding Jr., E. D. Houde, and M. R. Roman. 2009. Estuarine ecosystem response captured using a synoptic climatology. Estuaries and Coasts. 32:3: 403-409.

Kiryu, Y., J. D. Shields, W. K. Vogelbein, D. E. Zwerner, and H. Kator. 2002. Induction of skin ulcers in Atlantic menhaden by injection and aqueous exposure to the zoospores of Aphanomyces invadans. J. of Aquatic Animal Health 14(1): 11-24.

Kleisner, K.M., M.J. Fogarty, S. McGee, A. Barnett, P. Fratantoni, J. Greene, J.A. Hare, S.M. Lucey, C. McGuire, J. Odell, and V.S. Saba. 2016. The effects of sub-regional climate velocity on the distribution and spatial extent of marine species assemblages. PLoS ONE 11(2): e0149220. doi:10.1371/journal.pone.0149220

Knowlton, A.R. and S.D. Kraus. 2001. Mortality and serious injury of North Atlantic right whales (Eubalaena glacialis) in the North Atlantic Ocean. J. Cetacean Res. Manage. (Special Issue) 2: 193-208.

Kraus, S. D., M. J., Crone and A. R. Knowlton. 1988. The North Atlantic right whale. Pages 684-698 *in* W. J. Chandler, ed. Audubon Wildlife Report, 1988/1989. Academic Press, New York, NY.

Kroger, R. L., J. F. Guthrie, and M. H. Judy. 1974. Growth and first annulus formation of tagged and untagged Atlantic menhaden. Trans. Am. Fish. SOC. 103:292-296.

Laist, D. W., Knowlton, A. R., Mead, J. G., Collet, A. S. and Podesta, M. 2001. Collisions between ships and whales. *Marine Mammal Science* 17(1): 35-75.

Laney, Wilson, Personal Communication. USFWS. March 2017.

Levine, J. F. 1990b. Species distribution of ulcerative lesions on finfish in the Tar-Pamlico River Estuary, North Carolina. Dis, of Aquatic Org. 8:1-5.

Levine, J. F., J. H. Hawkins, M. J. Dykstra, E. J. Noga, D. W. Moye, and R. S. Cone 1990a. Epidemiology of Ulcerative Mycosis in Atlantic Menhaden in the Tar-Palmico River Estuary, North Carolina. J. of Aquatic Animal Health 2:162-171.

Lewis R. M. and W. F. Hettler, Jr.1968. Effect of temperature and salinity on the survival of young Atlantic menhaden, Brevoortia tyrannus. Trans. Am. Fish. Soc. 97: 344-349.

Lewis, R. M. 1965. The effect of minimum temperature on the survival of larval Atlantic menhaden, Brevoortia tyrannus. Trans. Am. Fish. Soc. 94: 409-412.

Lewis, R.M. 1966. Effects of salinity and temperature on survival and development of larval Atlantic menhaden, *Brevoortia tyrannus*. Trans. Am. Fish. Soc. 95: 423-426.

Lewis, R.M., and W.C. Mann. 1971. Occurrence and abundance of larval Atlantic menhaden, *Brevoortia tyrannus*, at two North Carolina Inlets with notes on associated species. Trans. Am. Fish. Soc. 100: 296-301.

Lewis, R.M., D.W. Ahrenholz, and S.P. Epperly. 1987. Fecundity of Atlantic menhaden, Brevoortia tyrannus. Estuaries 10(4): 347-350.

Lewis, V.P., and D.S. Peters. 1984. Menhaden - a single step from vascular plant to fishery harvest. J. Exp. Mar. Biol. Ecol. 84: 95-100.

Light, P.R., and K.W. Able. 2003. Juvenile Atlantic menhaden (*Brevoortia tyrannus*) in Delaware Bay, USA are the result of local and long-distance recruitment. Estuar. Coast. Shelf. S. 57:1007-1014.

List of Fisheries for 2001. 66 Fed. Reg. 42780 (August 15, 2001).

List of Fisheries for 2003. 68 Fed. Reg. 41725 (July 15, 2003).
List of Fisheries for 2006. 71 Fed. Reg. 48802 (August 22, 2006).
List of Fisheries for 2007. 72 Fed. Reg. 14466 (March 28, 2007).
List of Fisheries for 2012. 76 Fed. Reg. 73911 (November 29, 2011).
List of Fisheries for 2017. 82 Fed. Reg. 3655 (January 12, 2017).
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 49:627-647.
Love, J. W., A. K. Johnson and E. B. May. 2006. Spatial and temporal differences of Atlantic menhaden (Brevoortia tyrannus) recruitment across major drainages (1966-2004) of the Chesapeake Bay watershed. Estuaries and Coasts 29:794-801.
Lozano, C. and E. D. Houde. 2013. Factors contributing to variability in larval ingress of Atlantic menhaden, *Brevoortia tyrannus.* Estuarine, Coastal and Shelf Science, 118:1-10.
Lozano, C., Houde, E. D., Wingate, R. L., and D. H. Sector. 2012. Age, growth and hatch dates of ingressing larvae and surviving juveniles of Atlantic menhaden *Brevoortia tyrannus.* Journal of Fish Biology, 81:1665-1685.
Luo, J., K. J. Hartman, S. B. Brandt, C. F. Cerco, and T. H. Rippetoe. 2001. A spatially-explicit approach for estimating carrying capacity: an application for the Atlantic menhaden (Brevoortia tyrannus) in Chesapeake Bay. Estuaries 24(4):545-556.
Lutcavage, M. and J.A. Musick. 1985. Aspects of sea turtle biology in Virginia. Copeia 2:449- 456.
Lynch, A. J., J. R. McDowell, J. E. Graves. 2010. A molecular genetic investigation of the population structure of Atlantic menhaden (Brevoortia tyrannus). Fishery Bulletin 108:87-97.
Lynch, P.D., M.J. Brush, E.D. Condon, and R.J. Latour. 2010. Net removal of nitrogen through ingestion of phytoplankton by Atlantic menhaden (Brevoortia tyrannus) in Chesapeake Bay. Marine Ecological Progress Series 401: 195-209.
Magnuson-Stevens Fishery Conservation and Management Act, Pub. L. No. 94-265, 16 U.S.C. § 1801 et seq., 90 Stat. 331 (1976).
Manderson, John, Personal Communication. NOAA Northeast Fishery Science Center. April 2017.
Marine Mammal Protection Act of 1972 As Amended, Pub. L. No. 92-522, 16 U.S.C. § 11361-1362, 1371-1389, 1401-1407, 1411-1418, 1421-1421h, 1423-1423h, 86 Stat. 1027 (1972).
MDSG, 2009. EBFM Menhaden Species Team. Ecosystem-Based Fisheries Management For Chesapeake Bay: Menhaden Background and Issue Briefs. Maryland Sea Grant, College Park, MD. UM-SG-TS-2009-08.
Miller, W. D., and L. W. Harding, Jr. 2007. Climate forcing of the spring bloom in Chesapeake Bay. Marine Ecology Progress Series 331:11-22.
Musick, J. A., and C. J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pages 137-164 in P. L. Lutz and J. A. Musick, editors. The biology of sea turtles. CRC Press, Boca Raton, Florida, USA.
National Marine Fisheries Service. 1991. Proposed regime to govern the interactions between marine mammals and commercial fishing operations after October 1, 1993. Draft Environmental Impact Statement, June 1991.
National Marine Fisheries Service. 1993. Report on Implementation of the Marine Mammal Protection Act Interim Exemption Program, 1988-1993. Office of Protected Resources, NMFS, NOAA. 63 pp.
National Marine Fisheries Service. 1995. Status Reviews of Sea Turtles Listed Under the Endangered Species Act of 1973. Silver Spring, MD.
National Marine Fisheries Service. 1997. Fin Whale *(Balaenoptera physalus):* Western North Atlantic Stock.
National Marine Fisheries Service. 1999. Endangered Species Act Section 7 Consultation. Biological Opinion. Consultation Regarding the Federal Atlantic Herring Fishery.

National Marine Fisheries Service. 2002. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2002.

National Marine Fisheries Service. 2007. Hawksbill Sea Turtle *(Eretmochelys imbricata)* 5-Year Review: Summary and Evaluation. Office of Protected Resources. Silver Spring, MD.

National Marine Fisheries Service. 2008. Bottlenose Dolphin *(Tursiops truncates):* Western North Atlantic Coastal Morphotype Stocks.

National Marine Fisheries Service. 2011. Fin Whale *(Balaenoptera physalus)* 5-Year Review: Summary and Evaluation. Office of Protected Resources. Silver Spring, MD.

National Marine Fisheries Service. 2012. North Atlantic Right Whale 5 Year Review: Summary and Evaluation. Northeast Regional Office. Gloucester, MA.

National Marine Fisheries Service. 2013. Biological Report on the Designation of Marine Critical Habitat for the Loggerhead Sea Turtle, *Caretta caretta.*

National Marine Fisheries Service. 2013. Leatherback Sea Turtle *(Dermochelys coriacea)* 5-Year Review: Summary and Evaluation. Office of Protected Species, Silver Spring, MD.

National Marine Fisheries Service. 2015. Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the Mid-Atlantic and New England Regional Fishery Management Councils.

Nelson, W.R., M.C. Ingham, and W.E. Schaaf. 1977. Larval transport and year-class strength of Atlantic menhaden, Brevoortia tyrannus. Fish. Bull. 75: 23-41.

Nicholson, W.R. 1972. Population structure and movements of Atlantic menhaden, Brevoortia tyrannus, as inferred from back-calculated length frequencies. Ches. Sci. 13: 161-174.

Nicholson, W.R. 1978. Movements and population structure of Atlantic menhaden indicated by tag returns. Estuaries 1(3): 141-150.

Noga, E. J. and M. J. Dykstra. 1986. Oomycete fungi associated with Ulcerative Mycosis in Menhaden, Brevoortia-tyrannus (Latrobe). Journal of Fish Diseases 9(1):47-53.

Noga, E. J., J. F. Levine, M. J. Dykstra, and J. H. Hawkins. 1988. Pathology of ulcerative mycosis in Atlantic menhaden Brevoortia tyrannus. Dis. of Aquatic Org. 4: 189-197.

Nordlie, F. G. 1976. Influence of environmental temperature on plasma ionic and osmotic concentrations in *Mugil cephalus*. L. Comp. Biochem. Physiol. 55A:379-381.

Nordlie, F. G., W. A. Szelistowski, and W. C. Nordlie. 1982 Ontogenesis of osmostic regulation in the striped mullet, *Mugil cephalus*. L. J. Fish Biol. 20:79-86.

North Carolina Department of Environmental Quality. 2015. North Carolina Division of Water Resources Annual Report of Fish Kill Events 2015. North Carolina Department of Environmental Quality Division of Water Resources, Raleigh, NC.

ORCS-Berkson, J., L. Barbieri, S. Cadrin, S. L. Cass-Calay, P. Crone, M. Dorn, C. Friess, D. Kobayashi, T. J. Miller, W. S. Patrick, S. Pautzke, S. Ralston, M. Trianni. 2011. Calculating Acceptable Biological Catch for Stocks That Have Reliable Catch Data Only (Only Reliable Catch Stocks – ORCS). NOAA Technical Memorandum NMFS-SEFSC- 616, 56 P.

Orth, R, J., T. J. B. Carruthers, W. G. Dennison, C. M. Duarte, J. W. Fourqurean, K. L. Heck, Jr., A. R.Hughes, G. A. Kendrick, W. J. Kenworthy, S. Olyarnik, F. T. Short, M. Waycott, and S. L.Williams. 2006. A global crisis for seagrass ecosystems. BioScience 56(12): 987-996.

Oviatt, A. 1977. Menhaden, sport fish and fishermen, p. 53-66 In: Clepper, H. [Ed.] Marine recreational fisheries 2. Sport Fish. Inst., 220 p.

Oviatt, C.A., A.L. Gall, and S.W. Nixon. 1972. Environmental effects of Atlantic menhaden on surrounding waters. Chesapeake Sci. 13: 321-323.

Paerl, H. W., J. L. Pickney, J. M. Fear, and B. L. Peierls. 1998. Ecosystem responses to internal and watershed organic matter loading: consequences for hypoxia in the eutrophying Neuse River Estuary, North Carolina, USA. Marine Ecol. Progress Ser. 166: 17-25.

Perry S. L., DeMaster D. P. and Silber G. K. 1999. The fin whale. *Marine Fish Review* 61(1): 44-51.

Pershing, A. J., Alexander, M. A., Hernandez, C. M., Kerr, L. A., Bris, A. L. Mills, K. E., Nye, J. A., Record, N. R., Scannell, H. A., Scott, J. D., Sherwood, G. D., and A. C. Thomas. 2015. Slow adaptation in the face of rapid warming leads to collapse of the Gulf of Maine cod fishery. *Science,* Vol. 350, Issue 6262: 809-812.

Peters, D.S., and V.P. Lewis. 1984. Estuarine productivity: Relating trophic ecology to fisheries, p. 255-264 In: B.J. Copeland, K. Hart, N. Davis and S. Friday, (eds.) Research Managing the Nation's Estuaries. UNC Sea Grant College, Pub. UNC-SG-84-08, 420 p.

Peters, D.S., and W.E. Schaaf. 1981. Food requirements and sources for juvenile Atlantic menhaden. Trans. Am. Fish. Soc. 110: 317-324.

Poukish, Charles, Personal Communication. Environmental Assessment Division, Maryland Department of the Environment. March 2017.

Quinlan, J.A., B.O. Blanton, T.J. Miller, and F.E. Werner. 1999. From spawning grounds to the estuary: using linked individual-based and hydrodynamic models to interpret patterns and processes in the oceanic phase of Atlantic menhaden *Brevoortia tyrannus* life history. Fish. Ocean. 8 (Supplement 2): 224-246.

Reimschussel, R., C. M. Gieseker, C. Driscoll, A. Baya, A. S. Kane, V. S. Blazer, J. J. Evans, M. L. Kent, J. D. W. Moran and S. L. Poynton. 2003. Myxosporean plasmodial infection associated with ulcerative lesions in young-of-the-year Atlantic menhaden in a tributary of the Chesapeake Bay, and possible links to Kudoa clupeidae. Diseases Aquatic Organisms 53:143-166.

Reintjes, J.W., and A. Pacheco. 1966. The relation of menhaden to estuaries. Am. Fish. Soc. Spec. Publ. 3: 50-58.

Reish, R.L., R.B. Deriso, D. Ruppert, and R.J. Carroll. 1985. An investigation of the population dynamics of Atlantic menhaden (Brevoortia tyrannus). Can. J. Fish. Aquat. Sci. 42 (Suppl. 1): 147-157.

Rice, J.A., Quinlan, J.A., Nixon, S. W., Hettler, W. F., Warlen, S. M., and P. M. Steggmann. 1999. Spawning and transport dynamics of Atlantic menhaden: inferences from characteristics of immigrating larvae and predictions of a hydrodynamic model. Fisheries Oceanography 8:93-110.

Rogers, S. G., T. E. Targett, and S. B. VanSant. 1984. Fish-nursery use in Georgia salt-marsh estuaries: the influence of springtime freshwater conditions. Trans. AM. Fish. Soc. 113:595-606.

Rogers, S.G. and M.J. Van Den Avyle. 1989. Species Profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Atlantic Menhaden. Biol. Rept. 82(11.108) TR EL-82-4. 23 p.

Schaaf, W. E. and G. R. Huntsman. 1972. Effects of fishing on the Atlantic menhaden stock: 1955-1969. Transactions of the American Fisheries Society, 101:290-297.

Schick, R. S., P. N. Halpin, A. J. Read, C. K. Slay, S. D. Kraus, B. R. Mate, M. F. Baumgartner, J. J. Roberts, B. D. Best, C. P. Good, S. R. Loarie, J.S. Clark. 2009. Striking the Right Balance in Right Whale Conservation. Canadian Journal of Fisheries and Aquatic Sciences 66(9):1399-1403.

Schueller, A.M., E.H. Williams, and R.T. Cheshire. 2014. A proposed, tested, and applied adjustment to account for bias in growth parameter estimates due to selectivity. Fisheries Research 158: 26-39.

Sherman, K., I. Belkin, K.D. Friedland, J. O'Reilly, and K. Hyde. 2009. Accelerated warming and emergent trends in fisheries biomass yields of the world's largest marine ecosystems. AMBIO: A Journal of the Human Environment 38(4): 215-224.

Smith, H.M. 1896. Notes on an investigation of the menhaden fishery in 1894 with special reference to the 93 food fishes taken. Bull. U.S. Fish Comm. 15: 285-302.

Smith, J. W. 1991. The Atlantic and gulf menhaden purse seine fisheries: origins, harvesting technologies, biostatistical monitoring, recent trends in fisheries statistics, and forecasting. Mar. Fish. Rev. 53(4):28–41.

Smith, J. W.1999. Distribution of Atlantic menhaden, Brevoortia tyrannus, purse-seine seta and catches from southern New England to North Carolina, 1985-1996, NOAA Tech. Rep. NMFS 144, 22p.

Smith, JW and WB O'Bier. 2011. The bait purse-seine fishery for Atlantic menhaden, Brevoortia tyrannus, in the Virginia portion of Chesapeake Bay. Mar Fish Rev 73(1): 1-12.

Smith, Kent, Personal Communication. Florida Fish Wildlife Conservation Commission. March 2017.

Stegmann, P.M., J.A. Quinlan, F.E. Werner, B.O. Blanton, and P. Berrien. 1999. Atlantic menhaden recruitment to a southern estuary: Defining potential spawning regions. Fish. Oceanogr. 8: 111-123.

Stephens, E. B., M. W. Newman, A. L. Zachary and F. M. Hetrick. (1980). A viral aetiology for the annual spring epizootics of Atlantic menhaden, Brevoortia tyrannus (Latrobe) in Chesapeake Bay. Journal of Fish Diseases 3:387-398.

Stine et al. 2005. Mycobacterial infection in laboratory-maintained Atlantic menhaden. J. Aquatic Animal Health 17:380-385.

Stout, V.F., C.R. Houle, and F.L. Beezhold. 1981. A survey of chlorinated hydrocarbon residues in menhaden fishery products. Mar. Fish. Rev. 43(3): 1-13.

Taking of Marine Mammals Incidental to Commercial Fishing Operations; Bottlenose Dolphin Take Reduction Plan Regulations; Sea Turtle Conservation; Restrictions to Fishing Activities; Final Rule. 71 Fed. Reg. 24776 (April 26, 2006).

Thompson, C. 2010. The Gulf of Maine in Context: State of the Gulf of Maine Report. Fisheries and Oceans Canada. Dartmouth, NS.

Threatened and Endangered Status for Distinct Population Segments of Atlantic Sturgeon in the Northeast Region. 77 Fed. Reg. 5880 (February 6, 2012).

U.S. Census Bureau. 2010. Coastline Population Trends in the United States: 1960 to 2008 Population Estimates and Projections. P25-1139. https://www.census.gov/prod/2010pubs/p25-1139.pdf

Vaughan, D.S., and J.W. Smith. 1988. A stock assessment of the Atlantic menhaden, Brevoortia tyrannus, fishery. NOAA Tech. Rep. NMFS 63, 18 p.

Viverette, C. B., Garman, G. ., McIninch, S. P., Markham, A. C., Watts, B. D., and S. A. Macko. 2007. Finfish-waterbird trophic interactions in tidal freshwater tributaries of the Chesapeake Bay. Waterbirds. 32:1: 50-62.

Walford, L.A., and R.I. Wicklund. 1968. Monthly sea temperature structure from the Florida Keys to Cape Cod. Serial Atlas of the Marine Environment. Folio 15. American Geographical Society, N .Y.

Walsh, H. J., Richardson, D. E., Marancik, K. E., and Hare, J. A. 2015. Long-term changes in the distributions of larval and adult fish the Northeast U.S. Shelf Ecosystem. PLoS ONE, 10: e0137382.

Waring GT, Josephson E, Fairfield-Walsh CP, Maze-Foley K, (eds.). 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2008. NOAA Tech Memo NMFS NE 210; 440 p.

Waring, G.T. J.M. Quintal and S.L. Swartz (eds.). 2000. U.S. Atlantic and GOM Marine Mammal Stock Assessments- 2000. NOAA Tech Memo. NMFS-NE-162, U.S. DOC. Washington, D.C. 303 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stocks Assessments, 2015. NOAA Technical Memorandum NOAA-NE-238. 512 p.

Warlen, S. M. 1994. Spawning time and recruitment dynamic of larval Atlantic menhaden, *Brevoortia tyrannus,* in a North Carolina estuary. Fisheries Bulletin, 92:420-433.

Warlen, S.M., D.A. Wolfe, C.W. Lewis, and D.R. Colby. 1977. Accumulation and retention of dietary 14C-DDT by Atlantic menhaden. Trans. Am. Fish. Soc. 106: 95-104.

Warlen, S.M., K.W. Able, and E.H. Laban. 2002. Recruitment of larval Atlantic menhaden (*Brevoortia tyrannus*) to North Carolina and New Jersey estuaries: evidence for larval transport northward along the east coast of the United States. Fish. Bull. 100(3): 609-623.

Werner, F.E., B.O. Blanton, J.A. Quinlan and R.A. Luettich, Jr. 1999. Physical oceanography of the North Carolina continental shelf during the fall and winter seasons: implications for the transport of larval menhaden. In: Crowder, L.B. and F.E. Werner (eds.) Fisheries Oceanography of the Estuarine-dependent Fishes of the South Atlantic Bight. Fish. Oceanogr. 8(suppl. 2): 7-21.

Westman, J. R., and R. F. Nigrelli. 1955. Preliminary studies of menhaden and their mass mortalities in Long Island and New Jersey waters. N .Y. Fish Game J. 2: 142-153.

Whitehurst, J.W. 1973. The menhaden fishing industry in North Carolina. UNC-Sea Grant Publ. No. UNC-SG-72-12, 51 p.

Wiley, D. N., R. A. Asmutis, T. D. Pitchford, and D. P. Gannon. 1995. Stranding and mortality of humpback whales, Megaptera novaeangliae, in the mid-Atlantic and southeast United States, 1985-1992. Fish. Bull., U.S. 93: 196- 205.

Wilkens, E. P. H., and R. M. Lewos. 1971. Abundance and distribution of young Atlantic menhaden (*Brevoortia tyrannus)* in the White Oak River estuary, North Carolina. Fish. Bull., U.S. 69: 783-789.

Winn, H.E., C.A. Price and P.W. Sorensen. (1986). The distributional biology of the right whale (Eubalaena glacialis) in the western north Atlantic. Rep. Int. Whal. Comm. (Special issue) 10:129-138.

Wood, R. J., and H. M. Austin. 2009. Synchronous multidecadal fish recruitment patterns in Chesapeake Bay, USA. Can. J. Fish. Aquat. Sci.

Wood, R. J., E. D. Houde and S. Jung. 2004. Variability in the dynamics of forage fish abundances in Chesapeake Bay: retrospective analysis models and synthesis. Pages 97- 107. In; Orner, D. M. (ed.). Chesapeake Bay Fisheries Research Program, Symposium Report- -2003. NOAA Chesapeake Bay Office, Annapolis, MD.

Wood, R.J. 2000. Synoptic scale climatic foraging of multispecies fish recruitment patterns in Chesapeake Bay. Coll. of William and Mary, Ph.D. Dissertation, 163 p.

Wynne, K. and M. Schwartz. 1999. Marine Mammals and Turtles of the U. S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant. Narragansett, Rhode Island. 114 pp.

9.0 TABLES

Table 16: Atlantic menhaden total commercial landings by jurisdiction (in pounds). This includes directed landings, landings under the bycatch allowance, and episodic events landings.

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	PFRC	VA	NC	SC	GA	FL
1985	C		3,039,625	8,388,046	234,800	901,800	2,879,766	176,135	5,372,193	16,768,889	620,119,243	97,738,403	C	-	7,579,674
1986	C		3,411,000	10,389,187	254,400	399,650	2,453,593	20,081	5,449,350	10,971,973	445,664,204	66,377,931	9,952	-	7,997,973
1987	C		1,215,175	13,609,224	94,900	206,795	2,563,163	22,034	5,793,683	13,120,698	622,989,111	55,498,571	C	-	2,776,777
1988	C	C	8,047,320	15,583,437	175,200	504,100	1,984,045	127,713	6,430,164	13,231,368	565,962,962	73,715,713	500	-	1,026,228
1989	C	C	1,459,402	19,033,173	148,500	449,100	2,854,361	104,382	6,166,236	8,334,174	590,581,595	66,756,288	-	-	1,372,959
1990	5,744,597	264,500	1,709,605	17,102,650	96,706	649,710	9,041,459	167,116	1,662,275	4,523,776	699,320,699	72,231,989	-	-	2,636,497
1991	C	204,000	12,798,310	5,090,375	96,300	650,150	16,597,402	278,774	3,540,179	5,376,264	638,130,543	110,528,754	-	-	2,062,983
1992	C	C	13,499,450	2,849,359	91,200	1,131,701	27,470,906	131,033	1,777,088	5,061,565	566,222,504	57,515,712	C	-	2,788,592
1993	19,520,455	C	1,211,569	5,146,280	195,827	1,048,993	28,296,741	164,406	2,326,613	7,884,001	622,024,284	64,711,384	-	-	2,584,766
1994	-		351,251	533,800	60,128	961,474	38,176,201	78,672	2,369,071	6,680,937	502,576,593	73,853,901	-	-	1,387,012
1995	-		2,910,613	5,873,315	255,264	1,087,978	36,572,507	101,388	4,264,754	7,002,818	691,212,717	2,792,221	-	-	687,944
1996	-		8,500	802	82,851	11,135	35,516,726	100,063	3,906,808	5,111,423	579,027,717	56,583,873	-	-	294,936
1997	-		238,500	5,750	72,329	553,953	38,118,579	55,733	3,457,237	5,757,370	494,098,429	56,295,597	C	-	408,492
1998	-	C	121,200	400	338,817	430,084	33,287,641	58,048	2,933,818	3,980,738	513,869,130	97,473,775	-	-	301,566
1999	-		292,800	2,330	30,298	242,886	27,753,567	78,551	4,460,534	4,860,883	374,934,651	57,434,540	-	-	288,144
2000	-		72,600	320,000	14,423	565,800	31,266,780	47,995	3,935,307	5,023,374	358,228,939	42,034,812	-	-	260,710
2001	-		144,600	-	38,865	576,426	26,375,573	53,257	3,970,243	3,329,035	484,517,820	57,261,488	-	-	179,951
2002	-		301,500	5,750	1,138,788	444,739	24,716,412	80,261	4,023,389	3,122,050	362,633,153	55,600,503	-	-	55,304
2003	-		218,255	62	46,515	384,875	17,080,463	43,193	3,163,252	2,438,790	372,479,419	68,444,122	-	-	35,810
2004	-	C	-	39,232	33,210	543,481	20,678,813	75,635	5,369,952	5,411,043	394,093,117	48,318,743	-	-	21,220
2005	-		2,177,724	14,453	30,636	871,081	17,574,826	120,658	10,635,776	4,759,905	370,689,041	50,987,985	-	-	39,404
2006	-		2,524,255	15,524	866,235	811,934	21,290,309	111,405	6,841,296	3,413,517	369,912,280	12,846,438	-	-	157,117
2007	C	C	5,543,805	8,948	90,254	483,557	37,202,485	81,850	11,210,764	5,036,906	416,447,111	1,134,167	-	-	71,373
2008	4,310,055	C	14,131,256	269,288	104,881	410,121	38,210,688	72,970	8,153,008	4,820,645	344,813,285	645,231	-	-	60,098
2009	166,942	33	6,719,048	107,548	170,907	330,496	33,329,177	69,476	7,756,192	3,191,905	349,413,370	2,124,733	-	-	52,800
2010	38,000	C	4,973,857	78,149	42,489	394,556	50,497,253	51,933	6,903,300	2,790,728	430,527,995	1,299,130	-	-	76,593
2011	56,000		116,151	83,899	26,929	279,117	74,324,485	70,326	6,505,890	2,759,597	411,802,254	3,529,967	-	-	146,534
2012	C	C	1,648,395	106,606	37,454	258,271	85,457,890	140,375	13,746,098	5,892,228	386,545,236	538,783	-	-	126,141
2013	-		2,314,888	99,821	26,463	1,187,525	39,819,342	125,912	7,074,727	3,295,295	315,724,384	454,172	-	-	276,636
2014	-		2,226,294	500,903	36,552	825,549	41,449,670	161,512	7,005,271	3,175,893	324,209,381	917,375	-	-	220,694
2015	-		2,932,828	2,060,381	77,003	1,468,165	47,810,037	150,542	7,551,430	2,739,035	351,281,666	896,919	C	-	377,729
2016	4,548,566	-	3,069,433	317,328	66,957	1,439,173	45,826,473	75,238	5,198,654	2,504,823	334,145,464	860,761	-	-	272,425

Table 17: Average Atlantic menhaden landings by gear type over three time periods. All Atlantic coast states collected gear specific landings data by 1993.

	2009-2011 Avg. Landings (lbs)	2012-2016 Avg. Landings (lbs)	1993-2016 Avg. Landings (lbs)
Purse Seine	449,088,431	388,663,919	460,333,505
Pound Net, Fish Weir, Fish Trap	13,007,093	16,279,145	13,101,585
Gill Net	2,590,405	4,343,878	2,725,962
Trawl	2,590,405	2,222,175	958,165
Seines	51,388	389,425	204,929
Cast Net	244,094	627,658	301,767
Traps, Pots	4,671	10,045	8,132
Fyke Nets	55,444	10,876	19,279
Hand Lines, Rod-n-Reel	1,347	852	13,075
Other/Unknown	53,643	22,446	83,893

Table 18. Atlantic menhaden bait and reduction landings (in 1000 metric tons).

	Reduction Landings (1000 mt)	Bait Landings (1000 mt)
1985	306.7	26.6
1986	238.0	21.6
1987	327.0	25.5
1988	309.3	43.8
1989	322.0	31.5
1990	401.2	28.1
1991	381.4	29.7
1992	297.6	33.8
1993	320.6	23.4
1994	260.0	25.6
1995	339.9	28.4
1996	292.9	21.7
1997	259.1	24.2
1998	245.9	38.4
1999	171.2	34.8
2000	167.2	33.5
2001	233.7	35.3
2002	174.0	36.2
2003	166.1	33.2
2004	183.4	34.0
2005	146.9	38.4
2006	157.4	27.2
2007	174.5	42.1
2008	141.1	47.6
2009	143.8	39.2
2010	183.1	42.7
2011	174.0	52.6
2012	160.6	63.7
2013	131.0	37.0
2014	131.1	41.6
2015	143.5	45.8
2016	137.4	43.3

Table 19: Timeline for BERP Workgroup development of menhaden-specific ecosystem reference points.

2016	Summer	Review steele-henderson multi-species model
		Evaluate data needs of model
		Review preliminary methodology of statistical catch-at-age and production models
	Fall	Review results of Ecopath with Ecosim model
2017	Winter	Review multi-species statistical catch at age model
		Evaluate data needs of model
	Summer	Review multi-species production model
		Evaluate data needs of model
	Fall	Review finalized modeling plan and candidate models
		Decide which candidate models will be included for ERP development and peer review
		Discuss data requirements of the models and data sources
2018	Winter	**Data Workshop #1**
		Review data sources for the multi-species models
		Develop criteria for inclusion of data in models
	Summer	**Data Workshop #2**
		Approve data sources of multi-species models
		Discuss standardization of data across sources
2019	Winter	**Assessment Workshop #1**
		Review base run results from multi-species models
		Discuss sensitivity runs for models
	Spring	**Assessment Workshop #2**
		Review final model results of multi-species models
		Summarize findings and recommendations
	Summer	Write stock assessment report
	Fall	**Peer Review Workshop**
		Independent review of multi-species models and single species BAM model

Table 20: Current reporting requirements in the menhaden commercial fishery per state.

State	Dealer Reporting	Harvester Reporting	Notes
ME	monthly	**monthly/daily**	Harvesters landing greater than 6,000 lbs must report daily during episodic event
NH	**weekly**	monthly	Exempt from timely reporting. Implemented weekly, trip level reporting for state dealers.
MA	**weekly**	monthly/daily	Harvesters landing greater than 6,000 lbs must report daily
RI	**twice weekly**	quarterly/daily	Harvesters using purse seines must report daily
CT	**weekly/monthly**	monthly	No directed fisheries for Atlantic menhaden
NY	**Weekly**	monthly	Capability to require weekly harvester reporting if needed
NJ	**weekly**	monthly	All menhaden sold or bartered must be done through a licensed dealer
DE	—	**monthly/daily**	Harvesters landing menhaden report daily using IVR
MD	monthly	**monthly/daily**	PN harvest is reported daily, while other harvest is reported monthly.
PRFC	—	**weekly**	Trip level harvester reports submitted weekly. When 70% of quota is estimated to be reached, then pound netters must call in weekly report of daily catch.
VA	—	**monthly/weekly/daily**	Purse seines submit weekly reports until 97% of quota, then daily reports. Monthly for all other gears until 90% of quota, then reporting every 10 days.
NC	**monthly (combined reports)**		Single trip ticket with dealer and harvester information submitted monthly. Larger dealers (>50,000 lbs of landings annually) can report electronically, updated daily.
SC	**monthly (combined reports)**		Exempt from timely reporting. Single trip ticket with dealer and harvester information.
GA	**monthly (combined reports)**		Exempt from timely reporting. Single trip ticket with dealer and harvester information.
FL	**monthly/weekly (combined reports)**		Monthly until 50% fill of quota triggers implementation of weekly.

Table 21: ACCSP data elements, and descriptions, for commercial harvester reporting.

DATA ELEMENT	DESCRIPTION
Form Type/Version Number	Version identification number for the ACCSP reporting form
Reporting Form Series Number	Individual number for each reporting form (ie: trip ticket number)
Trip Start Date	Date trip started
Vessel Identifier	Unique vessel ID such as US Coast Guard documentation or state registration number
Individual Fisherman Identifier	Identified unique to a fisherman
Dealer Identification	Identifier for the dealer at point of transaction
Unloading Date	Date of the landing at dealer
Trip Number	Sequential number representing the number of a trip taken in a single day by either a vessel or individual
Species	Genus and species for each species landed, sold, released, or discarded
Quantity	Amount that is landed, sold, released, or discarded
Units of Measure	Landed units
Disposition	Fate of catch
Ex-vessel Value or Price	Dollar value or price for each species that is landed or sold
County or Port Landed	Location within a state where the product was landed
State Landed	State where the product was landed or unloaded
Gear	Types(s) of gear used to catch the landed species
Quantity of Gear	Amound of gear employed
Number of Sets	Total number of sets or tows of gear during a trip
Fishing Time	Total amount of time that the gear is in the water
Days/Hours at Sea	Time from the start of the trip to the return to the dock
Number of Crew	Number of crew, including the Captain
Area Fished	NOAA Fisheries statistical area where fishing occurred
Distance From Shore	Determination of catch distance from shore
Sale Disposition	To whom catch was sold

Table 22: ACCSP standard measurements of gear quantity, fishing time, and sets for commercial harvester reporting.

TYPE OF GEAR	QUANTITY	FISHING TIME	# SETS
Pound nets, traps and pots	# of traps, pots, or pound nets fished	Total soak time for each pot, trap, or pound net	# of strings hauled or # of pound nets fished
Trawls	# of trawls towed	Total tow time of each trawl	# of tows
Gill Nets	Float line length for string	Total soak time	# of strings/hauls
Nests/cast nets	# of pieces of apparatus	Search time	# of hauls/throws
Hook and line	# of lines	Total soak time	n/a
Purse seines	Length of floatline	Total search time	# of sets
Hand gear	# of lines	Total soak time	n/a

Table 23: Number of ten fish samples from the reduction fishery landings at Reedville, VA from 2007-2016.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# 10 fish samples	379	277	283	327	323	263	213	208	256	251

Table 24: Number of ten fish samples required and collected by each jurisdiction in the bait fishery in 2016. Number of samples required is based on total bait landings in that jurisdiction.

State	#10-fish samples required	#10-fish samples collected	Age samples collected	Length samples collected	Gear/Comments
ME	7	9	9	9	purse seine
MA	5	7	7	7	purse seine (2), cast net (5)
RI	0	5	60	60	floating fish trap
CT	0	1	5	5	gill nets
NY	2	9	90	90	seines
NJ	69	113	1130	1130	purse seine (100), and other gears (13)
DE	0	5	50	50	drift gill net
MD	12	19	247	732	pound net
PRFC	6	9	90	90	pound net
VA	71	82	820	820	pound net (16), gill net (64), haul seine (2)
NC	2	6	60	60	gillnet, seine
Total	116	**265**	**2,568**	**3,053**	

Table 25: Fishery independent surveys used in the juvenile abundance index, the northern adult index, and the southern adult index as a part of the 2015 Stock Assessment.

Index	Survey
Juvenile Abundance Index	Rhode Island Trawl Survey
	Connecticut Seine Survey
	Connecticut Thames River Survey
	Connecticut Long Island Sound Trawl Survey
	New York Peconic Bay Trawl Survey
	New York Western Long Island Sound Seine Survey
	New Jersey Ocean Trawl Survey
	New Jersey Juvenile Striped Bass Seine Survey
	Delaware Bay Juvenile 16ft Trawl Survey
	Delaware Inland Bay Juvenile Trawl Survey
	Maryland Juvenile Striped Bass Seine Survey
	Maryland Coastal Trawl Survey
	Virginia Striped Bass Seine Survey
	VIMS Juvenile Trawl Survey
	South Carolina Electrofishing Survey
	Georgia Trawl Survey
Northern Adult Index	Connecticut Long Island Sound Trawl Survey
	New Jersey Ocean Trawl Survey
	Delaware Bay Juvenile 16ft Trawl Survey
	Delaware Bay Juvenile 30ft Trawl Survey
	Chesapeake Bay Fishery-Independent Multispecies Survey
	ChesMMAP
	VIMS Juvenile Trawl Survey
Southern Adult Index	Georgia Trawl Survey
	SEAMAP Trawl Survey

Table 26. Summary of ad-hoc approaches used by Fishery Management Councils to set harvest limits in data poor situations.

Council	Species group	Multiplier	Comments
New England	Atlantic herring	1	Not OF, OF not occurring
New England	Red crab	1	Based on stock status
Caribbean		0.85	Used to set ABC and ACL
New England	Groundfish	0.75	
Pacific		0.75	Used to set ABC
Pacific	Groundfish	0.5	Used to set OY
Pacific	Coastal pelagics	0.25	Used to set ABC

Table 27. The method table showing possible actions for determining ABC based on different fishery impact categories and expert opinion. Taken from the workshop report of the 2nd National SSC meeting (from ORCS, 2011).

Historical Catch	Expert Judgment	Possible Action
Nil, not targeted	Inconceivable that catch could be affecting stock	Not in fishery; Ecosystem Component; SDC not required
Small	Catch is enough to warrant including stock in the fishery and tracking, but not enough to be of concern	Set ABC and ACL above historical catch; Set ACT at historical catch level. Allow increase in ACT if accompanied by cooperative research and close monitoring.
Moderate	Possible that any increase in catch could be overfishing	ABC/ACL = f(catch, vulnerability) So caps current fishery
Moderately high	Overfishing or overfished may already be occurring, but no assessment to quantify	Set provisional OFL = f(catch, vulnerability); Set ABC/ACL below OFL to begin stock rebuilding

ABC = Acceptable Biological Catch ACL = Annual Catch Limit
ACT = Annual Catch Target OFL = Overfishing Level

Table 28: Total number of bycatch trips by year from 2013-2016 separated into 1,000 pound landings bins

Bins (LBS)	2013 Trips	2014 Trips	2015 Trips	2016 Trips	Total Trips	% of Total Trips 2013-2016
1-1000	1,875	3,673	3,163	1,450	10,161	69%
1001-2000	252	517	582	148	1,499	10%
2001-3000	148	318	316	73	855	6%
3001-4000	110	190	139	48	487	3%
4001-5000	131	206	132	48	517	4%
5001-6000	158	265	196	108	727	5%
6000+	130	109	140	33	412	3%
Total	**2,804**	**5,278**	**4,668**	**1,908**	**14,658**	

Table 29: Average landings under the bycatch allowance from 2013–2016 by gear type (stationary and mobile) and jurisdiction. Highlighted cells represent the gear type with the highest landings within a jurisdiction. (C) = confidential landings, and (-) = no landings. Total confidential landings are 183,747 pounds (i.e., the sum of all C's in the table below). Note that sum of pounds and percent of total columns do not include confidential data.

State/Jurisdiction	ME	RI	CT	NY	NJ	DE	MD	PRFC	VA	FL	Sum lbs (NonConf)	% of Total
Stationary Gears While Fishing												
Pound net	-	47,907	-	96,176	C	-	1,943,711	688,428	112,609	-	2,888,830	61.36%
Anchored/stake gill net	-	C	913	0	79,850	23,227	19,722	1,704	966,832	C	1,092,248	23.20%
Pots	-	-	-	C	-	C	C	-	-	C	-	0.00%
Fyke nets	-	-	-	-	C	-	C	26	77	-	103	0.00%
Mobile Gears While Fishing											-	
Cast Net	-	C	-	152,669	C	-	C	-	-	150,585	303,253	6.44%
Drift Gill net	-	-	-	24,443	83,697	53,381	12,061	-	62,189	-	235,771	5.01%
Purse Seine	C	-	-	-	-	-	-	-	-	-	-	0.00%
Seines Haul/Beach	-	-	-	177,173	-	-	C	35	3,840	-	181,048	3.85%
Trawl	-	C	C	6,565	C	-	-	-	-	-	6,565	0.14%
Hook & Line	-	C	C	-	-	-	C	-	-	C	-	0.00%
Sum lbs (NonConf)	-	47,907	913	457,025	163,547	76,608	1,975,494	690,193	1,145,547	150,585	4,707,818	
% of Total	0.00%	1.02%		9.71%	3.47%	1.63%	41.96%	14.66%	24.33%	3.20%		

Table 30: Episodic event set aside for 2013-2016 and the percent used by participating states.

Year	Set Aside (lbs)	Landed (lbs)	% Used	Participating State	Unused Set Aside Reallocated (lbs)
2013	3,765,491				
2014	3,765,491	295,000	8%	RI	3,470,491
2015	4,142,040	1,883,292	45%	RI	2,258,748
2016	4,142,040	3,810,145	92%	ME, RI, NY	331,895

10.0 FIGURES

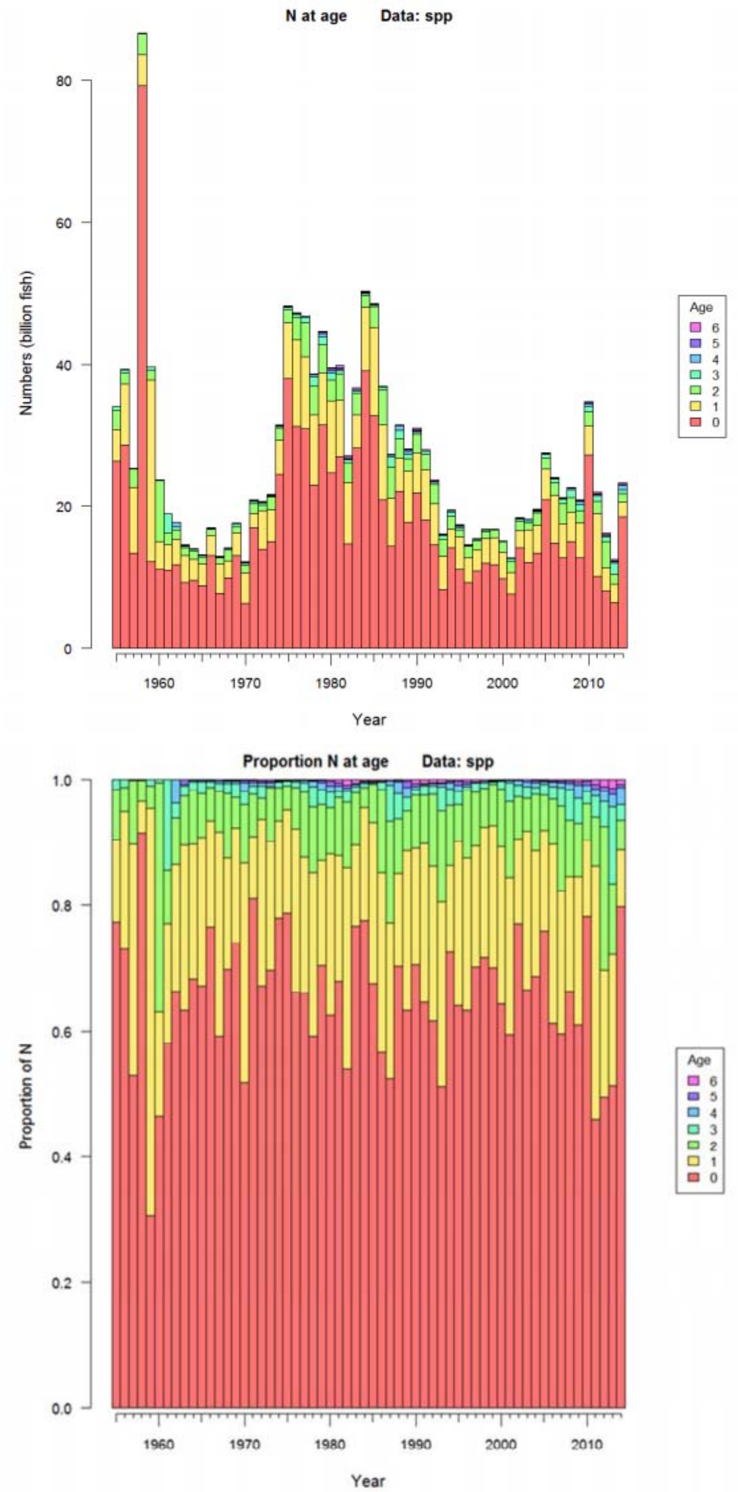


Figure 1. Numbers at age (upper panel) and proportion of numbers at age (lower panel) estimated from the base run of the BAM for ages 0-6+ during the time period 1955-2013. (Source: 2015 Stock Assessment)

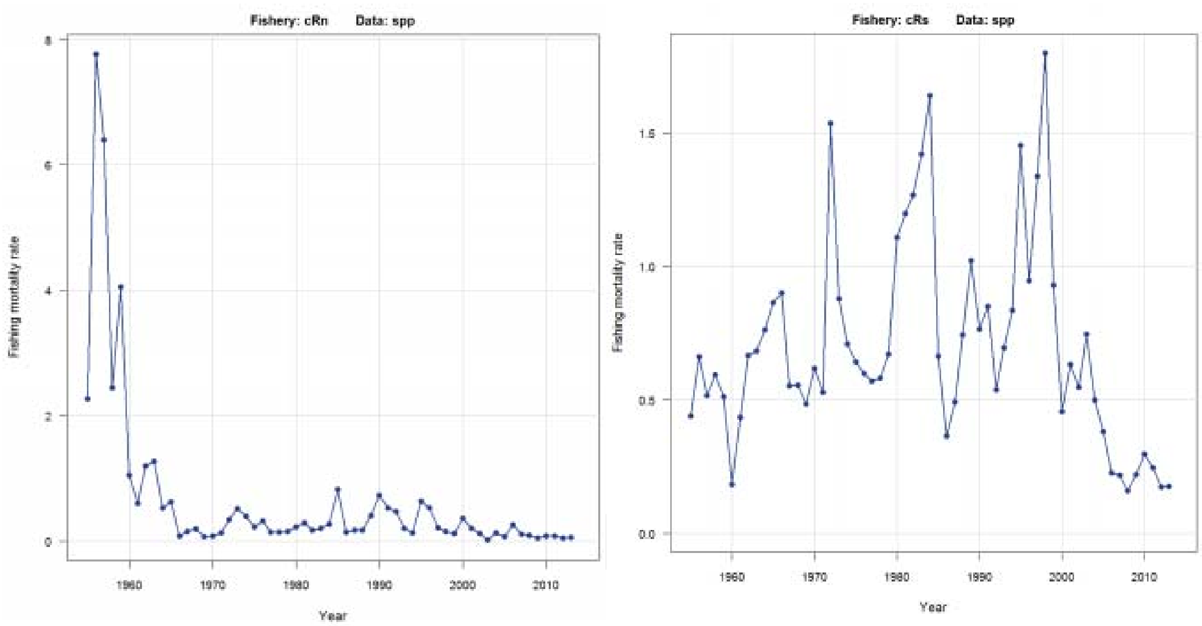


Figure 2. Fishing mortality rate for the northern commercial reduction fishery (left) and southern commercial reduction fishery (right) from 1955- 2013. The northern region is defined as waters north of Machipongo Inlet, VA and the southern region is comprised of waters south of Machipongo Inlet, VA. (Source: 2015 Stock Assessment)

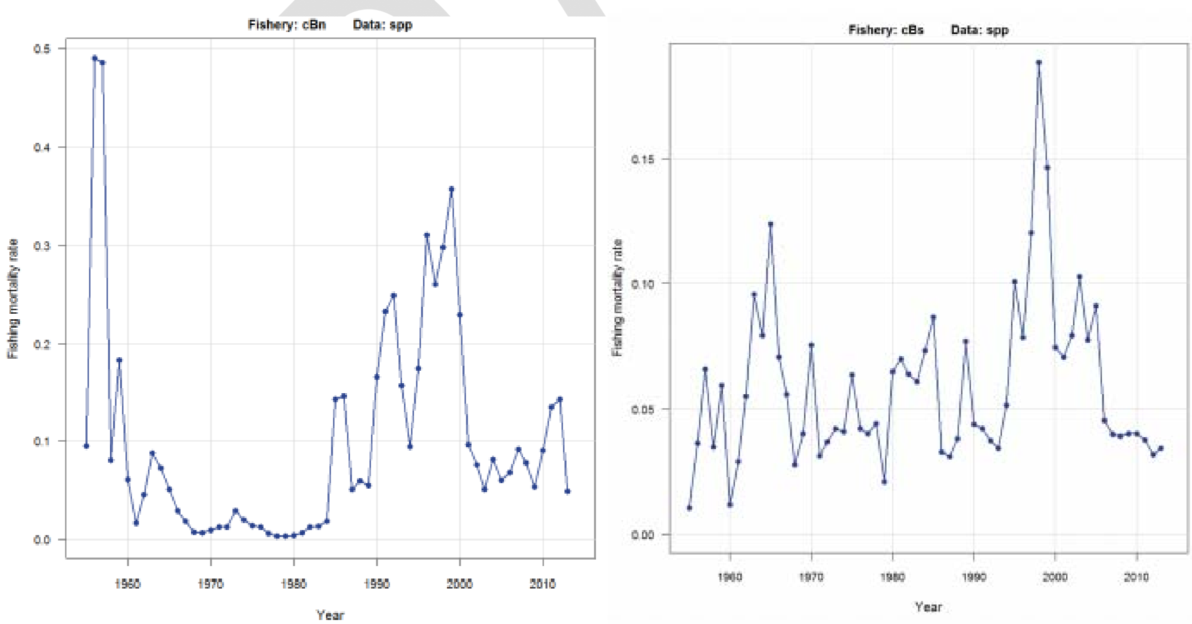


Figure 3. Fishing mortality rate for the northern commercial bait fishery (left) and the southern commercial bait fishery (right) from 1955-2013. The northern region is defined as waters north of Machipongo Inlet, VA and the southern region is comprised of waters south of Machipongo Inlet, VA. (Source: 2015 Stock Assessment)

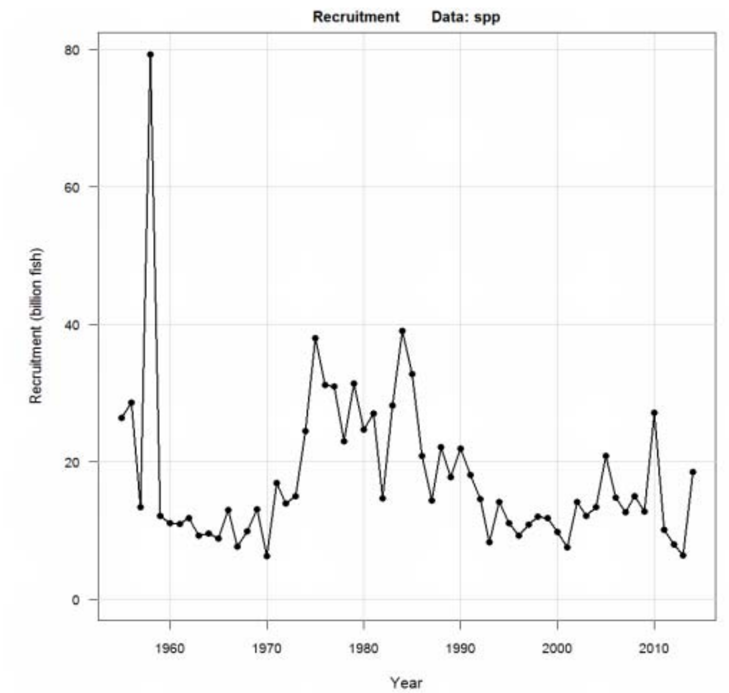


Figure 4. Number of recruits in billions of fish predicted from the base run of BAM for 1955-2013. (Source: 2015 Stock Assessment)

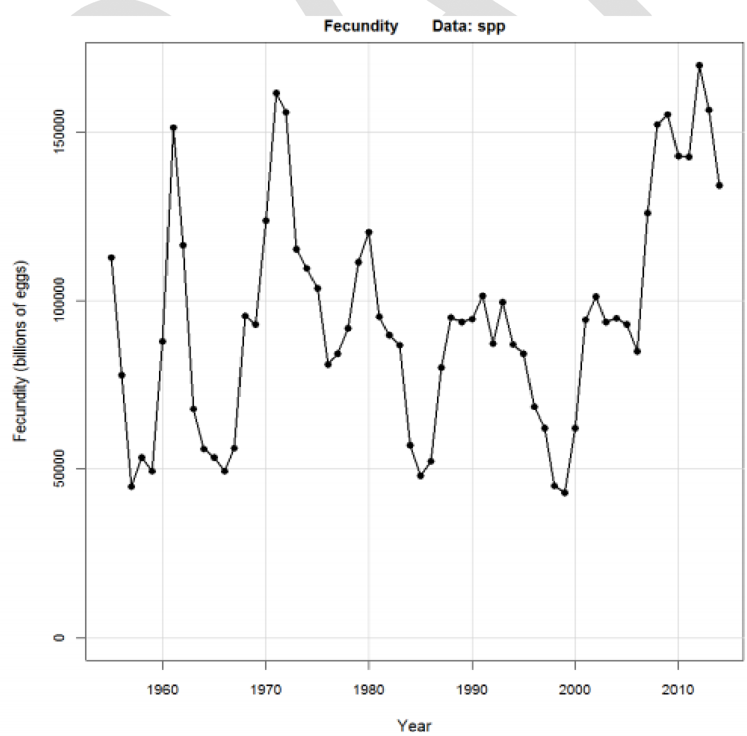


Figure 5. Fecundity in billions of eggs over time, 1955-2014, with the last year being a projection based on 2013 mortality. (Source: 2015 Stock Assessment)

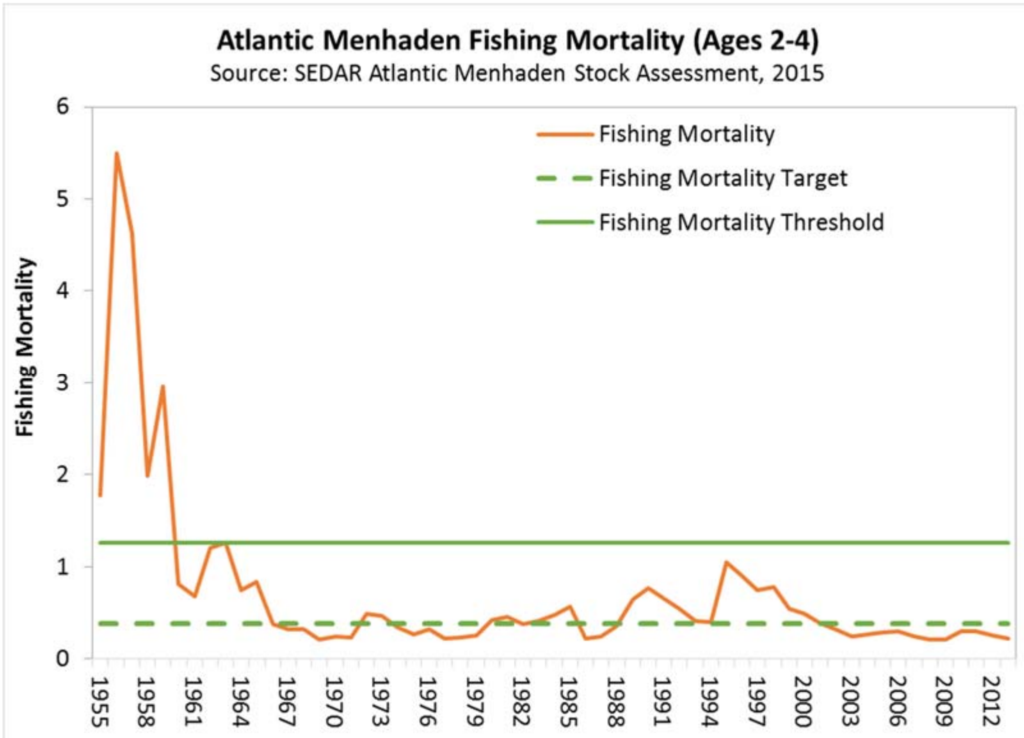


Figure 6: Atlantic menhaden fishing mortality (ages 2-4) from 1955-2013. Results of this figure show that overfishing is not occurring as fishing mortality is below the target.

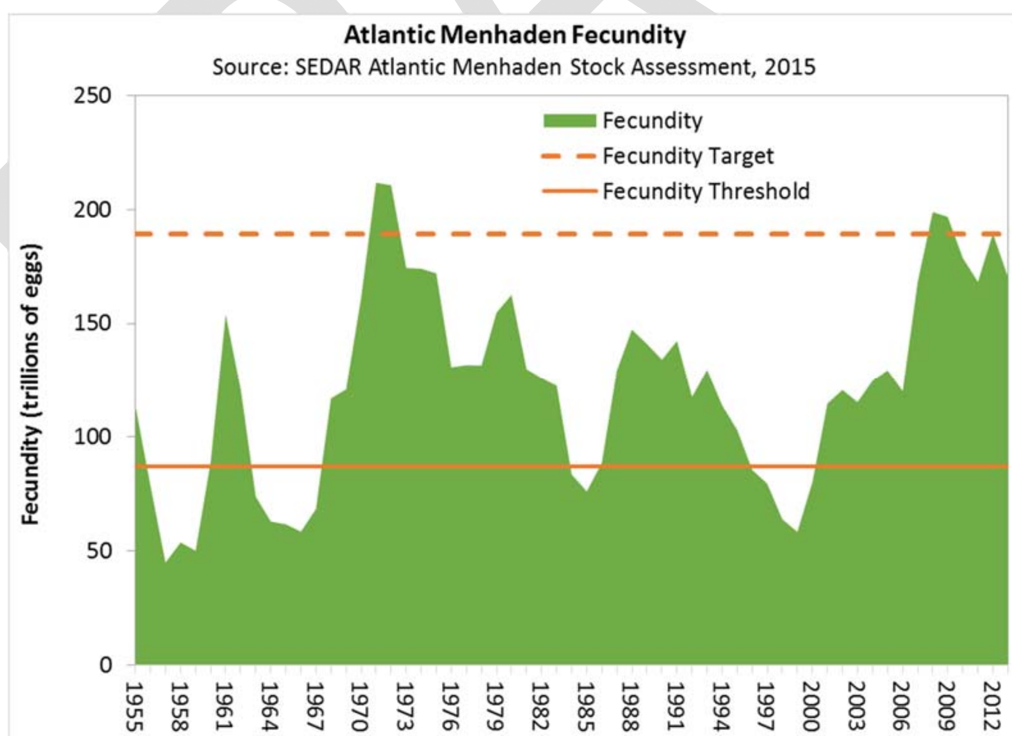


Figure 7: Atlantic menhaden fecundity (in trillions of eggs) from 1955 -2013. Results of this figure show the stock is not overfished as the fecundity is well above the threshold.

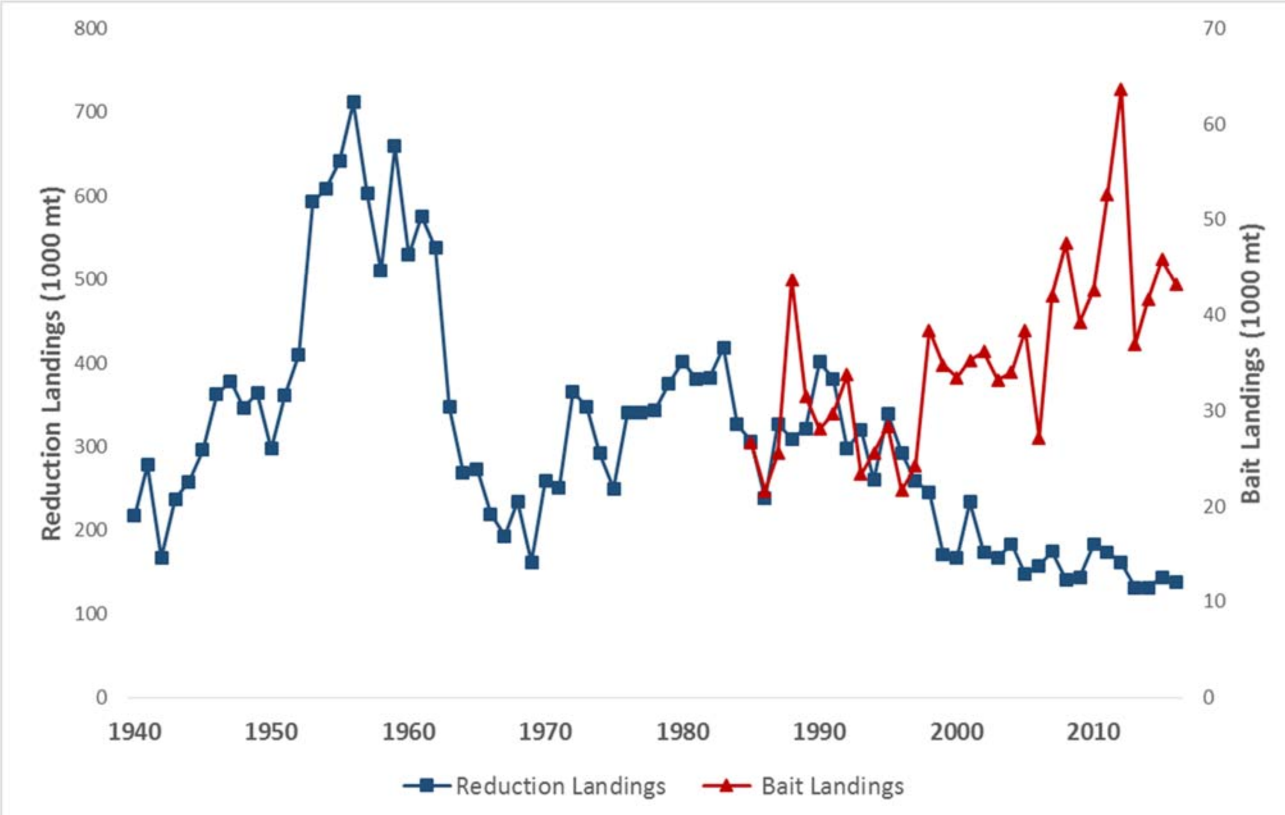


Figure 8: Landings from the reduction purse seine fishery (1940–2016) and bait fishery (1985–2016) for Atlantic menhaden. Note there are two different scales on the y-axes.

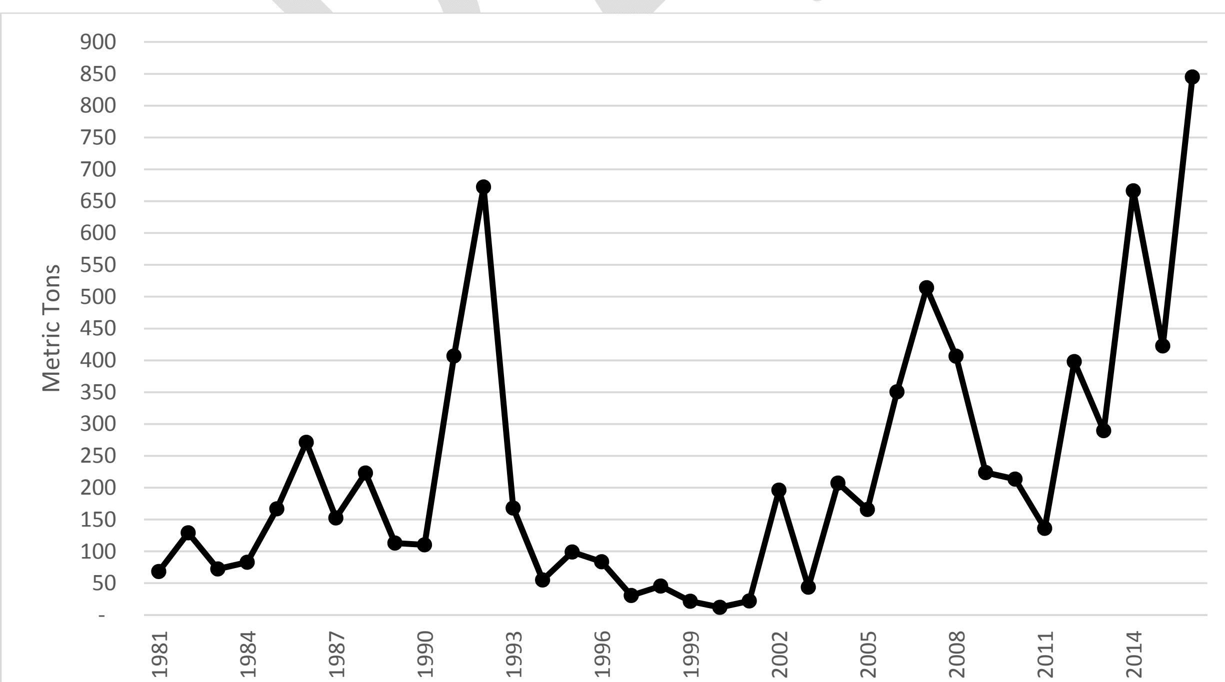


Figure 9: Recreational harvest of Atlantic menhaden from 1981-2016. Note: 2016 recreational landings are preliminary. (Source: MRIP).

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Marine Resources
205 North Belle Mead Road, Suite 1, East Setauket, NY 11733
P: (631) 444-0430 | F: (631) 444-0434 | FW.Marine@dec.ny.gov
www.dec.ny.gov

New York Menhaden Landings Recalibration

Historically, New York supported a large and active Atlantic menhaden processing fishery. The importance of this fishery diminished during the early to mid-1900s and the last processing plant ceased operations in 1969. From 1950-1969, menhaden harvest in New York averaged over 70 million pounds a year. From 1970 to present the menhaden fishery in New York has primarily been for local bait.

Many permit types in New York allow for the harvest of menhaden, although the only permit type requiring mandatory reporting of menhaden landings prior to 2009 was the menhaden purse seine license. New York implemented mandatory reporting on state trip reports for all permit holders between 2009 and 2011. However, compliance monitoring was not performed until 2013 due to staffing and funding constraints. In addition, discussions with permit holders post compliance monitoring indicated that many were unaware menhaden bait harvest needed to be reported. Thus, the validity of New York's menhaden landings history is of concern due to the significant under reporting of landings prior to 2013.

A previous effort to establish a more accurate landings history in New York occurred in 2013. Letters were sent to permit holders eligible to harvest menhaden between 2009 and 2012 requesting verifiable proof of landings during that time. Acceptable proof of landings included dated receipts, log book records, or trip reports that were not submitted to the state. Only five people were able to provide verifiable landings. While this process helped collect some of the missing information in our landings history, it still left New York with historical harvest data that does not represent the totality of our menhaden fishery during that time.

The current allocation system employed in Amendment 2 divides the TAC to each state/jurisdiction based on average landings between 2009 and 2011. This provides New York 0.055% of the TAC. The current allocation options proposed in the Public Information Document for Amendment 3 cover the time period during which New York's menhaden landings history is incomplete (1985-2012) and when our landings have been constrained by quotas and harvest limits (2013-2016) implemented in Amendment 2. The use of this information to set future quotas will continue to negatively impact New York menhaden fishers by setting quota limits well below true historical harvest levels in New York.

In order to provide a better estimate of our landings history, we compared landings and effort in the years prior to our compliance program (2009-2012) to post initiation of the program (2013-2016) (Table 1). The average annual menhaden reported landings were 315,610 lbs in 2009 - 2012, while average annual reported landings were 1,230,027 lbs in 2013 - 2016. The average yearly number of reported trips taken to harvest menhaden was 162 in 2009-2012, and 912 in 2013-2016. These values were used to determine the amount that reported landings and effort increased after compliance measures were in place.

Average Annual Landings			Average Annual Number of Trips	
2009-2012	315,610		2009-2012	162
2013-2016	1,230,027		2013-2016	912
Increase	2.90		Increase	4.62

Table 1. Average annual landings and effort pre (2009-2012) and post (2013-2016) initiation of New York's compliance program.

It was then assumed that during the years in which reporting was poor, prior to the beginning of our compliance program, landings were severely underreported. The landings multiplier (2.9) is assumed to be a low estimate of how much higher New York's landings were in the past, given that our landings in 2013-2016 occurred under Amendment 2 quotas/trip limits. In the same way, during 1985-2012 when there were no restrictions on menhaden harvest, it is probable that effort was at least 462% higher than reported based upon reporting levels from 2013-2016. For this reason, the effort multiplier (4.62) serves as a higher estimate of where New York's landings may have been during this time period. We present three time series of recalibrated landings in New York from 1985-2012; a low adjusted estimate (2.9 times our current landings), a higher adjusted estimate (4.62 times our current landings), and an average of the two (3.76 times our current landings), in order to account for the unreported landings during this time period (Table 2). In all three cases, these multipliers are still confounded by the limitations imposed by Amendment 2 and may represent underestimates.

	NY Landings		Adjusted Landings (Low-2.9)	Adjusted Landings (Higher-4.62)	Adjusted Landings (Average-3.76)
1985	901,800		2,612,786	4,167,178	3,389,982
1986	399,650		1,157,906	1,846,765	1,502,335
1987	206,795		599,147	955,590	777,369
1988	504,100		1,460,529	2,329,424	1,894,976
1989	449,100		1,301,178	2,075,271	1,688,224
1990	649,710		1,882,405	3,002,281	2,442,343
1991	650,150		1,883,680	3,004,314	2,443,997
1992	1,131,701		3,278,878	5,229,540	4,254,209
1993	1,048,993		3,039,248	4,847,350	3,943,299
1994	961,474		2,785,679	4,442,928	3,614,304
1995	1,087,978		3,152,199	5,027,498	4,089,848
1996	11,135		32,261	51,454	41,858
1997	553,953		1,604,968	2,559,792	2,082,380
1998	430,084		1,246,083	1,987,399	1,616,741
1999	242,886		703,714	1,122,365	913,040
2000	565,800		1,639,293	2,614,537	2,126,915
2001	576,426		1,670,079	2,663,639	2,166,859
2002	444,739		1,288,543	2,055,119	1,671,831
2003	384,875		1,115,099	1,778,490	1,446,794
2004	543,481		1,574,628	2,511,401	2,043,015
2005	871,081		2,523,783	4,025,226	3,274,505
2006	811,934		2,352,417	3,751,911	3,052,164
2007	483,557		1,401,010	2,234,495	1,817,753
2008	410,121		1,188,244	1,895,151	1,541,697
2009	330,496		957,546	1,527,207	1,242,377
2010	394,556		1,143,147	1,823,226	1,483,186
2011	279,117		808,686	1,289,787	1,049,236
2012	258,271		748,289	1,193,459	970,874
2013	1,187,525		1,187,525	1,187,525	1,187,525
2014	825,549		825,549	825,549	825,549
2015	1,467,861		1,467,861	1,467,861	1,467,861
2016	1,439,173		1,439,173	1,439,173	1,439,173
Average	640,752		1,564,735	2,404,153	1,984,444

Table 2. Current landings in New York and the values adjusted by the low, higher, and average multipliers.

In table 3, we show what our initial Amendment 2 quota would have been under each of the adjusted landings scenarios. In all cases, the quota New York would have received is more in line with our average total harvest of 1,230,027 pounds between 2013 and 2016. This is especially true for the higher and average scenarios, where our quota would have been 1,237,392 pounds, and 1,006,613 pounds respectively.

	Low Adjusted Landings	Higher Adjusted Landings	Average Adjusted Landings
2009-2011 Average Landings	969,793	1,546,740	1,258,267
20% Reduction (Amendment 2)	193,959	309,348	251,653
Quota	775,834	1,237,392	1,006,613

Table 3. New York's Initial Amendment 2 quota based on the low, higher, and average adjusted landings.

We believe that these scenarios provide a more realistic representation of the historical menhaden landings in New York, given the limitations of historical reporting.

Stony Brook University

School of Marine and Atmospheric Sciences

Dr. Ellen Pikitch
Discovery Hall, 167
Stony Brook University
Stony Brook, NY 11794
Email: ellen.pikitch@stonybrook.edu

To: Douglas Grout, Commission Chair
Robert Beal, Executive Director
Bob Ballou, Menhaden Management Board Chair
Megan Ware, Menhaden FMP Coordinator
Shanna Madsen, Fisheries Science Coordinator
Matt Cieri, Member, Atlantic Menhaden Technical Committee
Jason McNamee, Chair, Atlantic Menhaden Technical Committee
Atlantic States Marine Fisheries Commission

From: Ellen Pikitch on behalf of the Lenfest Forage Fish Task Force

Date: May 1, 2017

Subject: For the Public Record

Thanks again to those of you who participated in the call with me, Tim Essington and Edward Houde of the Lenfest Forage Fish Task Force, and the ASMFC BERP WG last week. We sincerely hope that dialogue was useful as you move forward management of menhaden within an ecosystem context. If you were on that call you might also have heard mention during the public comment period of the recent paper by Hilborn et al. in Fisheries Research. We also note that consideration of the Hilborn et al. paper is on the agenda of the ASMFS Spring Meeting scheduled for 9 May 2017, 3:30-5:45 pm (http://www.asmfc.org/home/2017-spring-meeting).

The 13 members of the Lenfest Forage Fish Task Force have written a response to the Hilborn et al. paper and associated materials that accompanies this letter and is attached. This statement discusses some of the striking misrepresentations of our work as well as some of the shortcomings of the Hilborn et al. paper itself. We are also preparing a more detailed technical response.

We hereby submit this letter and the accompanying statement[1] as a public comment for the Commission's upcoming meeting, in particular the agenda item considering the Hilborn et al. paper for technical review. The statement is attached, and publicly available at
[http://oceanconservationscience.org/media/2017/nr_2017.05.01.shtml]

We believe any review of the Hilborn et al. paper should consider the technical shortcomings we raise in the attached. Please feel free to reach out to me directly if you have any questions.

[1] Correcting the record on forage fish and their predators: A response from the Lenfest Forage Fish Task Force to recent publications, May 1, 2017

Correcting the record on forage fish and their predators

A response from the Lenfest Forage Fish Task Force to recent publications

May 1, 2017

Five years ago, we authored the report *Little Fish, Big Impact*, which included a suite of recommendations for the management of forage fish. The goal of our group, the Lenfest Forage Fish Task Force, was to bring attention to these important species and to provide recommendations for their sustainable management.

We are pleased to see that others continue to study forage fish and to reach conclusions similar to ours, including a recent publication by Ray Hilborn and others in *Fisheries Research* (Hilborn et al. 2017). That paper recommended, as we did, that fisheries management be tailored to individual species and ecosystems where possible. Our Task Force also went a step further, providing general advice for situations when information is insufficient for a tailored approach. We urged that this advice be used as an interim measure, in light of strong evidence that existing management approaches are not designed to take into account the variability in forage fish stocks, their unusual life-history characteristics, and the role they play in the ecosystem.

It is this general advice that the Hilborn et al. study took issue with. We are disappointed to see that it did so by mischaracterizing our work in several places and presenting technically questionable analyses. Moreover, there were a number of misleading and verifiably false statements in a video and press release associated with the study.

We feel compelled to correct the record promptly with the statement below, which addresses some of the worst falsehoods and examples of mischaracterization. We plan to address the many additional shortcomings of the paper in a separate publication.

Mischaracterizations in the press release and video

One of the obviously false statements in the press release is that our report "recommended slashing forage fish catch rates by 50 to 80 percent." In fact, we recommended reducing fishing *mortality*, not catch rates, an important distinction. And we recommended reductions of 25 to 50 percent relative to F_{MSY}, not 50 to 80 percent. This recommendation was part of a more detailed set of recommendations, which the materials did not acknowledge.

Another false statement in the video was that we concluded "that predators rise and fall with their prey populations as a generality." Our report contains many nuanced statements about the evidence for a strong link between forage and predator abundance, but none as simplistic as this quote.

The press release and video also seriously mischaracterize our work. For example, one of the study authors stated the following in the video:

> The Lenfest conclusion that forage fish fisheries can only be managed successfully to sustain predators as well as the forage fishery by very precautionary policies and reduced harvesting is not based on any fact. It's based on model predictions, on running alternative scenarios on models that we now understand have been fundamentally flawed.

The implication here is that if a conclusion is based on modeling, it has no sound basis. This is incorrect because this type of modeling uses empirical data and biological knowledge to construct a coherent picture of a species or system. It is generally accepted that all models have weaknesses, but when used with caution and good information, can provide a useful representation of a system. We are aware of the published critiques of the Ecopath with Ecosim (EwE) model, but we do not share the belief that it was not suitable for our purpose. We chose this modeling framework because it helped us to survey a large number of ecosystems and arrive at a reasonable approach for places where there is not yet enough data to tailor management of the system.

Moreover, our recommendations were not based exclusively on the output of a single type of model. We also relied on detailed case studies, analysis of the real-world impacts of various harvest strategies, and a comprehensive review of the literature on forage fish and their predators. One of the other modeling studies we considered (Smith et al. 2011), employed several different kinds of ecosystem models, including EwE, and came to similar conclusions about the need to greatly lower fishing mortality rates relative to F_{MSY}, a common fisheries benchmark, to sustain forage fish fisheries. Finally, we relied on empirical data suggesting global patterns that can be used as interim rules for management, such as the finding that successful seabird breeding requires forage fish abundance to be at least one-third of its long-term maximum (Cury et al. 2011). We based our recommendations on these multiple, independent lines of evidence, which the Hilborn et al. study does not acknowledge.

It should be noted that single-species models and simple predator-prey models also have limitations and uncertainties. They can yield unreliable predictions because they do not account for the full suite of complex ecosystem interactions. The Hilborn et al. study is therefore a contribution to an active area of research, not conclusive evidence that "reductions in fishing mortality rate would benefit predators less than argued by Pikitch et al. (2012)".

Our last example is the following statement by one of the authors in the video:

> What we found is there was essentially no relationship between how many forage fish there are in the ocean and how well predators do in terms of whether the populations increase or decrease.

This is a misleading overstatement of the Hilborn et al. study's findings because it asserts that the authors have proven a negative. This study only adds one piece of evidence to a large body of literature, much of which contradicts their paper. For example, empirical studies have already demonstrated a strong connection between forage fish and the abundance of predators in southern Africa, Norway, Peru, and Antarctica (the species in the last example is krill, which is not a fish but fits our definition of a forage species). Others trace the link between forage abundance and breeding success, both through field data (e.g. Boersma & Rebstock 2009) and global analysis of existing data (Cury et al. 2011).

When studies come into conflict, the scientific community does not blindly accept the most recent. Instead, it investigates the reasons for the discrepancy. We were surprised at the sweeping assertion in the statement above, given that there is a large body of evidence that supports the finding that dependent predators are strongly impacted by the abundance of their forage fish prey.

Shortcomings of the Hilborn et al. study

We now turn to five of the numerous shortcomings of the Hilborn et al. study itself. First, the study makes broad claims about the adequacy of our advice for **forage fish** management, yet six of the 11 species in its empirical analysis (Pacific hake, chub mackerel, Atlantic mackerel, and three squids) do not meet the definition of "forage fish" that we used in our 2012 report. While our definition is now in common use, we do not claim that it is the only correct one, only that one needs to pay attention to such things when making comparisons.

Second, the study used estimated population levels generated by stock assessment models to identify correlations between predators and prey. Yet, the models that generated these estimates were not designed for this purpose. In effect, the rigor and attention to detail demonstrated in their examination of ecosystem models was not applied to these models.

Third, the Hilborn et al. study only used examples from U.S. fisheries, which they note are among the best managed in the world. It therefore ignores major systems where forage fish have been demonstrated to play an important role, including large upwelling systems such as the Humboldt and Benguela systems, and Antarctic ecosystems.

Fourth, the study looked across food webs with very different levels of predator dependency on individual prey items and concluded that there was no strong dependency overall. This ignores the results of our report and other studies, such as Smith et al. (2011), showing that dependencies are strong in some food webs and weaker in others. To conclude that fishery management need not change because dependencies are not always strong is faulty reasoning.

Fifth, Hilborn et al. mischaracterized a paper by two of us (Essington & Plagányi, 2013). That paper addressed "recycled" models, which are designed for one purpose but used for another. Hilborn et al. incorrectly presented this paper as a blanket rejection of "recycling," when in fact it is a guide on how to do it thoughtfully. The Task Force did in fact proceed thoughtfully in its use of models, for example by considering the potential distorting effects of aggregating species groups.

A path forward

One point of agreement between us and the Hilborn et al. authors is that more information about individual systems can enable better management. In the five years since our Task Force, the Lenfest Ocean Program has sought to provide this information through numerous grants focused on forage fish, and by sponsoring a second Task Force that also included one of the Hilborn et al. co-authors (Essington et al. 2016). Past experience (e.g. Worm et al. 2009) has shown that scientists can make progress toward resolving disagreements through a process of open-minded collaboration.

Given the important role of forage fish from ecological, economic, and social perspectives, we welcome advances in improving management of these species, and our Lenfest team continues to support our default recommendations in situations where detailed information is lacking.

References

Boersma, P. D., and Rebstock, G. A. (2009). Foraging distance affects reproductive success in Magellanic penguins. *Marine Ecology Progress Series, 375*, 263–275.

Cury, P. M., Boyd, I. L., Bonhommeau, S., Anker-Nilssen, T., Crawford, R. J., Furness, R. W., Mills, J. A., Murphy, E. J., Österblom, H. Paleczny, M., Piatt, J. F., Roux, J. P., Shannon, L., & Sydeman, W. J. (2011). Global seabird response to forage fish depletion—one-third for the birds. *Science*, *334*(6063), 1703-1706.

Essington, T.E., Levin, P.S., Marshall, K.N., Koehn, L., Anderson, L.G., Bundy, A., Carothers, C., Coleman, F.C., Grabowski, J.H., Gerber, L.R., Houde, E.D., Jensen, O.P., Mollmann, C., Rose, K., Sanchirico, J.N. & Smith, A.D.M. (2016). *Building Effective Fishery Ecosystem Plans: A Report from the Lenfest Fishery Ecosystem Task Force*. Lenfest Ocean Program, Washington, D.C.

Essington, T. E., & Plagányi, É. E. (2013). Pitfalls and guidelines for "recycling" models for ecosystem-based fisheries management: evaluating model suitability for forage fish fisheries. *ICES Journal of Marine Science: Journal du Conseil*, fst047.

Hilborn, R., Amoroso, R. O., Bogazzi, E., Jensen, O. P., Parma, A. M., Szuwalski, C., & Walters, C. J. (2017). When does fishing forage species affect their predators? *Fisheries Research*.

Pikitch, E., Boersma, P.D., Boyd, I.L., Conover, D.O., Cury, P., Essington, T., Heppell, S.S., Houde, E.D., Mangel, M., Pauly, D., Plagányi, É., Sainsbury, K., and Steneck, R.S. 2012. *Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs*. Lenfest Ocean Program. Washington, DC. 108 pp.

Smith, A. D., Brown, C. J., Bulman, C. M., Fulton, E. A., Johnson, P., Kaplan, I. C., Lozano-Montes, H., Mackinson, S., Marzloff, M., Shannon, L. J., Shin, Y. J., & Tam, J. (2011). Impacts of fishing low–trophic level species on marine ecosystems. *Science*, *333*(6046), 1147-1150.

Worm, B., Hilborn, R., Baum, J. K., Branch, T. A., Collie, J. S., Costello, C., Fogarty, M. J., Fulton, E. A., Hutchings, J. A., Jennings, S., Jensen, O. P., Lotze, H. K., Mace, P. M., McClanahan, T. R., Minto, C., Palumbi, S. R., Parma, A. M., Ricard, D., Rosenberg, A. A., Watson, R., & Zeller, D. (2009). Rebuilding global fisheries. S*cience*, *325*(5940), 578-585.

Task Force members

Ellen Pikitch
Chair of the Task Force
Professor and Executive Director
Institute for Ocean Conservation Science
Stony Brook University
ellen.pikitch@stonybrook.edu

David O. Conover
Vice President for Research and Innovation
University of Oregon
dconover@uoregon.edu

Dee Boersma
Director, Center for Ecosystem Sentinels
Wadsworth Endowed Chair in Conservation Science
University of Washington
boersma@u.washington.edu

Ian Boyd
Professor in Biology
University of St. Andrews
Chief Scientific Adviser at the UK Department of Environment, Food and Rural Affairs
ilb@st-andrews.ac.uk

Philippe Cury
Senior Scientist
Institut de Recherche pour le développement, France
Philippe.cury@ird.fr

Tim Essington
Professor
School of Fisheries and Aquatic Sciences
University of Washington
essing@uw.edu

Selina Heppell
Department Head, Professor of Fisheries
Department of Fisheries and Wildlife
Oregon State University
selina.heppell@oregonstate.edu

Edward Houde
Professor Emeritus
University of Maryland Center for Environmental Science
Chesapeake Biological Laboratory
ehoude@umces.edu

Marc Mangel
Director
Center for Stock Assessment Research
Distinguished Research Professor of Mathematical Biology
University of California, Santa Cruz
msmangel@ucsc.edu

Daniel Pauly
UBC Killiam Professor
Fisheries Centre
University of British Columbia
Canada
d.pauly@oceans.ubc.ca

Eva Plaganyi
Principal Research Scientist
CSIRO Oceans & Atmosphere
Australia
Eva.Plaganyi-Lloyd@csiro.au

Keith Sainsbury
Director
SainSolutions Pty Ltd
Professor, Marine System Management
Institute of Marine and Antarctic Science
University of Tasmania

Bob Steneck
Professor of Marine Sciences
University of Maine
School of Marine Sciences
steneck@maine.edu

OMEGA PROTEIN
Healthy Products for a Healthy World

Via Electronic Mail
Robert Ballou
Chair, Menhaden Management Board
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200 A-N
Arlington, VA 22201

RE: Amendment 3 Allocation Options

Dear Chairman Ballou:

At its upcoming meeting on May 9, 2017, the Atlantic Menhaden Management Board will review the status of Amendment 3 to the Interstate Fishery Management Plan ("ISFMP") for Atlantic Menhaden. Currently, the document contains an unwieldy number of reallocation options. Omega Protein encourages the Board to begin paring back alternatives, specifically by eliminating Option B, which allocates every state a minimum amount of quota. We also make recommendations for a few refinements to existing options.

While it is easy to see why, at least in the short run, the minimum allocation option is attractive to some. It grants low-quota states with active fisheries and high local abundance allocations several orders of magnitude higher than currently. In some cases, states would have their allocations increased by hundreds or even thousands of percent. Those without fisheries, such as Georgia, Pennsylvania, and South Carolina, or other *de minimis* states, like Florida and New Hampshire, would receive millions of pounds of quota that could be traded.

As a matter of principle, however, this option places the entire burden of conserving the menhaden resource on, at most, three states: Virginia, New Jersey, and, potentially, Maryland. This is contrary to ISFMP Charter's requirement that "[c]onservation programs and management measures shall be designed to achieve equivalent management results throughout the range of a stock or subgroups of that stock." ISFMP Charter, Section Six(a)(3). Wisely, the Board soundly rejected a similar proposal during its deliberations over Amendment 2, analogizing it to all states running up a bar tab and sticking one state with the entire bill.

Nor would such a precedent bode well for future difficult allocation decisions the Board will face. Establishing the principle that a simple majority can benefit at the expense of the minority would undermine the cooperative management system created by the Compact and Charter.

Only a handful of low-allocation states have both high current abundance and an active fishery interested in expanding. These include Rhode Island, New York, and Maryland. Maine remains a special case because traditionally it only periodically has menhaden in its near shore waters available for harvest. In Maine, abundance is truly episodic.

The most effective way to help these states is to start by restoring catch levels to the Amendment 2 baseline of 212,500 metric tons ("mt") from which the original 20 percent reduction was taken. This is consistent with current stock abundance and the fact that the stock has not experienced overfishing or been overfished for decades.

When the Atlantic States Marine Fisheries Commission reallocated spiny dogfish quota, it was done with concurrence of "donor" states like Virginia. In the same vein, Omega Protein is willing to take a lower allocation, but only once the stock has recovered to the point that the Board believes the Amendment 2 harvest reductions are no longer required. This is Option H in the document. The alternative allocation system would only be applied to additional quota above the 212,500 mt baseline. Option H represents a fair and equitable means of achieving reallocation while ensuring equal conservation results throughout the stock's range.

Finally, we would note that if, as appears likely, the Board chooses to change the years (currently 2009-2011) on which allocations are based, Virginia's share will be reduced. Thus, changing the base period alone will effectuate a measure of reallocation away from the state's historic share.

Given problems that have arisen with the quality of data going back to the 1980s and 1990s, coupled with the confounding effects of states that previously had reduction fisheries, the Plan Development Team recently discussed looking at the more recent period, post-2005 when the Beaufort Fisheries plant in North Carolina closed, as a potential new option. The period going back to 2006 has the advantage of better reporting (required by Amendment 1 in 2001). It also includes a series of years with high abundance throughout New England. For instance, in 2008, Maine landed over 4 million pounds of menhaden. It is thus worth considering replacing options that extend back before Amendment 1 with ones that begin at 2006.

In summary, Omega Protein urges the Board to reject the minimum allocation options; replace the allocation timeframe alternatives that include older years with two alternatives, 2006-2012 and 2006-2016, that better reflect the modern fishery; and consider adding our proposed alternatives (attached hereto with detailed justification) as Option H for analysis in the Amendment 3 public hearing draft.

Thank you very much for your time and attention to these comments. We will be on hand at the meeting to answer any questions you may have.

Sincerely,

Ben Landry
Director of Public Affairs,
Omega Protein Corporation

I. Quota Allocation (PID Issue 2) – The Board Should Chose Option H

Omega Protein understands fishermen's frustration with low allocations at a time when the stock is as abundant as it has been in decades. The Amendment 2 allocation system, however, was based on actual landings during a period when there was no constraint on catch or participation (save for decisions by some states to restrict use of efficient gear such as purse seines). Use of more recent years also avoids distortions in landings patterns that resulted from past reduction fisheries in states such as Maine, Massachusetts, Rhode Island, North Carolina, and Florida that have long since ceased.

Allocation based on current and recent historical participation is the most common and equitable approach utilized by the Commission and federal managers when a decision is made to restrict harvest. The main problem, as revealed both by the 2015 benchmark stock assessment and the volume of fish present coastwide, is that the decision to reduce landings came at a time when adult menhaden abundance was at its highest sustained level in the entire fifty-plus year time series. This is especially true in New England waters, including the Gulf of Maine where menhaden have moved inshore this year in numbers not seen since 2008.

While Omega Protein believes that the menhaden stock's condition warrants a return to at least the 2012 landings level of just under 225,000 mt, the Board has determined that landings should be maintained at levels below the Amendment 2 baseline. It thus appears the Board believes the Atlantic menhaden stock still requires conservation. In order to effectuate this conservation program, each state has taken the same proportionate catch reduction from the same baseline. This approach is consistent with standards governing management under an ISFMP.[4]

By contrast, TAC reallocation from states that had greater recent participation, such as Virginia and New Jersey, would foist the entire burden of conservation on only a few (or one) state. Historical bait and reduction fishermen in the "donor" states would see their harvest further reduced to allow new participants into the fishery in others. This outcome is neither fair nor equitable. Such an action would be an unprincipled act of majoritarianism.

For these reasons, Omega Protein can support reallocation only when every state is made whole from the cuts each endured under Amendment 2. This is the intent of Option H. Under this alternative, a greater share of menhaden TAC will go to states wishing increase participation when the stock is deemed to be healthy enough to sustain harvest levels above the Amendment 2 baseline.

As explained below, Omega Protein is willing to see its allowable harvest grow at a slower rate to allow increased participation by others, but only once this threshold is passed. It should not, however, be required to bear the entire burden of conservation. Omega Protein is entirely dependent on the menhaden resource. Nearly every other participant has access to other fisheries.

---

[4] *See, e.g.,* ISFMP Charter, Section Six(a)(3) ("Conservation programs and management measures shall be designed to achieve equivalent management results throughout the range of a stock or subgroups of that stock."); *see also id.* § (8)(ii) ("Fishery resources shall be fairly and equitably allocated or assigned among the states.").

Under the alternative allocation option presented below, Omega Protein would see its share of the fishery grow more slowly so that other states may take advantage of increased amounts of menhaden in their waters when they are present. Following that is a discussion of the states' performance under the current quota system. Finally, we provide suggest language to implement this alternative, including possible options for distributing the additional TAC among other jurisdictions.

A. Proposed Alternative for Reallocation When TACs Exceed 212,500 mt

Under this alternative, each state would be granted a base share of the annual TAC based on the formula established through Amendment 2. So long as the coast-wide TAC is at or below 212,500 mt, each state would be granted that proportion of the TAC commensurate with its share, as currently. When the TAC exceeds this baseline catch level, however, each state other than Virginia would continue to receive the same proportion of the quota plus, potentially, additional quota. Options for distributing this reallocated quota are presented below.

As to Virginia, it would receive 85.32% of the first 212,500 mt and just 50% of any coast-wide TAC above that amount.

This approach results in a slower expansion of the reduction sector when the menhaden stock is at high levels in order to allow for increased fishing opportunities for bait fishermen.[5] Another advantage of this approach is its consistency with the fact that menhaden expand their range when at higher abundances. Currently, as back in the 1980s when the striped bass population crash led to an abundant menhaden stock, there are more menhaden (at least as reflected in catches and anecdotal reports) in the northern and southern ranges than over most of the past two decades. Commensurately, however, the proposed alternative also ensures each jurisdiction contributes equally to menhaden conservation whenever, as currently, the Board determines that such conservation is necessary.

B. Distribution Options

The second level of allocation decisions is how to distribute the additional TAC available when the quota is greater than 212,500 among states interested in increasing harvest. We first discuss the current performance of the states relative to their allocation under Amendment 2, along with their historic participation in the fishery. We then present suggested options for reallocation.

1. *States' Use of Current Quota and Likely Future needs*

It does not appear that the southern states would benefit from reallocation. North Carolina has only harvested about half of its allocation since the adoption of Amendment 2. Neither South Carolina nor Georgia have a menhaden fishery. Florida's small gear fishery appears to operate entirely under the "bycatch" exemption. Florida's quota has not been constraining, with recent catch levels two to three times greater than its allocation. This state would only be meaningfully

[5] The Virginia General Assembly would determine the allocation as among the reduction and various bait fisheries within the state, as it does now. Omega Protein would advocate to have the Virginia bait sector quota increase at the same rate as in other states.

affected if the Board were to change the bycatch allowance in a manner that adversely impacts Florida's small gear fishery.

As to New England, availability of menhaden tends to be sporadic. It is the adult fish (generally age 4 and up) that seasonally inhabit these waters. It has long been established that menhaden migrate north during the spring and summer, segregating by age, with the oldest fish moving furthest northward. When, as currently, the population of older fish is high, menhaden abundance throughout New England increases. This historical pattern supports a higher allocation to New England states when menhaden abundance is high so long as the TAC itself grows in conjunction with population increases.

As to the individual states, Maine is in a unique situation. Situated at the extreme northern end of the stock's range, Maine only sporadically has menhaden in its coastal waters. When they do arrive, as they have this year, however, Maine's landings can be substantial. In most years, however, landings are low or nonexistent.[6] It is for this reason that the state's representatives advocated for the creation of the episodic event set-aside. However, Maine may be disadvantaged as the southern New England states, particularly Rhode Island, can take a significant portion of the set-aside before the fish reach Maine's waters. Maine may thus be best served by an episodic event set-aside specific to the Gulf of Maine, one available only for landings in Maine. The unused portion could roll-back to the other states if not utilized by a fixed date.

New Hampshire lacks a substantial fishery. Massachusetts landings mostly are from Narragansett Bay. It has not fully caught its allocation since Amendment 2, but landings have increased each year since 2013. There is likely room for expansion of the fishery in the state when menhaden are abundant in places like Buzzards Bay, Boston Harbor, and Ipswich Bay. Nonetheless, Massachusetts' needs can likely be met through its current allocation and the existing episodic event set-aside. The same is likely true of Connecticut which never had a substantial fishery.

Rhode Island and New York each desire a substantial increase in harvest opportunities over recent history. From 1985 to 2012, New York averaged landings of just under 558,000 pounds. Since the twenty percent cut imposed by Amendment 2 came into effect, New York's catch has averaged 1.2 million pounds, or double its historical landings over the prior twenty-seven years. Its catches since 2013 are four to nearly six-and-a-half times New York's menhaden allocation.

For its part, Rhode Island had a substantial fishery from 1985 to 1995, with average landings of 9.4 million pounds per year. With the end of local reduction processing, its landings dropped dramatically to 66,000 pounds per year up through 2012. This decline may be partially attributable to decreased local availability. Management actions, however, have also contributed to this

[6] An exception to this was during the 1980s and into the early 1990s when Maine had a consistently robust reduction fishery. This sustained period of high menhaden abundance coincided with a dramatic reduction in the striped bass population. This depletion was so severe that a federal moratorium on striped bass harvest was imposed in in 1984. As the striped bass population increased, the menhaden population decreased even as menhaden catches declined significantly. There is also a possibility that sustained high levels of catch of older menhaden in New England waters adversely impacted the population by disproportionately reducing fecundity at a given level of fishing mortality. From 1985 through 1993, catches from Connecticut to Maine averaged 30.4 million pounds per year. From 1994 to 2012, the average was only 3.1 million pounds.

reduction. The Narragansett Bay menhaden fishery has been the subject of great controversy, much as has the Chesapeake Bay fishery. As a result of advocacy by sports fishermen and environmentalists, the state imposed a cap on harvest in the Bay in 2007. As a result of this management program, it is highly unlikely that landings could ever achieve the levels of the early period. (It should be noted that most of menhaden landed in Massachusetts come from Narragansett Bay and count against the cap.) Since Amendment 2, however, Rhode Island has raised its landings substantially through its participation in the episodic event fishery. In 2015, Rhode Island landed 1.8 million pounds, but the nearly 3 million pounds landed in Massachusetts likely came mostly from the Narragansett Bay, as well.

Over the entire time series, Virginia and New Jersey were often the top two states in terms of bait landings. Average catches in New Jersey from 1985 to 2009 were 22.9 million pounds. Thereafter, however, fishermen in this state increased their bait harvest substantially. New Jersey landings totaled 50.5 million pounds in 2010, 74.3 million in, 2011 and 85.5 million in 2012. Its 2017 quota is 48.8 million pounds, which is more than twice the state's average catch prior to 2010, but is over forty percent lower than New Jersey's 2012 landings. New Jersey's purse seine sector, like that of Virginia, has stayed within its sub-allocation.

Maryland's landings under Amendment 2 have been about equal to the state's average harvest during the baseline period, or just over 7 million pounds per year. This is due to harvests made by pound net fishermen under the bycatch cap. These landings are substantially below Maryland's harvest of 13.7 million pounds in 2012. The same is true of the Potomac River Fishery Commission ("PRFC"), which averaged 2.9 million pounds during the Amendment 2 baseline years and 3 million pounds per year between 2013 and 2015. In 2012, the PRFC's landings were 5.9 million pounds.

Finally, Virginia has met its Amendment 2 target in each year save for a one percent overage in 2014. The fixed gear component of the bait fishery had a slight overage that year, but nothing on the order of the other Chesapeake Bay fisheries. Meanwhile, the reduction fishery and snapper rig sector have operated within their limits.

To sum up, six states – Rhode Island, New York, Delaware, Maryland, PRFC, and Florida – have averaged landings above their respective Amendment 2 allocations. New Jersey and Virginia have landed their allocations, while (of states with a fairly substantial quota), Massachusetts and North Carolina each have "underfished" their allocations by fifteen to seventy-five percent, depending on the year.

2. *Allocation/Reallocation Options*

With that discussion, we present several alternatives for distributing TAC reallocated from Virginia when the overall coast-wide quota exceeds the Amendment 2 baseline catch level of 212,500 mt. The simplest approach would be a proportionate redistribution. The plan development team could calculate each state's average share of the catch based on the reference period excluding Virginia's landings. Alternatively, each state (or each state with a fishery) could be given an equal share, or the quota could be given only to states that have fully utilized their Amendment 2 allocation.

Other approaches could utilize elements of other options presented in the Amendment 3 PID, such as use of a regional quota (Option E). For instance, Amendment 2 established a one percent episodic event set-aside. This has been routinely used by Rhode Island fishermen, and this year, too, by Maine. As the availability of fish in Maine's waters are truly "episodic" and Rhode Island fishermen wish for more reliable access to quota, it may make sense to reduce the set-aside to one-half percent and to grant that to Maine (along with the current "roll-back" provision if unused).

The other half percent could be rolled into the other New England states' quotas. Perhaps, though, a better approach would be to create a New England regional quota, similar to that used under the spiny dogfish FMP. Because the region has administered a similar system, this may be workable and may also provide flexibility for the region's fishermen to better target menhaden when and where they are available.

C. Draft Language for the Amendment 3 Public Hearing Draft

Option H. Allocation Strategy Based on TAC Level

1. **Allocation when the TAC is less than or equal to 212,500 mt:** The average landings for the years 2009–2011 (212,500 mt), from which a 20% reduction was taken in Amendment 2, would serve as the catch level baseline. When the annual, coastwide TAC is at or below 212,500 mt, it would be allocated to jurisdictions based on average landings during 2009–2011 (*i.e.*, the Amendment 2 allocation strategy).

2. **Allocation of any TAC greater than 212,500 mt:** When the TAC exceeds 212,500 mt, Virginia would receive 85.32% of 212,500 mt and 50% any TAC above this amount. Under this formula, there would be 778,453 pounds for each 1,000 metric tons above the baseline catch level available for reallocation. All other states will receive their share of the TAC as determined by the formula set forth in Amendment 2, plus a share of the TAC reallocated from Virginia according to the formula established below.

3. **Alternatives for Redistributing Reallocated Quota:**

   a. **Equal shares among states other than Virginia:** Under this alternative, the extra TAC available for redistribution when the TAC exceeds 212,500 mt would be divided equally among all jurisdictions with a fishery, either in equal shares or proportional to each state's share of the TAC.

   b. **Regional TAC for New England, proportionate reallocation of TAC to States with need**. Under this alternative, the New England states (optionally including New York) would share a common TAC, determined as the sum of shares of each New England state under Amendment 2, pus any additional TAC available if and when the coastal TAC is greater than 212,500 mt. Further, the episodic event set aside of 1 percent would be reduced to 0.5 percent and made available only to Maine. If not used by September 1, it would roll back into the coastal TAC. The other 0.5 percent would be added to the New England TAC. To the extent it is still available, Maine could participate in the common TAC once it has exhausted its set aside.

Reallocated quota when the TAC is greater than 212,500 would be divided among New England, New Jersey, Maryland, and the PRFC, the Virginia bait fishery if the use-based option is chosen. The rationale is that these states have had substantially larger fisheries in the past and have fully utilized their Amendment 2 allocations. Reallocated quota would be divided among these jurisdictions based on the proportion of landings during the baseline period.

c. Set aside 0.75 percent for the Small Capacity Fleet and manage under a soft TAC, allocate/reallocate the remaining TAC according to Alternative a or b above. These small capacity gears (cast net, trawl, trap/pot, haul seine, fyke net, and hook and line) averaged just over three million pounds per year over the Amendment 2 reference period. This option will allow these fleets to continue to operate at or around historic levels, while allowing states to focus enforcement on medium and large capacity gear fleets.

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

TO: Executive Committee

FROM: Robert Beal, Executive Director

DATE: April 25, 2017

SUBJECT: Advisory Panel Members Serving as Board Proxies and Chair Terms Limits

This memo presents two issues for consideration and potential action by the Executive Committee – Commissioner proxies serving on advisory panels (APs) and the term limits for AP chairs. While not common, there have been situations in which individuals who serve as AP members have also been appointed to serve as a Commissioner proxy. Concern has been raised that proxies who also serve as AP members have the potential to influence both Board decisions and AP recommendations based on their participation at both levels. It is has also been unclear at times if an AP member serving as a proxy was representing his personal views or that of the AP. Currently, both the Advisory Committee Charter and the ISFMP Charter are silent on this issue.

The ISFMP Charter does provide the following guidance on the participation of AP Chairs at Board meetings: *Advisory panel chairs should present reports to Boards/Sections and answer any specific questions relevant to their report. Chairs may not ask questions or present their own viewpoints during Board/Section deliberations. If the chair would like to present their own viewpoints, they must go to the public microphone during the public comment portion of the meeting.*

Options for Consideration (more than one may be selected):

Option 1. Once an AP member is assigned as an ongoing proxy, the new proxy must step down from the AP and the state appoint a new AP member.

Option 2. Once an AP member is assigned as a board-specific proxy to a species board for which he serves as an advisor (e.g. American Eel Board/American Eel AP), the new proxy must step down from the AP and the state appoint a new AP member.

Option 3. AP Chairs may not serve as proxies and present an AP report at the same meeting.

Option 4. No restrictions on serving as an AP member and a board proxy. It will be the board chair's responsibility to ensure the proxy is speaking for himself and not claiming to represent the AP position.

Regarding the issue of AP chair term limits, the ISFMP Charter specifies two-year term limits for Board, Technical Committee and AP chairs. Because of the infrequency with which APs meet and the difficulty in getting willing volunteers to serve as AP chairs, this standard has not been applied to AP chairs. The unintended consequence has been that for some APs, the chairs have served for extended periods of time (10 – 20 years). Clearly, the extended term limits of these individuals reflect their passion and commitment to species management and the Commission, as well as the AP's support of their continuing chairmanship. It raises the question, however, as to whether these long chairmanships benefit or detract from the process? Can someone who has been chair of a panel for an extended period of time continue to impartially represent the various viewpoints/interests of the members? Is it fair to expect them to put aside their own interests and that of their state and remain an impartial chair of an AP?

Options for Consideration:

Option 1. Status quo – no limits on term of chairs

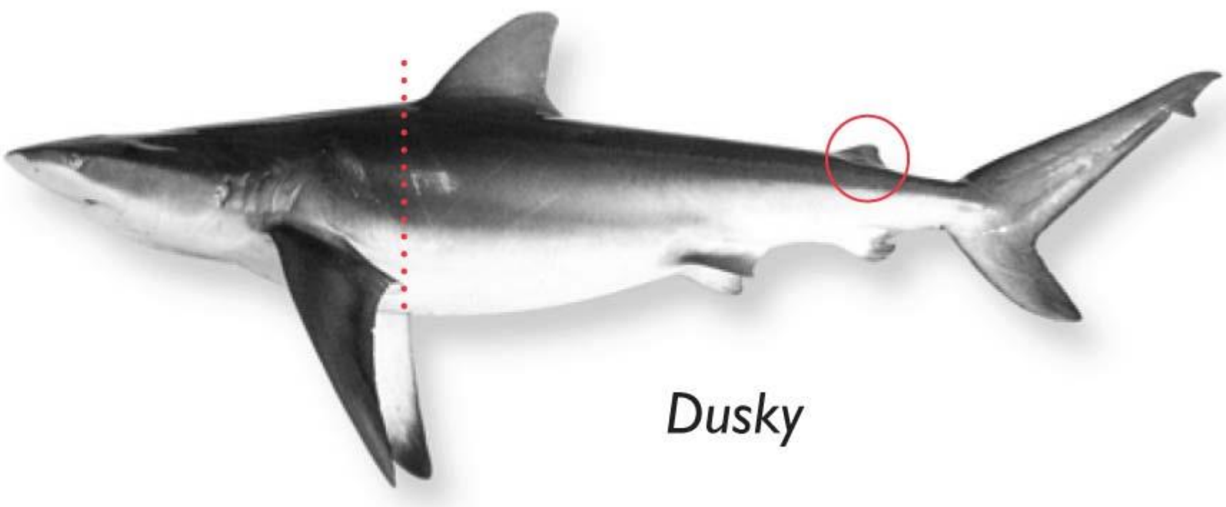
Option 2. Limit chair terms to 4 (or 5) years. The downside of this option is there may not be people who are willing to step into the role of AP chair.

Option 3. Limit chair terms to 2 years, but allow for re-election to extend total term to 4 years. The downside of this option is there may not be people who are willing to step into the role of AP chair.

If some of the above options are adopted, the ISFMP Charter and Advisory Panel Primer will need to be modified to reflect the changes.

Atlantic Highly Migratory Species

Amendment 5b - Dusky Sharks: Final Measures & Implementation



Dusky

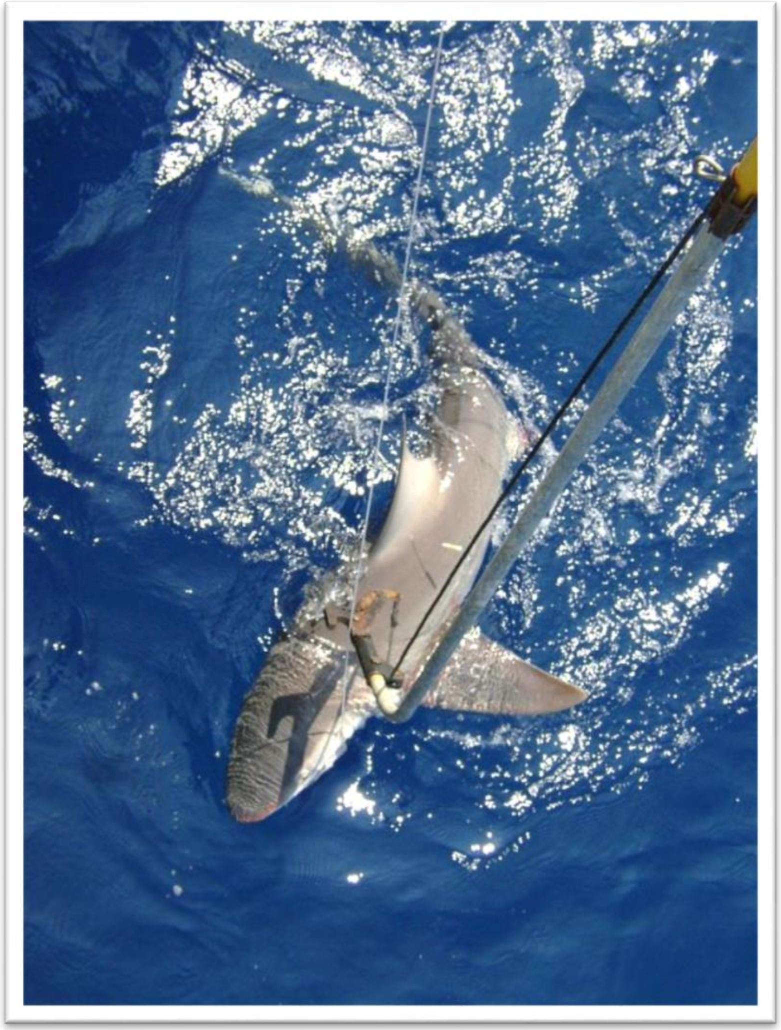
Presented to:

Atlantic States Marine Fisheries Commission

May 2017

Outline

- Brief Background
- Summary of Public Comments
- Final A5b Measures
- Request for Complementary Measures



Brief Background

- SEDAR 21 Stock Assessment Update – July-September 2016
  - Determined dusky sharks were overfished, experiencing overfishing
  - Mortality reduction of 12% needed to end overfishing
  - Mortality reduction of 35% needed to rebuild by 2107 (90 years)
- Proposed Rule published October 18, 2016 (81 FR 71672)
  - Comments accepted through December 22, 2016
  - Public Hearings: RI, NJ, NC, FL, LA, TX, Webinar, Councils, & ASMFC
  - Advisory Panel meeting December 1-2, 2016
  - 76 submissions, including petitions with 32,860 total signatures
- Final EIS released February 24, 2017 – 30-day "review" period
- Final Rule published April 4, 2017 (82 FR 16478)
  - Some measures effective June 5, 2017; remainder January 1, 2018

Summary of Public Comments

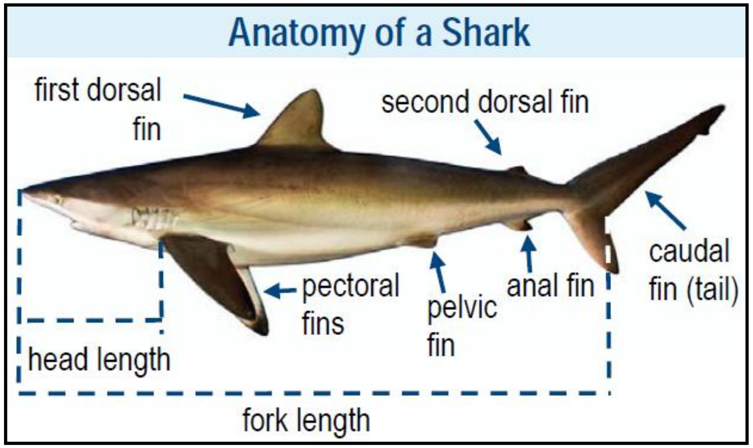
- **Recreational Measures**
  - General support for Shark Endorsement, but should be short, focused on dusky sharks
  - Many comments regarding circle hooks
  - NMFS needs to improve recreational catch estimates of dusky sharks (and other species)

- **Commercial Measures**
  - Cutting PLL gangions less than 3 feet from the hook has safety concerns
  - Concern that 1 nautical mile is not enough distance to reduce bycatch after a dusky interaction
  - Some concern about effectiveness of circle hooks on bottom longline gear

- **Other Comments**
  - Several comments about dusky shark bycatch in non-HMS fisheries, bycatch levels, and what the appropriate ACL should be
  - Support for hotspot closed areas
  - Questions about monitoring effectiveness of the final measures

Final Recreational Measures

- **Alternative A2**: Require HMS permit holders fishing for sharks recreationally to obtain a **shark endorsement**, which requires completion of an online shark identification and fishing regulation training course, in order to retain sharks - **Effective January 1, 2018**
  - Built into permit application/renewal website
  - Educational video (~2 minutes)
    - Dusky (Ridgeback) Shark ID
    - Safe handling and release
    - Circle hook requirements
    - Recreational regulations
  - Quiz (~7 multiple choice questions)
    - Educational tool; Everyone passes
  - Additional recreational outreach materials

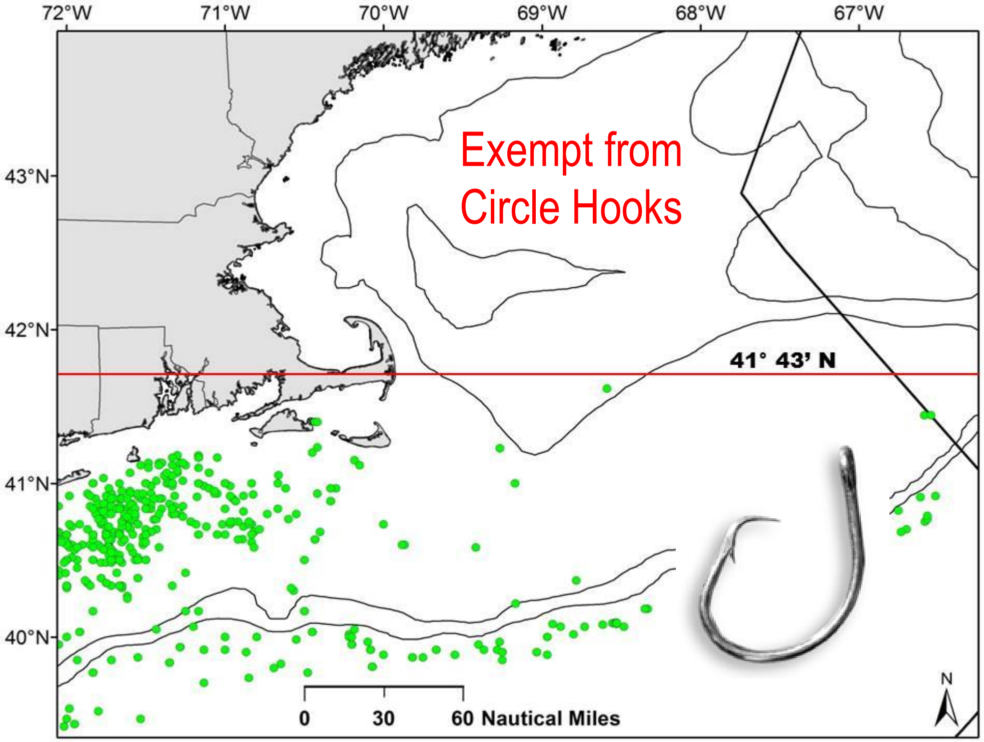


Final Recreational Measures

- **Alternative A6d**: Require the use of non-offset, non-stainless steel circle hooks by all HMS permit holders with a shark endorsement when fishing for sharks recreationally south of 41° 43’ N latitude, except when fishing with flies or artificial lures – **Effective January 1, 2018**

  - Sharks incidentally caught on J-hooks must be released

  - Line-by-line basis for circle hooks



Final Commercial Measures

- **Alternative B3**: Fishermen with an Atlantic shark limited access permit with pelagic longline gear must release all sharks not being retained using a dehooker or by cutting the gangion less than three feet from the hook, *as safely as practicable* – **Effective June 5, 2017**
- **Alternative B5**: Require completion of shark identification and fishing regulation training as a new part of the Safe Handling, Identification, and Release Workshop for vessel owners and operators of a HMS limited access permitted vessel that fishes with pelagic longline, bottom longline, or shark gillnet gear – **Effective June 5, 2017**
- **Alternative B6**: Increase dusky shark outreach and awareness through development of additional commercial fishery outreach materials, and require pelagic longline, bottom longline, and shark gillnet vessels with shark limited access permits to abide by a dusky shark fleet communication and relocation protocol – **Effective June 5, 2017**
- **Alternative B9**: Require the use of circle hooks by all shark directed limited access permit holders using bottom longline gear – **Effective January 1, 2018**

Summary

- The final measures will:
  - End overfishing immediately
  - Achieve mortality reduction target recommended by the stock assessment update to rebuild by 2107

Final Recreational Measures
Alternative A2 Shark Endorsement Training and Quiz – **Effective Jan. 1, 2018**
Alternative A6d Non-offset, non-stainless steel circle hooks for all HMS permit holders with a shark endorsement when fishing for sharks recreationally south of 41° 43' N latitude, except when fishing with flies or artificial lures – **Effective Jan. 1, 2018**

Final Commercial Measures
Alternative B3 Shark limited access permit holders fishing with PLL must release all sharks not being retained using a dehooker or cutting the gangion less than three feet from the hook, as safely as practicable – **Effective June 5, 2017**
Alternative B5 Safe Handling, Identification, and Release Workshops for HMS pelagic longline, bottom longline, and shark gillnet vessel owners and operators – **Effective June 5, 2017**
Alternative B6 Commercial outreach, and require HMS PLL, BLL, and shark gillnet vessels to abide by a dusky shark fleet communication and relocation protocol – **Effective June 5, 2017**
Alternative B9 Require the use of circle hooks by all HMS directed shark permit holders using bottom longline gear – **Effective Jan. 1, 2018**

Annual Catch Limits (ACLs) & Accountability Measures (AMs)

- ACLs and AMs established for all sharks in Amendment 3 (2010)
- Amendment 5b clarifies ACLs and AMs for the 19 prohibited sharks

ACL = 0

Basking *Cetorhinus maximus*	**Dusky** *Carcharhinus obscurus*	**Sand Tiger** *Carcharias taurus*	**Sevengill** *Heptranchias perlo*	**Bigeye Sand Tiger** *Odontaspis noronhai*
Bigeye Thresher *Alopias superciliosus*	**Galapagos** *Carcharhinus galapagensis*	**Whale** *Rhincodon typus*	**Sixgill** *Hexanchus griseus*	**Bigeye Sixgill** *Hexanchus nakamurai*
Bignose *Carcharhinus altimus*	**Longfin Mako** *Isurus paucus*	**White** *Carcharodon carcharias*	**Narrowtooth** *Carcharhinus brachyurus*	**Smalltail** *Carcharhinus porosus*
Caribbean Reef *Carcharhinus perezi*	**Night** *Carcharhinus signatus*	**Atlantic Angel** *Squatina dumeril*	**Caribbean Sharpnose** *Rhizoprionodon porosus*	

Request for Complementary Measures

- Assist with outreach and education; provide links to NOAA Fisheries materials
- Collaborate on development of best practices for the handling and release of sharks when shore and pier fishing
- Consider requiring circle hooks in various state hook and line fisheries (e.g., recreational, short lines, commercial handgear)
- Consider requiring fishermen to maximize gear removal before releasing sharks
- Consider cooperative research with NOAA Fisheries to improve estimates of dusky (and other) sharks caught in state water fisheries – maybe via the shark research fishery

Questions?

For more information go to: http://www.nmfs.noaa.gov/sfa/hms/ or contact Tobey Curtis **tobey.curtis@noaa.gov** or Karyl Brewster-Geisz **karyl.brewster-geisz@noaa.gov** at (301) 427-8503

Atlantic States Marine Fisheries Commission

Summer Flounder, Scup, and Black Sea Bass Management Board and Mid-Atlantic Fishery Management Council

May 10, 2017
1:00 – 5:45 p.m.
Alexandria, 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 *(M. Luisi)* — 1:00 p.m.

2. Board Consent — 1:00 p.m.
   - Approval of Agenda
   - Approval of Proceedings from February 2017

3. Public Comment — 1:05 p.m.

4. Scup Addendum XXIX for Final Approval **Final Action*** (*K. Rootes-Murdy*) — 1:15 p.m.
   - Review Management Alternatives
   - Public Comment Summary
   - Technical Committee Report
   - Advisory Panel Report
   - Consider Final Approval of Addendum XXIX

   **Council will also take action on Scup Framework 10*

5. Review Summer Flounder Draft Comprehensive Amendment Range of Alternatives for Commercial Issues (*K. Rootes-Murdy & K. Dancy*) — 2:00 p.m.

6. Consider 2017 Black Sea Bass Recreational Measures **Final Action** (*K. Rootes-Murdy*) — 3:30 p.m.
   - Review Final 2016 Recreational Black Sea Bass Harvest Estimate
   - Consider Management Response to the Final Harvest Estimate

7. Review White Paper on Potential Experimental Recreational Wave 1 Black Sea Bass Fishery **Possible Final Action*** (*B. Muffley*) **Joint Board and Council Action* — 4:30 p.m.
   - Consider Postponed Motion to Allow Experimental Wave 1 For-hire Fishery

     Motion to allow an experimental 2018 January/February (wave one), recreational, federally permitted for-hire fishery for black sea bass with a 15 fish per person possession limit, a suspended minimum size limit, and a zero discard policy to allow for barotrauma, and a mandatory trip reporting requirement.

The meeting will be held at the Westin Alexandria, 400 Courthouse Square, Alexandria, Virginia; 703.253.8600

8. Review State Compliance with Addendum XXVIII Summer Flounder Recreational Measures for 2017 **Possible Action** — 5:00 p.m.

9. Review White Paper on Summer Flounder Recreational Specifications *(B. Ballou)* — 5:15 p.m.

10. Other Business/Adjourn — 5:45 p.m.

MEETING OVERVIEW

Summer Flounder, Scup, and Black Sea Bass Management Board
and Mid-Atlantic Fishery Management Council Joint Meeting
May 10, 2017
1:00-5:45 p.m.
Alexandria, Virginia

Chair: Mike Luisi (MD) Assumed Chairmanship: 10/15	Technical Committee Chair: Greg Wojcik (CT)	Law Enforcement Committee Representative: Snellbaker (NJ)
Vice Chair: Bob Ballou	Advisory Panel Chair: Vacant	Previous Board Meeting: February 2, 2017
Voting Members: ME, NH, MA, RI, CT, NY, NJ, DE, MD, PRFC, VA, NC, NMFS, USFWS (14 votes for Black Sea Bass; 12 votes for Summer Flounder and Scup)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from February 2, 2017

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. Scup Addendum XXIX for Final Approval (1:15-2:00 p.m.) Final Action*
Background • The Board initiated Draft Addendum XXIX at the December 2016 joint ASMFC/MAFMC Meeting. At the 2017 ASMFC Winter meeting the Draft Addendum was approved by the Board for public comment. (**Briefing Materials**) • The draft addendum proposes management alternatives for the start and end dates of the scup commercial quota periods.
Presentations • Overview of the Draft Addendum and public comment summary by K. Rootes-Murdy (**Briefing Materials**) • Technical Committee Report by G. Wojcik
Board Actions for Consideration • Select management alternative • Approve final document **Council will also take action on Scup Framework 10*

5. Review Summer Flounder Draft Comprehensive Amendment Range of Alternatives for Commercial Issues (2:00-3:30 p.m.)
Background • The Board and Council initiated a comprehensive amendment on summer flounder management in 2014. The amendment was initially intended to reconsider many aspects of the FMP, including goals and objectives, commercial and recreational management strategies, and allocation. • In February, the Board and Council review recreational components of the FMP to determine which items could be dealt with faster through a framework process. The Board and Council agreed to move forward with the amendment focusing on goals and objectives and commercial management strategies in 2017. • The Fishery Management Action Team (FMAT) held commercial working group calls in April 2017 to consider data needs to develop draft management alternatives. (**Supplemental Materials**)
Presentations • Overview of draft range of alternatives for commercial issues by K. Rootes-Murdy & K. Dancy
Board Actions for Consideration • Provide guidance on the development of management alternatives for commercial issues.

6. Consider 2017 Black Sea Bass Recreational Measures (3:30-4:30 p.m.) Final Action
Background • In February, the Board and Council updated the commercial and recreational specifications for black sea bass after considering the results of the Black Sea Bass Benchmark Stock Assessment. The Board and Council approved increases to both the commercial quota and recreational harvest limit for 2017. • The Board and Council maintained status quo recreational management measures for federal waters from 2016 and approved continuing ad-hoc regional management for 2017 with the specification that recreational harvest from Northern Region states (Massachusetts-New Jersey) not increase from 2016 levels. • 2016 Preliminary harvest data through wave 6 (November/December) was released in late February and indicated higher harvest than previous projected. (**Supplemental materials**)
Presentations • TC Review of 2016 black sea bass harvest estimates by G. Wojcik
Board Actions for Consideration • Specification of final 2017 black sea bass recreational management measures for Northern Region states

7. Review White Paper on Potential Experimental Recreational Wave 1 Black Sea Bass Fishery (4:30- 5:00 p.m.) Possible Final Action*
Background • In February, the Board and Council tabled a motion to allow an experimental recreational black sea bass fishery in wave 1 (January/February) in 2018:

Motion to allow an experimental 2018 January/February (wave one), recreational, federally permitted for-hire fishery for black sea bass with a 15 fish per person possession limit, a suspended minimum size limit, and a zero discard policy to allow for barotrauma, and a mandatory trip reporting requirement.
Motion by: (Council) Mr. DiLernia, seconded by Mr. King; (Board) Mr. Heins, seconded by Mr. Reid.

- Analysis on the tabled motion was completed by Council staff to evaluate the fishery and its potential impacts and provide considerations on the potential management action. (**Supplemental Materials**).

Presentations
- Experimental Recreational Wave 1 Black Sea Bass Fishery by B. Muffley

Board Actions for Consideration
- Approve an experimental recreational wave 1 black sea bass fishery in 2018*

**Joint Board and Council Action*

8. Review State Compliance with Addendum XXVIII Summer Flounder Recreational Measures for 2017 (5:00-5:15 p.m.) Possible Action

Background
- In February, the Board approved Addendum XXVIII for 2017 summer flounder recreational management. The Addendum specified that states must notify the Board of their final 2017 measures by March 1, 2017.

Presentations
- Review of state compliance with Addendum XXVIII measures by K. Rootes-Murdy

Board Actions for Consideration
- Finding states out of compliance if required measures of Addendum XXVIII have not been implemented

9. Review White Paper on Summer Flounder Recreational Specifications (5:15-5:45 p.m.)

Background
- Since 2014, 4 addenda (including Addendum XXVIII) have been approved annually to continue regional management under conservation equivalency.
- A white paper outlining current recreational management specifications, annual process, and challenges was developed to identify how summer flounder recreational management can be improved. (**Supplemental Materials**).

Presentations
- Review White Paper on Summer Flounder Recreational Specifications by B. Ballou

Board Actions for Consideration
- Provide guidance on addressing summer flounder recreational management issues associated with regional management and/or conservation equivalency

9. Other Business/Adjourn

Dr. Chris Moore
Chairman
Mid Atlantic Fishery Management Council

April 27, 2017

Dear Dr. Moore and members of the Council,

The Connecticut Charter and Party Boat Association is comprised of 40 professional charter boats sailing from ten different Connecticut ports, covering the Western, Central and Eastern Long Island Sound. Our Professional Captains have verified credentials, are held to the highest ethics standards and are out on the water everyday often acting as the Sheppard's of their areas.

Our comments below have been organized in order of importance to us:

Poor recreational harvesting data causes unstable regulations to be published usually late in the end of the first quarter of most years. Sales can't begin till the second quarter as businesses are afraid of selling customers fishing trips for species that new regulations might closed. This inability to sell trips combined with open/closed dates varying greatly from year to year for our targeted species doesn't allow our businesses to plan to grow for the future. Data collection accuracy must be addressed.

-One example: MRIP data showed CT. anglers harvested 990,000 pounds of Black Sea Bass in 2016 which was said to be up dramatically from 2015. The CCPBA divided 990,000lbs by 2.04 (avg. keeper weight) then divides again by the season length in days (245) which calculates to 1990 keeper Sea Bass caught by rod and reel every single day of the open season. Now take into consideration poor weather cancels 5 to 10% of trips during the summer months and greater than 33% in the fall and this reduces the season length to less than 160 days. -Please be are aware that the Black Sea Bass biomass migrates through Long Island Sound during the fishing season. The Central and Western Sound hosts the Spring migration May-June then in July the Sea Bass move East in which the Niantic, New London and Mystic ports are able to target them. At this point Western and Central Long Island Sound are absent of Sea Bass dividing down the boats that can pursue them. -Finally, our Charter Captains report seeing 3 to 4 recreational anglers per vessel on the weekends, and rarely encounter any recreational boats out during the week. With a recreational limit is 5 Sea Bass per person (if they are successful), it is very difficult to believe the harvest data when you divide by real time professional observations.

The CCPBA recognizes the benefits of a "For Hire Category" stretching from Mid-New Jersey to include Cape Cod and data shows stable landings from charter boats over a long period of time. By the start of the 2017 fishing season over 50% of our membership will be voluntarily using Electronic data submission (Safis) (in both State and Federal waters) which could be used as a Census (an actual count) vs. a Survey (a guess on how the fleet caught). We could guarantee 100% compliance including discards, by the time of a for hire category announcement. We would ask for three years' terms on published regulations, which would allow our businesses to further plan and grow. We are sure the positive growth would be extended to the businesses in the communities surrounding our ports and Connecticut tourism can refocus on the shoreline and away from just our casinos.

After reviewing (and endorsing) the State of New Jersey Summer Flounder appeal, the CCPBA recognizes a slightly different body of Summer Flounder (SF) inhabit Connecticut waters. When applying maximum sustainable yield to a for hire category fishing in Connecticut, the CCPBA feels a slot limit (16to19") preserves the breeders and reduces mortality rates in discarded SF. As Option 5 has reduced our bag limit to three SF, we believe with the extra conservation imposed by the slot limit, we can add one trophy fish (19" and over) per person per day, keeping the same season length.

The Striped Bass population in Long Island Sound has been virtually non-existent since 2013. Since that time Black Sea Bass have become vital to our businesses. We file concern for the experimental Wave 1 Black Sea Bass season, in which no minimum size and a 15 fish bag limit per angler has been applied. The ramifications of the 2016 NJ/NY Wave 6 Black Sea Bass data could be crippling to CT Charter Boats, then apply additional landings during Wave 1 cause grave concern for our Connecticut Captains. The areas that would benefit from this Wave 1 experimental season have other species to target, such as (Tautog, Scup, Striped Bass) during Wave 1. If Sea Bass are over harvested out of our shared recreational quota, and the CT Sea Bass Season is shortened, our boats will have nothing to fish for in May and June. This would be devastating.

Thank you for your consideration,

The Officers and Captains of
The Connecticut Charter and Party Boat Association

Kirby Rootes-Murdy

From: Kirby Rootes-Murdy
Sent: Monday, May 01, 2017 1:35 PM
To: Kirby Rootes-Murdy
Subject: FW: Summer Flounder Amendment
Attachments: MAFMC-ASMFC Scopping Comments 10-27-2014.pdf

From: Rick Bellavance [mailto:makosrule@verizon.net]
Sent: Wednesday, April 26, 2017 11:18 AM
To: Moore, Christopher <cmoore@mafmc.org>
Subject: Summer Flounder Amendment

Hello Chris,

I have attached comments that the RIPCBA submitted in 2014 during scoping for the MAFMC Summer Flounder Amendment. In addition, I would like this email to be included for the record. The RIPCBA is encouraged by the MAFMC's continued work on the summer flounder amendment and we would like to reiterate how important it is to our industry that the amendment explore separate regulations for the for-hire component of the recreational fishery. Since 2014, the future of our industry has become less and less certain and we strongly believe managing our industry in the same way as the private and shore fisheries has contributed to that uncertainty. Throughout the northeast charter and headboats are leaving the industry and we feel it is important that this amendment include options that preserve our historic industry, including options that consider separate regulations that will encourage growth in our industry. The MAFMC has approved mandatory electronic reporting for federally permitted vessels, an action we fully support. As we work to improve the timeliness and accuracy of the for-hire catch and effort data, we would like to see the ability to set regulations that are reflective the ability to monitor our catch with high accuracy. Thank you once again for the opportunity to comment on this important amendment and we look forward to continued engagement as the amendment moves forward.

Rick

Capt. Rick Bellavance, President
RI Party and Charter Boat Association
401-741-5648
www.rifishing.com

R.I. Party and Charter Boat Association
70 Gladys Drive
North Kingstown, RI 02852
401-741-5648
www.rifishing.com

President	Capt. Rick Bellavance
Vice President	Capt. Steve Anderson
Treasurer	Capt. Andrew D'Angelo
Secretary	Capt. Paul Johnson
Director	Capt. Nick Butziger

Chris Moore, Executive Director
Mid-Atlantic Fisheries Management Council
North State Street, Suite 201
Dover, DE 19901

October 27th, 2014

Dear Mr. Moore,

On behalf of the 70 members of the RI Party and Charter Boat Association and the thousands of fishermen who fish aboard our vessels each year, I offer the following comments regarding the Summer Flounder Amendment Scoping Document.

FMP Goals and Objectives

1. Change Goal One to "Achieve F Rates that allow optimal harvest of summer flounder without overfishing"
2. The other goals still seem appropriate for summer flounder management

Quota Allocation

1. Examine the current 60/40 commercial recreational split to see if it still represents the best and most equitable allocation of the resource with consideration of economic value.
2. Extremely important to develop a separate allocation for the for hire industry

Commercial Summer Flounder Fishery

1. Develop commercial catch share programs with adequate reporting and monitoring. Encourage cooperative management that allows fishermen the flexibility to fish safely with predictability while selling their catch for the highest amount possible

Recreational Summer Flounder Fishery

1. Absolutely the single most important action to consider for the management of the recreational fishery is to develop separate allocations for the for hire component of this sector. The conflict created by trying to manage the sectors identically has become unmanageable and needs to be addressed.
2. Use ER tools such as ACCSP's Safis etrips mobile to mandate a census surveying of the for hire fleet region wide. Include discard information. The council needs to work with GARFO to make sure reporting is not duplicative.
3. Develop recreational fishing regions based of the range of the resource and practical availability to it. Reach out recreational fishermen to determine how the fishery works for them and develop regions based on that input. Regulations should be consistent throughout each region and across jurisdictions within each region. An example of a region might be eastern LI, CT and RI including federal and state waters.

Discard Reduction

1. Work collaboratively with industry to develop management tools that reduce discards in the commercial fishing fleet. Use data gathered in the RI Summer Flounder pilot catch share program as an example of effective management that reduces discards, promotes safety, and maximizes value of the resource.
2. Promote equity by working to reduce the recreational size limit to 16 inches coastwide, which is closer to the commercial size limit. This size has proven to be beneficial to the recreational experience as shown in the RI Fish for the Future pilot for hire cooperative program conducted during the 2013 and 2014 seasons.

The RIPCBA is encouraged by the joint MAFMC/ASMFC efforts to reach out to summer flounder fishermen as part of the scooping process and we look forward to participating throughout the entire amendment's development and implementation. Thank you for the opportunity to comment on this important document.

Capt. Rick Bellavance, President
R.I. Party and Charter Boat Association

Summer Flounder Recreational Management

White Paper

Introduction

In February 2017, the Board approved Addendum XXVIII (ASMFC, 2017) to the Summer Flounder, Scup, and Black Sea Bass FMP. The Addendum specified a one-inch increase in size limit and reduced possession limits to stay within the 2017 recreational harvest limit (RHL) and maintained the following regional alignment from 2016: Massachusetts; Rhode Island; Connecticut through New York; New Jersey; Delaware through Virginia; and North Carolina. The needed harvest reductions through summer flounder recreational management measures specified in the Addendum came in response to the 2015 and 2016 stock assessment updates which found that fishing mortality rate in 2015 was above the fishing mortality threshold and that Spawning stock biomass was estimated to be 58% of the biomass target and only 16% above the biomass threshold (Terceiro, 2016). In August 2016, the Board and Mid-Atlantic Fishery Management Council approved an approximate 30% reduction to both the 2017 commercial quota and RHL in response to the findings of the stock assessment updates.

Achieving these needed reductions for 2017 is not easy and the process undertaken to develop Addendum XXVIII and public comment received on the draft document demonstrated this. The Addendum noted that the management program for 2017 will '…have shortcomings with regards to addressing this problem, and thus intends for it to be an interim program while focusing on the development of a more comprehensive solution for the future'. Moving forward, the Board should re-consider the framework that has allowed regional management under Conservation Equivalency in recent years and develop an approach that provides more consistency in management measures year to year, improves stakeholder buy-in, uses the best available science. The following lays out the background for the current management program; the annual specification process; and then highlights challenges and questions for the Board to consider moving forward.

Background

Summer flounder, scup, and black sea bass fisheries are managed cooperatively by the states through the Atlantic States Marine Fisheries Commission (Commission) in state waters (0-3 miles), and through the Mid-Atlantic Fishery Management Council (Council) and the NOAA Fisheries in federal waters (3-200 miles). The management unit for summer flounder in US waters is the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border.

Amendment 2 (MAFMC, 1993) to the Fishery Management Plan (FMP) required each state (Massachusetts through North Carolina) to adopt the same minimum size, possession limit, and season length as established in federal waters for the recreational fishery, allowing only for different timing of open seasons. The consistent measures were intended to uniformly impact the resource and stakeholders in all state and federal waters throughout the management unit. However, the states later determined one set of management measures applied coastwide did not provide equitable access to the resource due to the significant geographic differences in summer flounder abundance and size composition. To address this disparity, the FMP was amended in 2001 (Framework Adjustment 2; MAFMC, 2001) to allow for the use of state-specific “conservation equivalent” management, through which recreational harvest would be constrained the same as under coastwide management. The Board and Council would engage in an annual process of determining whether to manage the fishery with coastwide measures or state-specific conservation equivalency; if the latter, the Board would have the lead in approving state-specific regulations. Concurrently, the Board adopted a series of addenda (Addenda III and IV in 2001, and Addendum VIII in 2004; ASMFC 2001, 2004) implementing state-based conservation equivalency. Estimates of state recreational landings in 1998 were established as the basis for state recreational allocations- this is outlined in Addendum VIII (see Table 1) upon which state-by-state regulations could be developed. From 2001-2013, the Board and Council opted to use state-specific conservation equivalency tied to the proportion of each state’s estimated 1998 recreational landings. This provided states with the flexibility to tailor their regulations—i.e., minimum size, possession, and season limits—to meet the needs and interests of their fishery, provided their targets were not exceeded.

Table 1. State summer flounder harvest in 1998 and the proportion of harvest conservation equivalency state-by-state harvest targets are based on (Addendum VIII)

State	1998 estimated harvest (thousands)	Percent of the 1998 harvest
MA	383	5.5%
RI	395	5.7%
CT	261	3.7%
NY	1,230	17.6%
NJ	2,728	39.1%
DE	219	3.1%
MD	206	3.0%
VA	1,165	16.7%
NC	391	5.6%

The Board also adopted Addendum XVII in 2005 (ASMFC, 2005), enabling the states to voluntarily opt into multi-state regions that would set regulations based on a pooling of their 1998-based allocations. The Council followed suit with the adoption of Framework Adjustment 6 in 2006, complementing the regional approach set forth by Addendum XVII. However, no states used this optional regional conservation equivalency approach.

Re-assessing in the Face of Changing Conditions:

The use of state-by-state regulations based on estimated state harvests in 1998 succeeded, initially, in mitigating the disparity in conservation burden among states, but later became viewed as an inadequate long-term solution, given changes in resource status and fishery performance.

As 2013 came to an end, the Board identified the following problems with the use of state allocations based on estimates of recreational harvest in 1998:

1. Substantial variation in stock dynamics since 1998. These included a six-fold increase in spawning stock biomass and expansion of the age structure from including 2–3 age classes to 7 or more. These changes led to geographic shifts in the distribution of the resource; as the stock rebuilt, its range expanded. Climate change was also identified as possibly contributing to shifts in migratory patterns, spatially and temporally.

2. Substantial changes in socio-economic patterns since 1998, particularly with regard to the number and distribution of anglers along the coast. For example, estimated angler participation increased significantly, and a growing percentage of harvest was attributed to private/rental vessels in contrast to shore-based and party/charter vessel harvest. Industry advisors indicated the rising costs of fuel, bait, and other trip expenditures were impacting angler effort.

3. Possible error in the estimates of harvest for 1998. Measuring recreational catch and effort, particularly on a state-by-state basis, is challenging and not without uncertainty in the estimates. The methods used to estimate recreational catch and effort are continually evolving, resulting in more accurate and precise estimates in more recent years.

4. Major disparities in the regulatory programs among the states; for example, as recently as 2012 and 2013, no two states had the same regulations, and several neighboring states had regulations that differed significantly. A case in point was New York, whose regulations were more restrictive than any other state, and that contrasted markedly with those of New Jersey, Connecticut, and Rhode Island.

To address these concerns, the Board adopted Addendum XXV, which implemented conservation equivalency on a regional basis for 2014. Five regions were established: 1) Massachusetts; 2) Rhode Island; 3) Connecticut, New York, and New Jersey; 4) Delaware, Maryland, and Virginia; and 5) North Carolina. All states within each region were required to have the same possession limit, size limit, and season length. To achieve regulatory uniformity within each region, and to meet the coastwide harvest target, regulatory revisions were enacted for CT, NY, NJ, DE, and MD in 2014 (Table 2). For 2015, the Board continued regional management, with the same regions, via Addendum XXVI. For all states, the same regulations in effect for 2014 were maintained for 2015 (Table 2).

Table 2. State regulations, 2013–2016. 2013 represents the last year state-by-state regulations applied; regional management applies 2014–2016. Colorblocking indicates regions. Red font indicates change from prior year.

	2013	2014	2015	2016
MA	16" 5 fish May 22-Sep 30	16" 5 fish May 22-Sep 30	16" 5 fish May 22-Sep23*	16" 5 fish May 22-Sep 23 (125 day season)
RI	18" 8 fish May 1-Dec 31	18" 8 fish May 1-Dec 31	18" 8 fish May 1-Dec 31	18" 8 fish May 1-Dec 31 (245 day season)
CT	17.5"** 5 fish May 15-Oct 31	18"** 5 fish May 17-Sep 21	18"** 5 fish May 17-Sep21	18"** 5 fish May 17-Sep21 (128 day season)
NY	19" 4 fish May 1-Sep 29	18" 5 fish May 17-Sep 21	18" 5 fish May 17-Sep21	18" 5 fish May 17-Sep21 (128 day season)
NJ Coast	17.5" 5 fish May 18-Sep16	18"*** 5 fish May 23-Sep 27	18"*** 5 fish May 23-Sep 26	18"*** 5 fish May 21-Sep 25 (128 day season)
NJ Delaware Bay	17.5" 5 fish May 18-Sep16	18" 5 fish May 23-Sep 27	18" 5 fish May 23-Sep 26	17" 4 fish May 21-Sep 25 (128 day season)
DE	17" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31 (365 day season)
MD	16" 4 fish Mar 28-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31 (365 day season)
VA	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31	16" 4 fish Jan 1-Dec 31 (365 day season)
NC	15" 6 fish Jan 1-Dec 31	15" 6 fish Jan 1-Dec 31	15" 6 fish Jan 1-Dec 31	15" 6 fish Jan 1-Dec 31 (365 day season)

*MA change in season not due to cut, but correction of error from prior year

**CT has 45 designated coastal sites where minimum size is 16" for the 5-fish limit, 2013–2016

*****NJ has 1 designated coastal site where 2 fish at 16" can be taken, 2014–2016 (another 3 at 18" can be taken outside of the designated site)**

For 2016, the Board again continued regional management via Addendum XXVII, with one adjustment to provide more equity in recreational opportunities for anglers in the Delaware Bay. That adjustment involved establishing New Jersey as a stand-alone region, with the caveat that New Jersey would enact separate management measures for the New Jersey portion of Delaware Bay, while maintaining regulations for the rest of its waters consistent with those of New York and Connecticut. New Jersey complied by enacting regulations for Delaware Bay that were closer to those of Delaware. For all other states the same regulations in effect for 2014 and 2015 were maintained for 2016 (Table 2).

In practice, the recreational fishery for summer flounder is managed on a "target quota" basis. A set portion (40%) of the total allowable landings is established as a recreational harvest limit (RHL), and management measures are established by the states that can reasonably be expected to constrain recreational harvest to this limit each year. It has historically been deemed impractical, because of the limitations of producing timely landing estimates, to try to manage the recreational fishery based on a real-time quota. Over the past nine years, the coastwide harvest exceeded the annual coastwide RHL four times: 2007, 2008, 2014, and 2016 (Table 3).

Table 3. Coastwide Harvest Relative to Coastwide RHL: 2007-2016

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Coastwide Harvest (mil. lb)	9.34	8.15	6.03	5.11	5.96	6.49	7.36	7.39	4.72	6.38
Coastwide RHL (mil. lb)	6.68	6.21	7.16	8.59	11.58	8.49	7.63	7.01	7.38	5.42
Percent of RHL harvested	**139.77%**	**131.25**	84.22%	59.47%	51.43%	76.44%	96.40%	**105.41%**	63.97%	**117.00%**

*2016 Harvest is preliminary and subject to change.

Recreational Survey Estimates

The Marine Recreational Information Program, or MRIP, is a program under NOAA Fisheries which counts and reports marine recreational catch and effort. MRIP is driven by data provided by anglers and captains. MRIP replaced the Marine Recreational Fisheries Statistics Survey, or MRFSS, in 2008, which had been in place since 1979. MRIP is designed to meet two critical needs: (1) provide the detailed, timely, scientifically sound estimates that fisheries managers, stock assessors, and marine scientists need to ensure the sustainability of ocean resources and (2) address head-on stakeholder concerns about the reliability and credibility of recreational fishing catch and effort estimates. MRIP is an evolving program with ongoing improvements. Detailed information on MRIP and the improvements can be found at http://www.st.nmfs.noaa.gov/recreational-fisheries/index.

Stock Status

The most recent peer-reviewed benchmark assessment for summer flounder (Northeast Regional Stock Assessment Workshop 57, NEFSC 2013) was updated in July 2016. The assessment utilizes an age-structured assessment model called ASAP. Results of the assessment update indicate the summer flounder stock was not overfished but overfishing was occurring in 2015 relative to the updated biological reference points established in the 2013 SAW 57 assessment. The fishing mortality rate has been below 1.0 since 1997, but was estimated to be 0.390 in 2015, above the threshold fishing mortality reference point FMSY = 0.309 (Figure 1). Spawning stock biomass (SSB) was estimated to be 88.9 million pounds (36,240 mt) in 2015, about 58% of the biomass target SSBMSY = 137.555 million pounds (62,394 mt) and 16% above the biomass threshold (Figure 2). The 2015 year class is estimated to be about 23 million fish at age 0, continuing the trend of below-average year classes for the past six years (2010-2015).

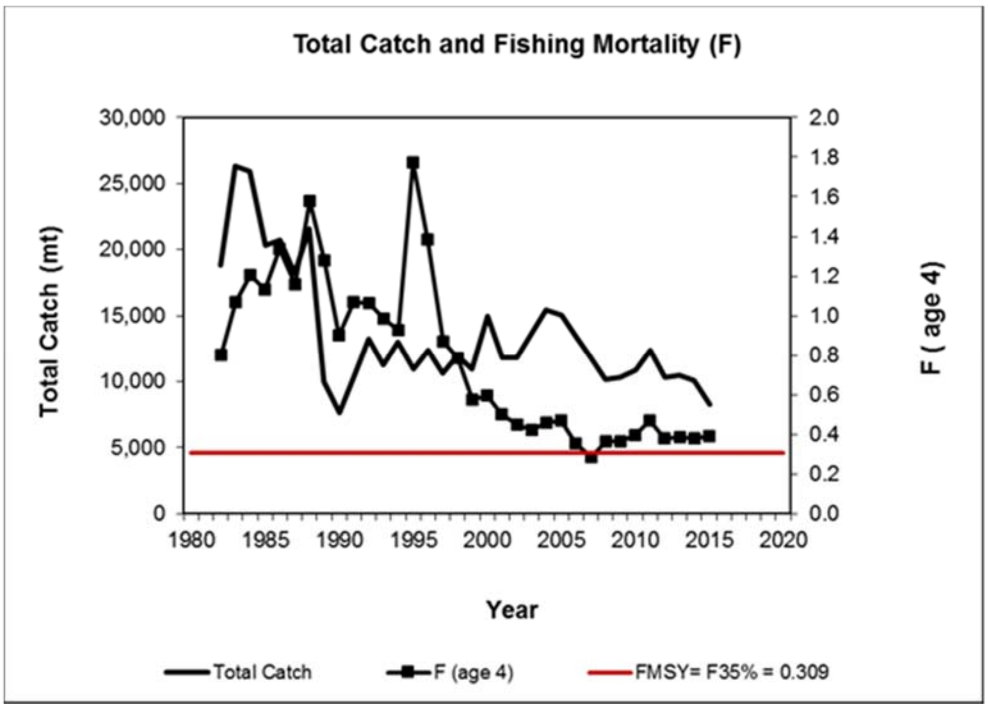


Figure 1. Total fishery catch and fully-recruited fishing mortality (F, peak at age 4) of summer flounder. The horizontal red line is the 2013 SAW 57 fishing mortality threshold reference point proxy. Source: NEFSC Summer Flounder Stock Assessment Update for 2016 (June 2016).

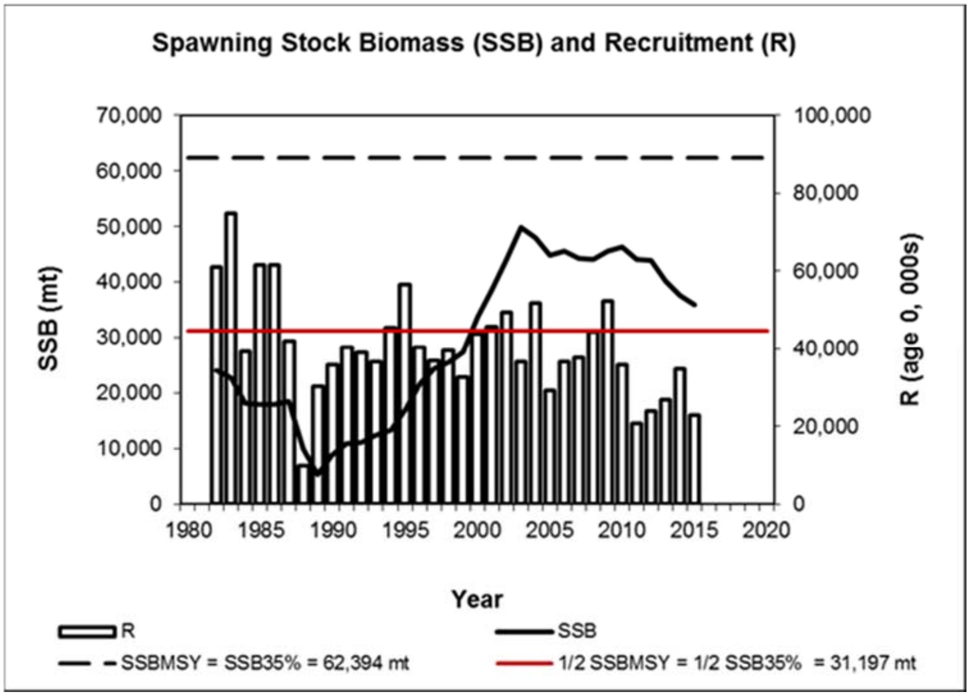


Figure 2. Summer flounder spawning stock biomass (SSB) and recruitment at age 0 (R) by calendar year. The horizontal dashed line is the 2013 SAW 57 biomass target reference point proxy; the horizontal red line is the biomass threshold reference point proxy. Source: NEFSC Summer Flounder Stock Assessment Update for 2016 (June 2016).

Annual Process

Annually, the Commission and Council meet to establish catch limits and specify management measures to achieve those catch limits for the following year. In first establishing the catch limits, the following process takes place: The Council's Science and Statistic Committee (SSC) meets to reviews the most recent stock assessment, biomass projections, and recommends an Overfishing Limit (OFL) and Acceptable Biological Catch (ABC). This process has taken place in recent years in July. Following the SSC's July meeting, the Commission and Council meet in August to consider the recommended OFL and ABC, and establish Acceptable Catch Limits (ACL) for both the commercial and recreational fisheries. The combined recreational and commercial ACLs cannot exceed the ABC. These specifications are required under National Standard 1 of the Magnuson Stevens Reauthorization Act or MSRA. Following the August meeting, Commission and Council staff monitor preliminary harvest estimates for the year as they become available. In recent years, Commission staff has strived to provide the Board with preliminary MRIP harvest estimates through wave 4 (July/August) and projections for waves 5 and 6 (September through December) at the ASMFC Annual Meeting in October or November. At the Annual Meeting, the Board considers the preliminary information relative to coastwide harvest limit and evaluate whether potential reductions are needed for the following year based on harvest performance. In recent years the Board has also initiated draft addenda to consider alternative management (such as regional management) under conservation equivalency.

The Commission and Council next meet in early December to specify management measures for the following year. During this meeting, the Board and Council must determine whether to use conservation equivalency to specify management measures or to adopt a coastwide set of measures. If the Board and Council decide to pursue conservation equivalency for the following year, the following procedure is to administered (Framework 2):

A) Late December - Commission staff summarizes the guidelines agreed upon by the Council and Board to determine conservation equivalent measures, and distributes them to the states.

B) Early January - A state must submit a proposal to the Commission staff at least two weeks prior to the Technical Committee meeting.

C) January 15 - Commission staff distributes the states' conservation equivalency proposals to the Technical Committee and the Board. Council staff submits the recreational specification package to NMFS. The package would include the overall percent reduction in landings required, coastwide measures (as a non-preferred alternative), and the recommendation to implement conservation equivalency (as the preferred alternative) and precautionary default measures.

D) Late January - The Technical Committee evaluates each state's proposal and advises the Board of the proposal's consistency with achieving the coastwide recreational harvest limit. Commission staff is responsible for compiling the Technical Committee recommendations and presenting them to the Board for determination.

E) February - The Board approves or disapproves the state proposals. If it is determined that a proposal is not consistent, then that state would be required to implement the precautionary default measures. States that do not submit proposals will be required to adopt the precautionary coastwide default measures, unless the Board gives the state a chance to recalculate management measures, following the guidelines set forth by the Council and Board. In this case, the Board's would detail the procedures by which the state can develop alternative measures.

F) March 1 (on or about) - NMFS publishes the proposed rule for recreational measures to announce the overall percent reduction in landings, the Council and Board's recommendation of state conservation equivalency (as the preferred alternative), the precautionary default measures, and coastwide measures (as the non-preferred alternative).

G) March 15 - The Board submits comments to NMFS during the comment period to inform NMFS about the approval or disapproval of the state conservation equivalency proposals.

H) April - NMFS publishes the final rule announcing the overall required reduction in landings and the state specific conservation equivalency measures and precautionary default measures, or coastwide measures.

Precautionary Default Measures
Precautionary default measures are defined as measures that would achieve at least the overall required reduction in landings for each state. They serve as worst-case scenario specifications should NOAA Fisheries determine management measures approved under conservation equivalency do not meet the requirements set forth in the MSA to constrain harvest to the coastwide RHL. The precautionary default measures for summer flounder in 2017 would be a two fish bag limit, a minimum size of 20 inches, and a 62 day season (July 1-August 31). If implemented, federal permit holders would be bound by the precautionary default measures, even while fishing in state waters. If a state does not implement a suite of measures approved by the Commission as 'conservationally equivalent,' the state would be obligated to implement the precautionary default measures.

With the recent move to use regional management under conservation equivalency through addenda, the following procedure has played out:

A) Late October/early November- the Board initiates a draft addendum at the ASMFC Annual Meeting using preliminary harvest data through wave 4.

B) November- a draft addendum for Board Review is developed in preparation for the Joint Commission/Council Meeting.

C) December- the Board considers the draft addendum for Public Comment. In recent years, the Board has approved the draft document for public comment.

D) Late December- prior to the draft addendum being released for public comment, preliminary harvest data through wave 5 is released and incorporated in the document.

E) January- the draft document is available to public for provide comment. Public hearings are held. Staff summarizes public comment ahead of ASMFC Winter Meeting.

F) Late January/early February- the Board considers final approval of the draft addendum for management. Preliminary harvest data through wave 6 is released after the Board meeting, potentially impacting projected harvest and needed reductions.

G) March/April- states notify the Commission of promulgated management measures as specified in approved addendum.

H) April/May- Commission sends NOAA Fisheries letter outlining state management measures under conservation equivalency that will achieve current year RHL. Final harvest estimates are scheduled to be released, with the potential for changes to data used in analysis to develop measures in the approved addendum.

Challenges

In recent years, the Board has opted to depart from state by state management under conservation equivalency, and instead has operated under regional management since 2014. This approach has relied heavily on the most recently available MRIP information that is preliminary. The TC in their review of Draft Addendum XXVIII Options memo (pg.5):

> 'The standard methodology (Total Reduction = (**X**+**Y**) - (**X*****Y**); **X** = The percentage decrease associated with seasonal closure(s). **Y**=the percentage decrease associated with size/possession limit) is problematic for a large number of reasons, many already pointed out above. Harvest estimates are highly variable from year to year, even when recreational measures have not changed. This was apparent in 2014-2016 under coastwide consistent measures. At the individual state level, when no changes were made to recreational measures, harvest estimates changed in 29 out of 30 cases (ranging from - 68% to +261%).
>
> In attempting to manage the recreational fishery in a manner similar to the commercial fishery, assumptions about data accuracy and precision are being made that are not true. The RHL is provided as a target, based upon the stock assessment and fixed through the Council specification process. Up until this point, uncertainty in many different forms has been considered and no single data source predominates. By comparison, recreational management utilizes only preliminary MRIP harvest point estimates, sans measures of uncertainty, to attempt to predict/constrain future harvest point estimates.
>
> It is very difficult to measure the effect that changing individual measures has on harvest estimates because it is rare that only one aspect (size, season or bag) has been manipulated, confounding the data. Increasing the size limit ought to result in less landed fish, resulting in some benefit to the stock. However, the relationship between size limit change and MRIP harvest estimate change (size change ≠ 0, combined with little or no other changes made to measures) is weak and not significant ($P>0.05$, $R^2 = 0.10$, n=23). Change in season length (subsetting the data for no size limit change, minimal change to bag limit, and ± at least 1 day) was also not significantly related to changes in harvest estimate ($P>0.05$, $R^2 = 0.21$, n=17). Reducing season should reduce harvest by limiting effort. However, the value of days added or removed to a season is highly inconstant because of the potential for recoupment and the fact that data resolution forces us to consider all days within a wave to be equal (an assumption that is most likely violated). Possession limit is perhaps the hardest measure to judge effectively. Few anglers "limit out" but the perception is that when a possession limit becomes too low, angler interest fades. Individual angler experience may not change, but the for-hire industry and fishing retail businesses may suffer. The sample size of less confounded possession limit changes is insufficient to conduct an analysis. Besides a tenuous conservation benefit, reasonably low possession limits may decrease the influence that

> heavily weighted intercepts can have on harvest estimates. A multi-variate analysis of the impact changing recreational measures has had on harvest estimates would increase our ability to judge the effectiveness of the standard methodology. The technical committee's efforts are currently time-constrained but looking at single factors (above) suggest that the standard methodology has performed poorly.'

The timetable for drafting a new addendum annually, and developing management measures based in part on preliminary estimates that change is challenging. As noted in the TC's review of the Addendum XXVIII options (pg.6)

> 'The TC notes there is limited time annually to undertake more extensive analysis due to the timing of when data becomes available and when the Board must make management decisions. For example, preliminary harvest estimates through wave 5 did not become available until after the Joint Board and Council meeting in December 2016 (December 16th). It is expected that preliminary data and past year's performance will be evaluated to predict the current year's performance in preparation for the ASMFC Winter Meeting. The TC has only a couple of weeks to conduct analysis during which time holidays and public comment and hearings for addenda take place. Both the timetable and data limitations, as previously stated, limit the TC's ability to fully evaluate the data and provide recommendations to effectively constraint harvest to an annual changing target.'

Moving Forward

There are a range of issues the Board may wish to explore and develop, as it considers potential reforms to the management program. Chief among them:

- Initiating and concluding the specification process in a timelier manner, e.g., initiating at or around the August meeting, and concluding at or around the December meeting. This issue is confounded by not having current year harvest estimates. The issue thus hinges on how the Board opts to address the use of current year harvest estimates in the specification process.

- Development of an F-based approach as the basis for management action (in lieu of using prior-year harvest estimates to predict subsequent year harvest estimates).

- Development of multi-year -- e.g., three-year -- timeframes for management measures established through the specification process (in lieu of the annual cycle).

- Enhanced understanding of the calculus employed by MRIP to generate estimates of recreational harvest to better inform the development of recreational management measures.

- The use of state-conducted voluntary angler reporting as a supplement to MRIP, ideally linked with regions if the regional approach is continued.

- Use of conservation equivalency:

  - If state-specific:
    - Based on each state's estimated 1998 recreational landings, or on something else?
  - If regional:
    - Based on the current regional configuration, or on some other configuration?

  - Objective (1) Allocation/target-based, affording maximum flexibility to each state/region to tailor regulations to meet the needs and interests of the state/regional fisheries;

vs.

  - Objective (2) Relative consistency in management measures across neighboring states/regions, the crux being to afford all anglers throughout the range of the resource some common, baseline angling experience.
    - Are state/regional differences in management measures a hallmark, or flaw, of the management program?

  - Consideration of biological factors – e.g., resource abundance and distribution, year-classes (fish sizes) – in the development of allocations/targets/management measures.

Several other issues pertaining to the recreational management of summer flounder have already been identified via the scoping process for the Comprehensive Amendment, and are thus slated to be addressed as that phase is undertaken. Some, perhaps all, of those issues could/should be added to the above outline. However, the outline is intended to serve as a first stab at priority issues that the Board may be able to begin addressing early in 2017. Those that are actionable during 2017 could be folded into the next Addendum. Those that are not actionable during 2017 could be tee'd up for subsequent action via the Comprehensive Amendment. For those issues that could be folded into the next Addendum, the following process of review and development is offered for consideration:

1. The Board will review this white paper at its May 2017 meeting, consider any modifications to the list of issues as presented, peel off those issue that it wishes to pursue more or less immediately, and task the Board's Recreational Working Group to flesh out those issues and report back to the Board, with recommendations, at the Board's August 2017 meeting (joint with MAFMC?).

2. Based on the WG's recommendations, the Board will consider initiating a draft Addendum, for 2018, at the August meeting.

3. The Board will endeavor to finalize the Addendum by the end of the 2017 calendar year (December joint with MAFMC?)

Literature Cited

ASMFC (Atlantic States Marine Fisheries Commission). 2001. Addendum III to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/sfScupBSBAddendumIII.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2001. Addendum IV to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/sfScupBSBAddendumIV.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2004. Addendum VIII to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/addendumVIII.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2005. Addendum XVII to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/addendumXVII.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2014. Addendum XXV to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file//53079e87SF_BSB_AddendumXXV_Feb2014.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2015. Addendum XXVI to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/551303e2SummerFlounderAddendumXXVI_Feb2015.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2016. Addendum XXVII to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/56d77016SFlounder_BSB_AddendumXXVII_Feb2016.pdf

ASMFC (Atlantic States Marine Fisheries Commission). 2017. Addendum XXVIII to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan. Available at: http://www.asmfc.org/uploads/file/58b5cf80SummerFlounderAddendumXXVIII_Feb2017.pdf

MAFMC (Mid-Atlantic Fisheries Management Council). 1993. Amendment 2 to the Summer Flounder Fishery Management Plan. Available at: http://www.mafmc.org/fisheries/fmp/sf-s-bsb

MAFMC (Mid-Atlantic Fisheries Management Council).2001. Framework 2 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan. Available at: http://www.mafmc.org/fisheries/fmp/sf-s-bsb

NEFSC (Northeast Fisheries Science Center). 2013. 57th Northeast Regional Stock Assessment Workshop (57th SAW) Assessment Report. U.S. Department of Commerce, Northeast Fisheries Science Center Reference Document 13-16. http://www.nefsc.noaa.gov/saw/

Terceiro M. 2016. Stock Assessment of Summer Flounder for 2016. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-15; 117 p, Available at: http://www.nefsc.noaa.gov/publications/

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

April 28, 2017

To: **Summer Flounder, Scup, and Black Sea Bass Management Board**

From: **Summer Flounder, Scup, and Black Sea Bass Technical Committee**

RE: **Analysis on black sea bass recreational data tasks**

2016 Recreational Black Sea Bass data

In February 2017, the Summer Flounder, Scup, and Black Sea Bass Board and Mid-Atlantic Fishery Management Council approved specifications that updated the 2017 commercial quota and recreational harvest limit (RHL). In considering the updated RHL the Board and Council also decided to maintain the 2016 federal management measures for 2017 and specified that in continuing ad-hoc regional management for 2017, that Northern region states (Massachusetts through New Jersey) not increase harvest from 2016. The Board and Council motions were made after also considering the results of the 2016 Benchmark Stock Assessment and 2016 preliminary black sea bass recreational harvest data through wave 5 (September/October). Following the meeting, the Northern Region state representatives met via conference call February 23rd to consider updated preliminary harvest estimates through wave 6 (November/December) that were published on February 17th. The preliminary harvest estimates through wave 6 indicated that coastwide harvest in 2016 was approximately 5.62 million pounds, exceeding the 2016 RHL (2.82 million pounds) by 2.8 million pounds and above the updated 2017 RHL of 4.29 million pounds by 1.33 million pounds. Additionally 2016 preliminary harvest estimates in wave 6 exceeded the TC's projections (based on prior year's harvest) by approximately 960,000 pounds. To better understand the preliminary harvest estimates relative to prior TC projections as well as the updated 2017 RHL, Board members requested that an analysis be conducted by the TC to further explore the harvest data. The TC met via conference call on April 27th to review and discuss initial analyses on the assigned tasks based on available 2016 preliminary MRIP data through wave 6.

It should be noted that there are several components to how the Marine Recreational Information Program (MRIP) developed the 2016 harvest estimates that remain unclear to the TC, specifically the weighting of intercepts, harvest by mode, and how the proportional standard error is calculated. Requests have been made to MRIP staff to further explain how the harvest estimates were generated, with many of those questions remaining unanswered.

Task 1) Using the TC's recommended measure of uncertainty, what is the uncertainty buffer around the 2016 harvest estimate? How does this compare to the 2017 RHL? How does the TC recommend incorporating the uncertainty of the harvest estimate into determining the harvest reduction needed to not exceed the 2017 RHL?

The TC sought to quantify the uncertainty of the harvest estimates in recent years and determine how harvest may decline in coming years based the projected 15% decline in the spawning stock biomass (SSB) per the 2016 assessment results. That work is outlined in figure 1 (see below). A 95% confidence interval was calculated for the harvest to show a proxy level of variability in the harvest estimates, with scenarios of possible declines of 5% and 10% in recreational harvest. These two scenarios were chosen as being more likely possibilities given the group's agreement that declines in harvest will not track 1:1 with SSB declines.

While this was a helpful visualization, the group did not have clear path forward in evaluating the uncertainty in the harvest point estimate. The group was in agreement that a more quantitative approach that incorporates the 2016 stock assessment would be more helpful to evaluate the likelihood of harvest declining in future years based on SSB projections from the assessment. The group expressed interest in further evaluating the strength of the 2011 year class in driving recent harvest rates and how harvest rates may fall as that cohort leaves the fishery. This exploration could possibly be pursued with the 2016 Assessment lead analyst Dr. Gary Shepherd, but it should be noted that specific guidance would be needed from the Board as well as time to complete the work. The group was in agreement that this line of work-specifically linking the assessment results including spatial attributes of the resource, relative year class strength, and fishing mortality rate-into recreational management would be an improvement on the current approaches using ad-hoc regional management and the standard methodology for calculating reductions/liberalizations from size limit, possession limit, and season length.

Focusing just on the MRIP data, the group also discussed the possibility of evaluating the 2016 estimate differently than in previous years. This modified harvest estimate would incorporate other information such as previous years' performance and uncertainties around harvest estimates and different ways of calculating averages given the anomalously high harvest estimate generated in 2016 relative to other more recent years' harvest estimates. To operationalize this concept, the group discussed the possibility of using multiple years to average catch and harvest information by mode and wave. This may be useful to help with trying to buffer against uncertainty moving forward and not take restrictions or over-liberalize based on noise in the data.

The TC also revisited some of arguments made in favor of status quo management measures for 2017 leading up to the February 2017 Joint ASMFC/MAFMC Meeting in Kitty Hawk, North Carolina. As noted before, following that meeting preliminary harvest estimates through wave 6 indicated a much higher harvest level in 2016 than previously projected- the updated reduction is closer to 23%, higher than the previous 8% reduction based on harvest through wave 5. In light of this, the group believes its recommendation of status quo management measures needs to be reanalyzed given the significant increase in harvest relative to what was calculated when the initial recommendation was made. Additionally, the uncertainty around the harvest those original measures would achieve the 2017 has not been re-evaluated. Task #1 does not specifically request a recommendation on 2017 management measures, so the group did not have a specific revised recommendation on 2017 measures. The group maintains the need to consider MRIP harvest estimates as a statistic, one that has variance around the estimate. The group was committed to using some guidance from MRIP staff provided to NY staff during a call held the week of April 15 2017 to better adjust the extremely high 2016 wave 6 preliminary estimate if the Board wishes. Two analyses could be conducted including a standard averaging calculation and a Bayesian estimation of the wave 6 data.

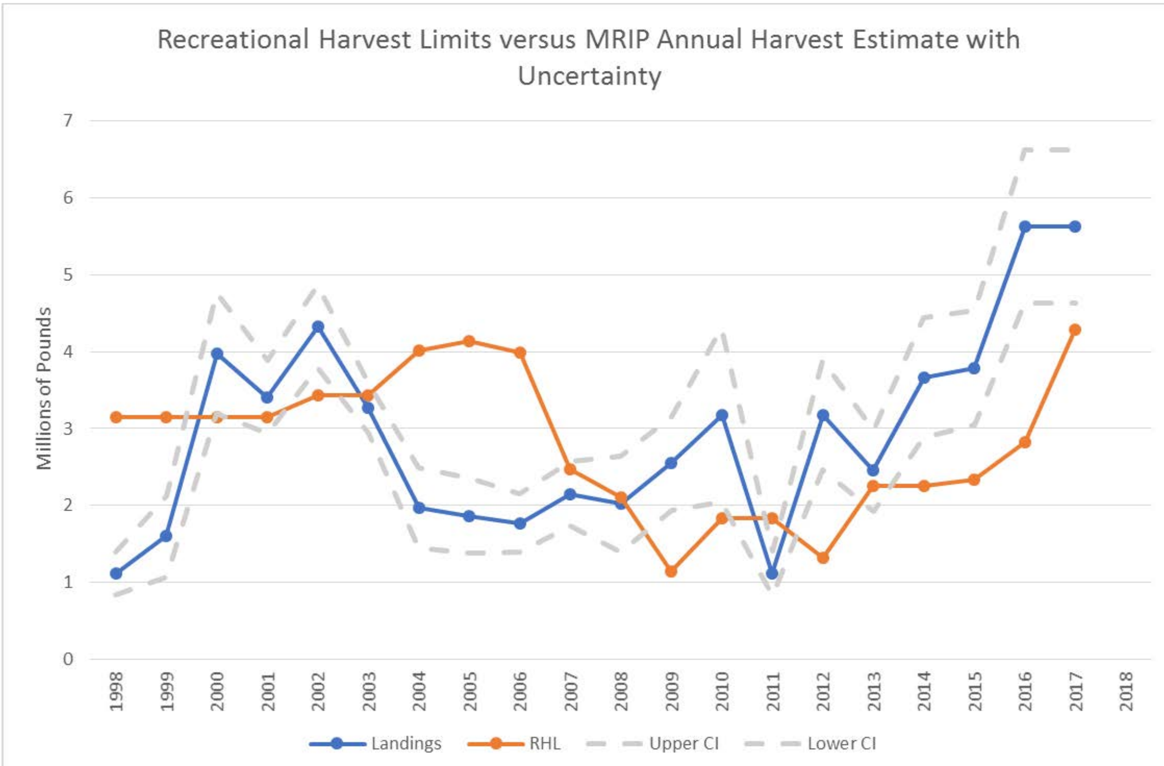


Figure 1 – Recreational black sea bass landings for the North and Mid Atlantic with 95% confidence bounds versus the recreational harvest limit through time.

Task 2) By state, identify 2016 wave/mode harvest estimates that are significantly higher than prior years. Describe the MRIP intercept data used to generate the 2016 and prior year harvest estimates and compare their associated PSEs. Were there any changes that could help explain a harvest increase in 2016, such as changes to regulations or MRIP sampling methods? Is there reason to believe these harvest estimates will change from MRIP preliminary to final status (such as due to low sample size or incorporation of VTR effort data)?

In 2016, most of the coastwide overage (A+B1; numbers of fish) came from New York harvest, landing almost 2.5 million pounds of black sea bass, which is 62% higher than 2015 and 138% higher than the 2013-2015 average. Massachusetts and Connecticut both landed just under 1 million pounds, and for Connecticut, that was an increase of about 500,000 more pounds as compared to 2015. In addition, Rhode Island's harvest has been steadily increasing since 2013, with an annual increase of about 100,000 pounds. Visual representation of the data is available in Appendix A.

Based on the data and considering 2016 management measures, it seems the 10 fish bag limit in wave 6 for NY was important, as multiple intercepts with landings of 8 fish or more per angler are present in the data. The intercept weights (or catch expansion factors) for some of these intercepts are extremely high, over 4,000. It is not clear how intercept weights are calculated by MRIP, but a few intercepts can have a disproportionately large influence on a harvest estimate. As an example, one intercept of a single angler with 10 landed black sea bass is "weighted" by 5,588.3, so the expanded harvest of that intercept is 55,883 A+B1 black sea bass (10 x 5,588.3). A single intercept (out of 56 intercepts with black sea bass landings) is responsible for 15% of the landings in NY's Wave 6.

After reviewing the intercept data, there haven't been any substantial changes in sampling (i.e., number of intercepts by state, wave, and fishing mode) or fishing effort, but it appears that catches during later waves (specifically waves 5 and 6) have increased from previous years. One thing that is unclear is how to quantify intercept refusal; this could be important in the number of intercepts that recorded catch. The New York TC member mentioned a change in contractor (i.e. state staff conducting the dockside intercepts starting in 2016) that could have some influence on interview success. In further seeking to understand the wave 6 data, New York staff were briefed by MRIP staff on harvest estimates from the state of New York in 2016. Based on their feedback, there is no indication that harvest estimates will change from preliminary data to final data, however, the TC still believes there is an unaccounted for bias in the MRIP data due to the state takeover of the APAIS program, and the evidence that high refusal rate areas are now providing interviews due to state outreach efforts with the fishing community and more comfort with state samplers versus the previous contract samplers.

As an example, the group discussed that while there hasn't been significant changes in sampling, inconsistencies in where positive interviews are being generated from may be part of the issue for 2016. Regulations were fairly consistent in New York during wave 6 in 2014, 2015 and 2016, though harvest for not just black sea bass, but Atlantic cod, tautog, and scup were all significantly higher (or highest in the last 10 years) based on preliminary wave 6 data. An increase in the number of intercepts for Montauk increased significantly in 2016 relative to 2015 and 2014. Further understanding of why intercepts may have been inconsistently sampled needs further investigation and will require the TC members to further evaluate harvest by wave and mode. This work was not done for most states ahead of the call.

In trying to understand the associated Proportional Standard Error (PSEs) with harvest by mode, the group maintains there are still alot of unknowns. Generally, the understanding is that as harvest data is parsed down to specific areas or to specific fishing modes and times of year, the amount of available intercepts decreases, likely increasing the proportional standard error of the estimate. But how that error is calculated amongst all of the collected data fields is unclear and the general rule of increased parsing of the data leading to higher PSEs does not hold in all cases (i.e. abnormally high 2015 NY bluefish harvest estimates in wave 3 had a low PSE).

Lastly, in seeking to evaluate 2016 harvest relative to the 2016 recreational management measures, some members of the group noted that changes to MRIP methodology over time- which have been uneven in scope year to year- complicates the group's ability to discern what is 'true' harvest year to year vs changes in the methodology that are influencing harvest. For NY, it should be noted that harvest decreased in 2016 wave 4 (July/August) relative to previous years; that being said wave 5 increased and wave 6 increased significantly. What is clear is the minimum size limit increase many states implemented in 2016 had little to no effect in reducing harvest across northern region states, and specific to NY, there were changes in high harvest between 2014 to 2015 and 2015 to 2016 relative to party/charter and private angler modes. The group also noted the need to keep in mind that while the specified RHL for 2018 will be lower than 2017, there is an understanding MRIP harvest estimates will be changing in the near future with the calibration changes due to adjustment from telephone to mail survey. Future estimates will very likely be higher than current estimates, and well as revision of historical harvest estimates, which will further complicate the group's work in using the data to set management measures. There is an abundance of conflation in unaccounted for bias, methodology changes, and uncertainty at this point, and the TC feels the ability to proceed with normal specification setting within this environment of yearly MRIP improvement rollouts, calibrations, and revisions is compromising any ability to do prospective harvest analyses. A new procedure is needed moving forward, such as a more formal quantification of management uncertainty through something such as an MSE, but it will be difficult to implement any new procedure until the underlying data settles down to a more consistent structure.

Task 3) Would closing Wave 6 (all or part) in the Northern Region (or just MA-NY, or just NY) reduce 2017 projected harvest so that the 2017 RHL is within the harvest estimate's uncertainty buffer? What bag limit for Wave 6 in the Northern Region (or just MA-NY, or just NY) would reduce 2017 projected harvest so that the 2017 RHL is within the harvest estimate's uncertainty buffer?

Using the North and Mid-Atlantic query from the MRIP website for BSB harvest, the PSE is 8.3 for the coastwide harvest estimate. This does not include NC (North of Cape Hatteras).

Considering the boundaries of the confidence intervals, the 2016 point estimate is 2,734,141 fish and -1SE (~68% CI) below that point estimate occurs at 2,507,207 fish and -2SE (~95% CI) occurs at 2,280,273 fish. The purpose of Task #3 is to identify the percent difference between the lower bounds of the 2016 point estimate and the 2017 RHL, and if some management changes impacting Wave 6 in MA-NJ, MA-NY or NY alone will be sufficient to account for any needed reduction.

The difference between the 2017 RHL in fish (2,084,473) and these lower bounds are 16.9% at 1SE and 8.6% at 2SE.

The reduction calculated for the total loss of all wave 6 fishing in MA-NJ is 18.1%, MA-NY is 14.3% and NY alone is 13.5%. The reduction associated with the loss of Wave 6 in MA-NJ is sufficient to reach the lower bound 1SE away from the point estimate but Wave 6 changes in MA-NY or NY alone are not (further restrictions would be required). All 3 are sufficient to reach the lower bound 2SE away (entire loss of Wave 6 isn't necessary). Additional work could be done once the appropriate confidence interval is identified and final harvest estimates are made available.

The NY TC member further looked at wave 5 harvest relative to wave 6 in recent years, to determine a proxy ratio to compare harvest over time; in theory, to get at an 'alternative' harvest estimate is for wave 6. Preliminary analysis was completed but not ready for the Board's consideration at this point.

4) Consider that the New York Wave 6 numbers at first appear unrealistic. Over the prior six years (2010–2015) New York's recreational harvest in wave 6 averaged about 26,000 pounds. Yet, 2016 Wave 6 has New York at over 887,000 pounds. Was New York actually responsible for about 88% of the 2016 RHL harvest?! Did New York's Wave 6 effort significantly increase in 2016 as compared to previous years?

On February 24th, John Maniscalco wrote Tom Sminkey the following email requesting more information/investigation into preliminary wave 6 New York Harvest (A+B1) data:

"…In 2015 NY harvested 15,822 fish (90% HB) in Wv 6, in 2016 367,806 fish (78% PRR). Regulations differed in that the size limit increased by 1" for 2016. The 2011 year class probably grew into that size limit for no realized reduction, but numbers of fish available to the fishery should not have increased by an order of magnitude.

Harvest by FH mode increased by 6x. By PRR mode 187x. Intercepts for the FH mode doubled, and for PRR mode 5x. Number of fish intercepted 4x by FH, and 17x by PRR. Fish per intercept doubled by the FH mode and over triple by the PRR mode. Avg. intercept weight (the expansion factor, wp_catch) per fish 3.5x in FH mode, and 11x in PRR mode.

In 2016 Wv 6, Montauk accounted for 92.5% of BSB A+B1 fish with 44 intercepts (of 56). In 2014 there was 1 BSB intercept from Montauk, and none in 2015.

In 2016 Montauk was successfully sampled for BSB on 9 separate days across 3 locations for PRR, 4 days across 2 locations for CB, 1 day at 1 location for HB (and an additional day of HB sampling at Point Lookout also yielded BSB in 2016).

19 days of assignments in Montauk in Nov 2016.

17 days of assignments in Montauk in Dec 2016.

How does assignment frequency in Montauk differ between 2016 and 2015 and 2014 for Wave 6?

Were other species successfully sampled in Montauk but not BSB in prior years? Coincidentally, tautog harvest in 2016 Wv 6 was also very high with Montauk PRR figuring prominently.

How does the number of successful intercepts differ?

How does the number of interviews not granted differ?

How does the CHTS results differ btw each year for Wave 6?

NY now has two motivated, personable individuals sampling in Montauk. Their efforts have resulted in what appears to be substantially more intercepts. At the same time PRR intercept weights have increased by an order of magnitude. Is this due to greater diligence in recording the number of interviews not granted/missed or due to CHTS results or both? How does each factor contribute to the whole? My APAIS staff have stated that they did not change site pressures appreciably for 2016, wanting to run through the year and gather their own data. Changes are occurring for 2017.

What do we know of the previous field sampler(s) completing assignments in Montauk in Wave 6? What performance metrics could be reviewed and compared?

The recreational management system currently in place treats harvest estimates generated by MRIP as one continuous uninterrupted time series. This Wave 6 estimate poses significant issues for NY and other states along the coast. We need to understand what factors cause this degree of volatility. I am not arguing which estimate is more “right”, I am interested in the underlying cause for the substantial differences in magnitude, location of origin, and mode of fishing. Are such problems occurring in other states and/or other species?

While I know that these intercepts were previously reviewed, I would appreciate some additional consideration spent on the issues/questions pointed out above. This may also be a good time to revisit setting up a meeting between MRIP staff and some of its state partners (NY, others?). John Foster has (very helpfully) previously discussed MRIP methodology with members of the SFL, BSB and Scup TC/MC. I feel as I f I have a solid grasp on catch sampling but effort estimation and its incorporation into wp_catch and wp_int remains a bit of a black box. …”

As noted earlier, NY staff was briefed by MRIP staff on wave 6 harvest estimates for New York in recent weeks, due to the significantly higher harvest estimate than projected. MRIP staff noted that wave 6 was a lower fishing effort wave- less anglers and party charter vessels targeting black sea bass- relative to earlier waves in 2016 (such as waves 4 and 5) and that the lower fishing effort can influence variability in harvest estimates derived from intercept data (similarly applies to wave 1 and 2). MRIP staff communicated that a ‘smoothing’ approach of data from years using Bayesian statistics may help in further considering harvest for setting 2017 management measures. The full report from MRIP staff to on NY’s wave 6 black sea bass harvest was not publicly available and not able to be shared with the group for this call. The group was interested in pursuing the Bayesian analysis at the advice of MRIP staff as a way to potentially dampen this variability out of this wave. The TC thought they could do one analysis based solely on NY, and one looking along the entire northern region as two appropriate scopes for the suggested alternative analysis.

Appendix A.

MRIP intercept summary for BSB from 2013-2016

April 12, 2017

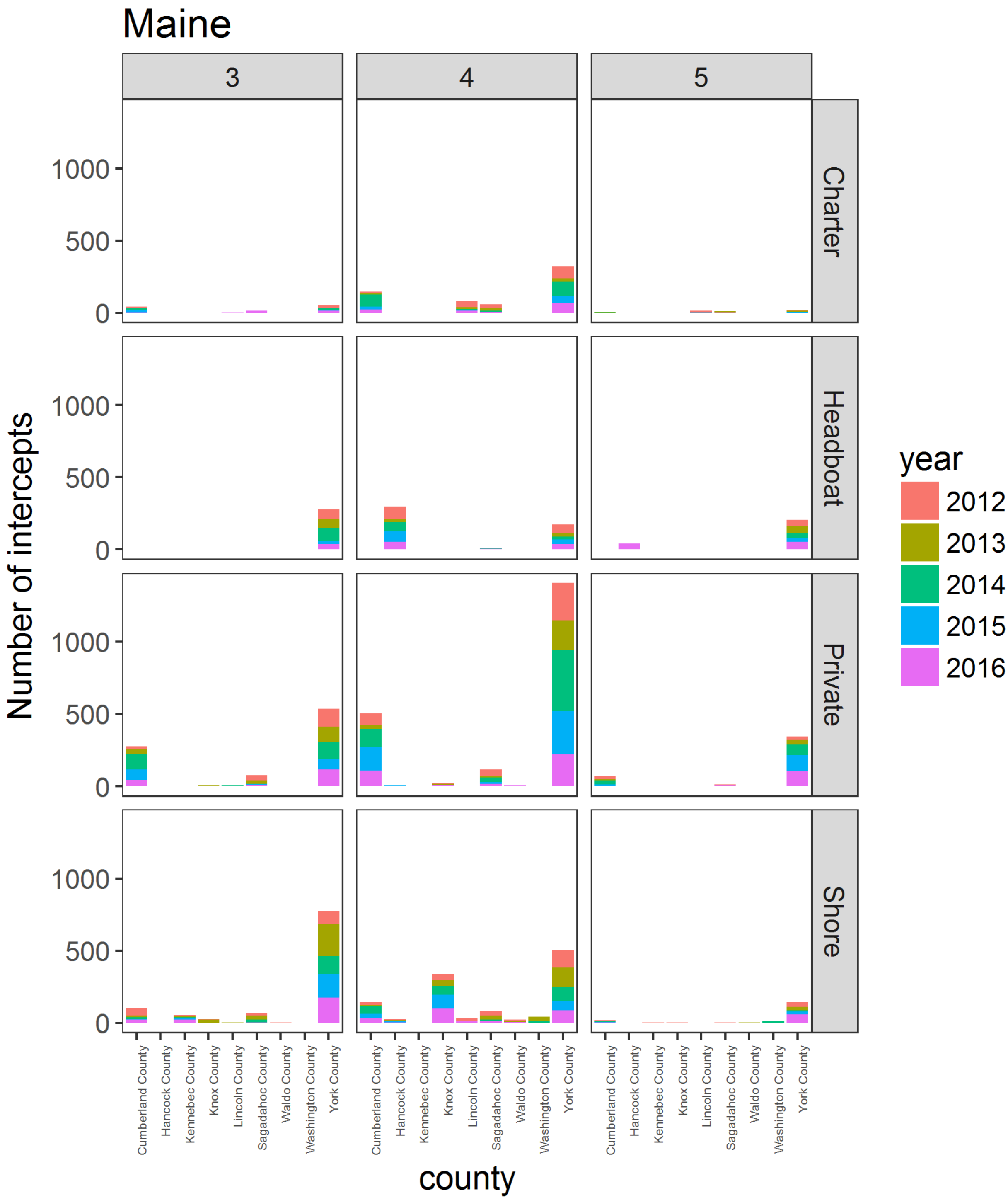
The total number of intercepts is pulled from the MRIP data, using id_code as the unique identifier. These intercepts may not have had any catch.

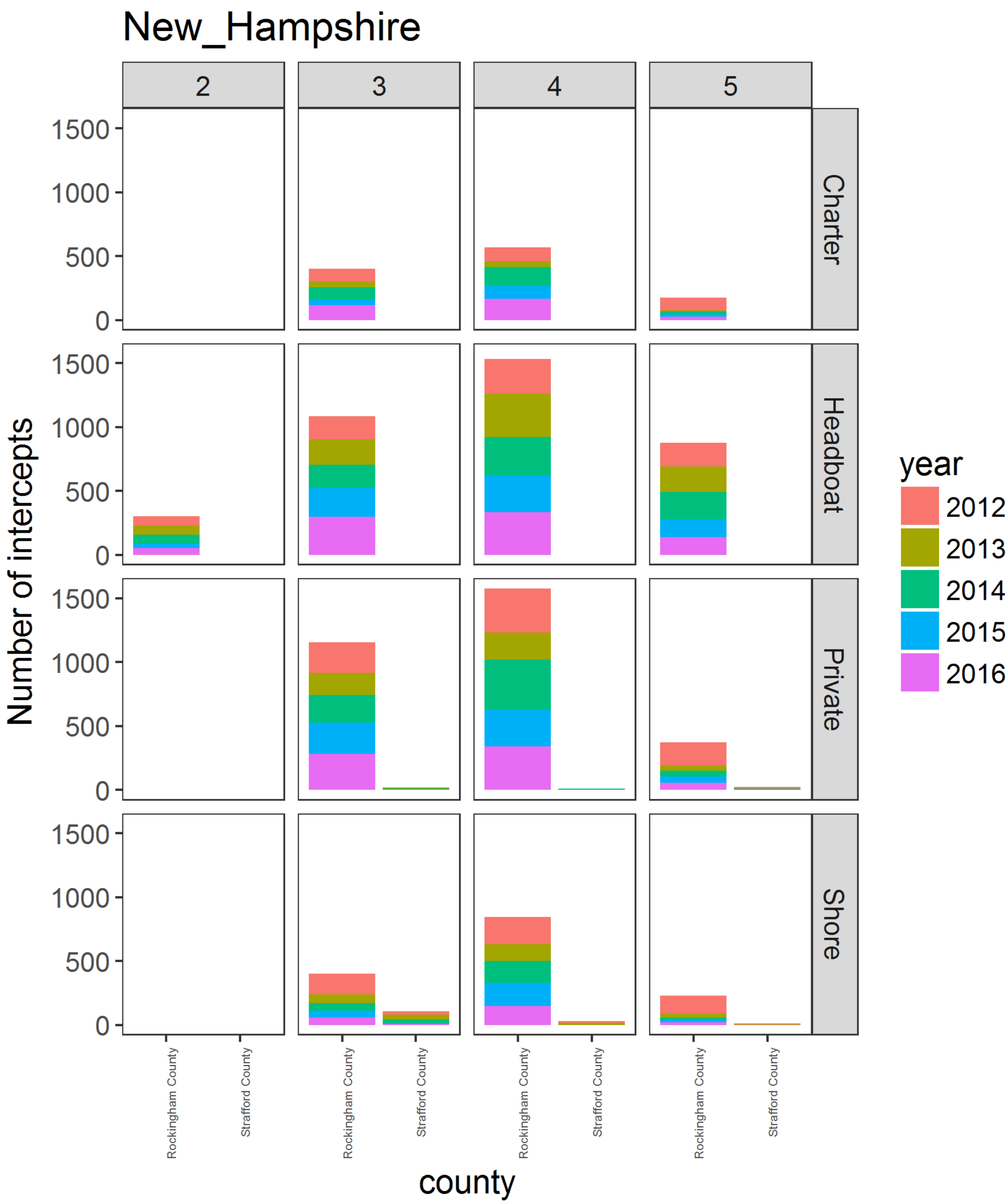
Table 1: Summary of total number of intercepts by year, state, and fishing mode.

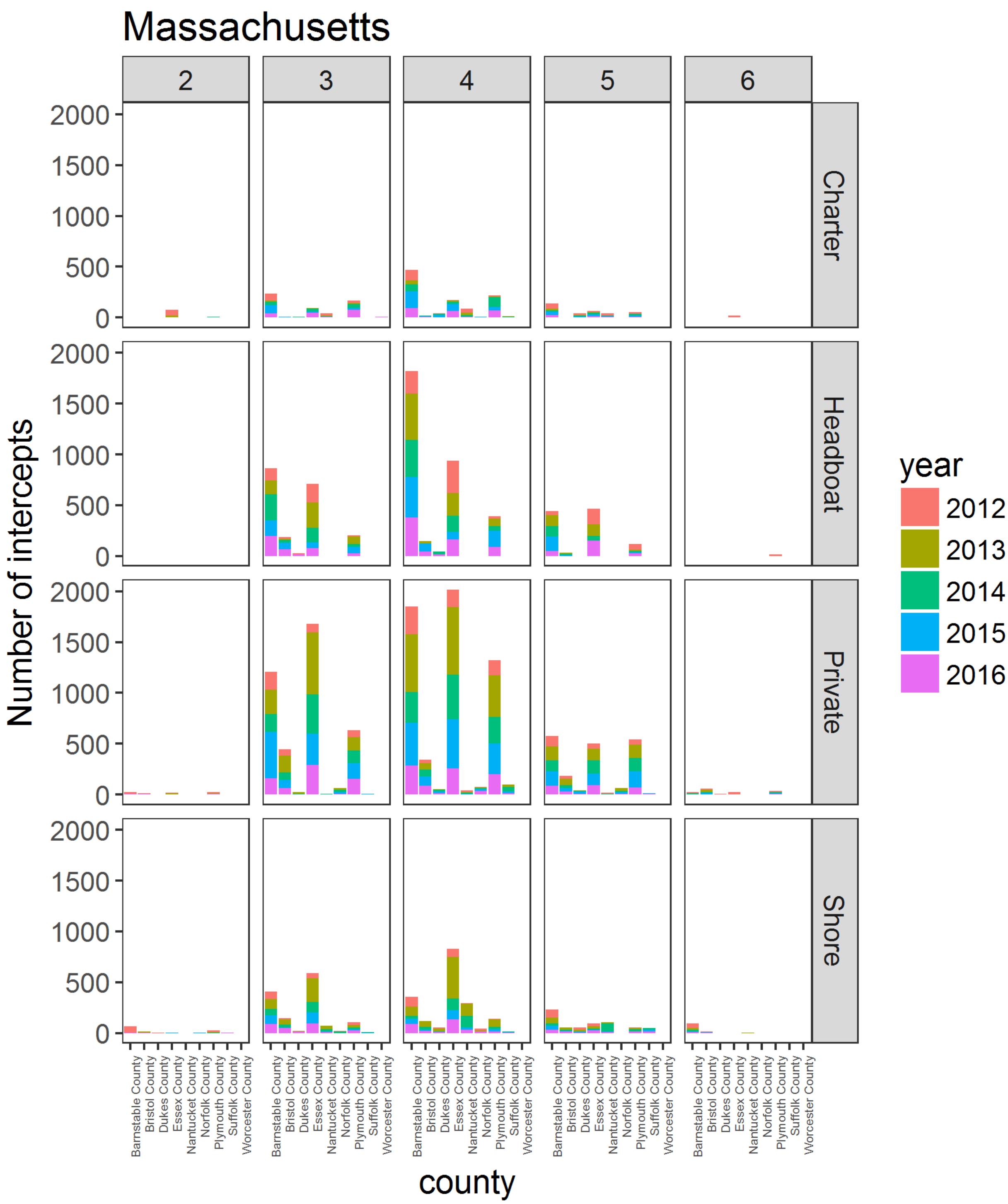
		State									
Mode_fx	**Year**	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA
Charter	2012	222	315	493	237	270	517	341	629	320	271
Charter	2013	86	106	173	100	48	177	55	155	106	87
Charter	2014	227	270	396	695	62	84	189	130	263	71
Charter	2015	106	166	504	458	31	74	109	169	231	95
Charter	2016	150	307	489	422	126	284	137	219	637	177
Headboat	2012	264	717	1172	236	272	511	905	607	588	460
Headboat	2013	162	815	1490	539	357	1187	1353	515	509	801
Headboat	2014	227	766	1227	663	221	954	1292	595	753	599
Headboat	2015	147	702	1224	691	257	1068	1083	834	647	636
Headboat	2016	235	825	1297	787	773	1308	1144	641	1143	943
Private	2012	627	778	1407	737	812	1560	1435	1278	1128	1803
Private	2013	457	443	3438	654	833	1218	1319	2411	1390	2169
Private	2014	906	674	2417	550	1190	1212	2621	1932	1652	2185
Private	2015	748	586	2888	708	1166	1841	2775	2422	1371	2393
Private	2016	639	681	1888	554	2106	1762	1878	1407	2034	2243
Shore	2012	462	570	661	823	385	698	775	746	495	470
Shore	2013	582	285	1421	640	210	790	899	2156	855	778
Shore	2014	417	280	748	604	340	606	1136	1694	552	590
Shore	2015	405	258	541	573	330	783	1277	1508	509	563
Shore	2016	533	239	739	389	508	737	978	1083	847	766

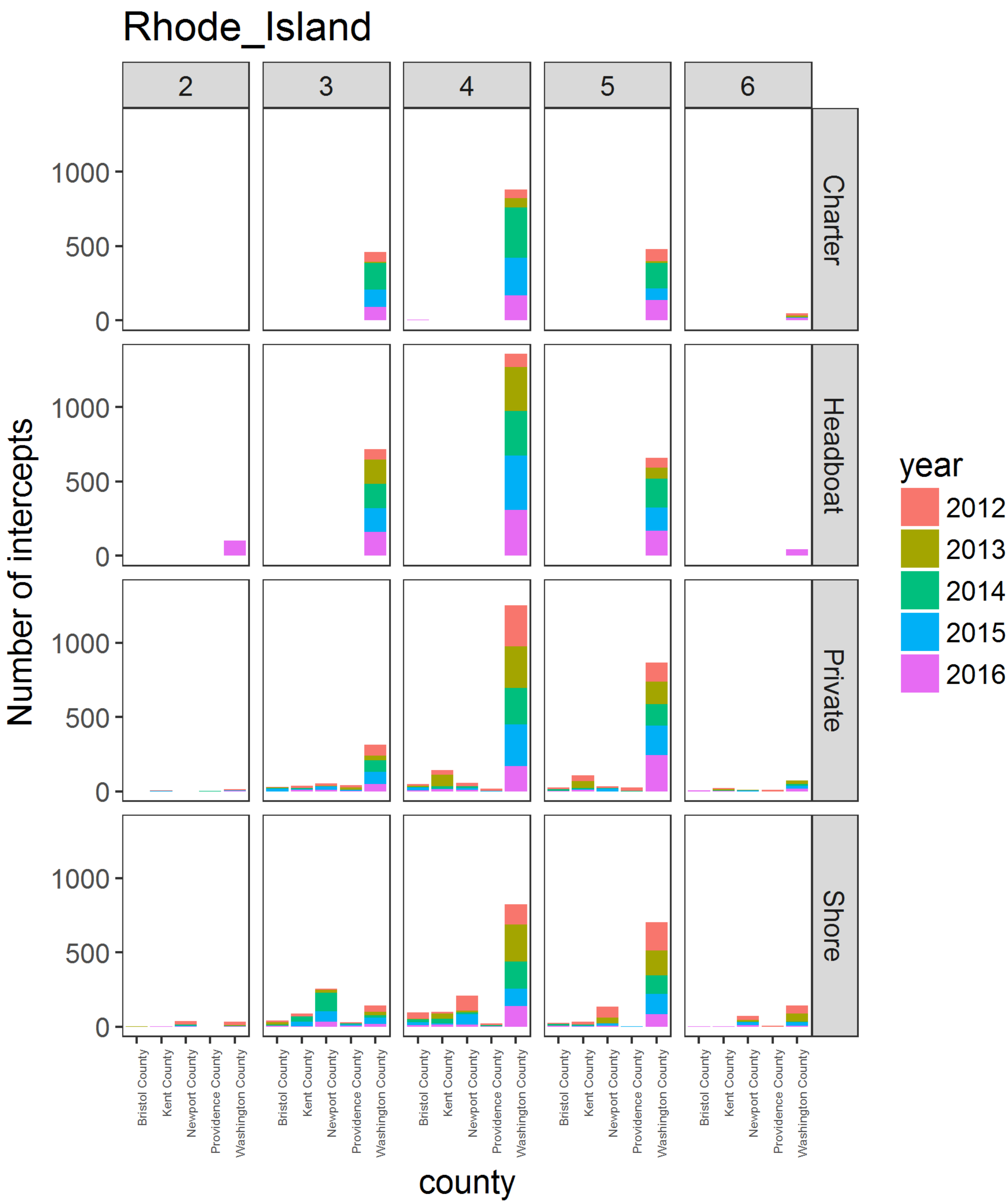
All intercepts 2012-2016

Visual summary of MRIP intercepts by year, state, county, wave, and mode (charter, headboat, private, shore). These are data exclusively from the trip .csv files and are irrespective of target, harvested or discarded species; simply the total number of intercepts.

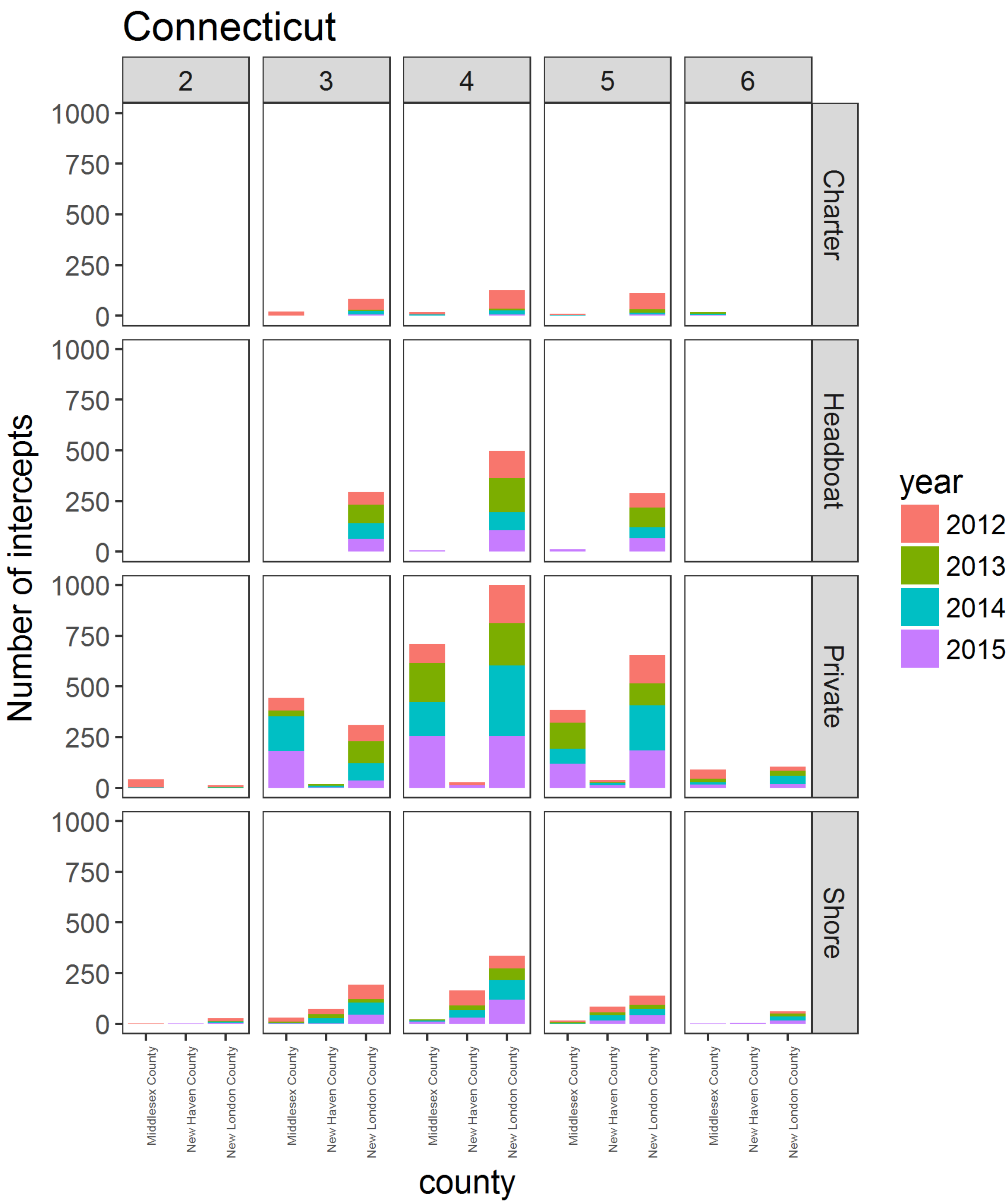



New_Hampshire
2
3
4
5
Charter
Headboat
Private
Shore
Number of intercepts
1500
1000
500
0
Rockingham County
Strafford County
county
year
2012
2013
2014
2015
2016

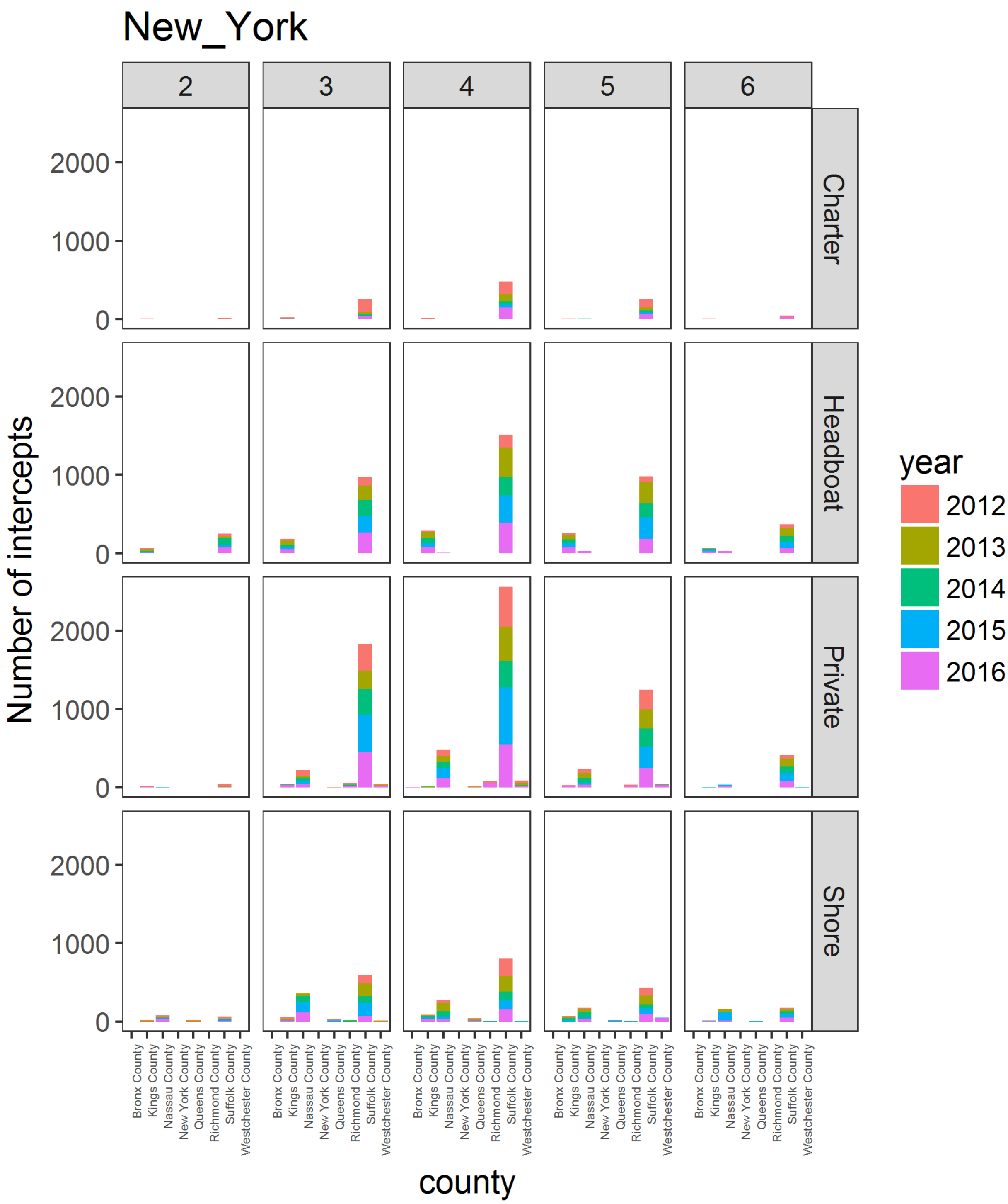

Massachusetts
2
3
4
5
6
Charter
Headboat
Private
Shore
2000
1500
1000
500
0
Number of intercepts
year
2012
2013
2014
2015
2016
Barnstable County
Bristol County
Dukes County
Essex County
Nantucket County
Norfolk County
Plymouth County
Suffolk County
Worcester County
county

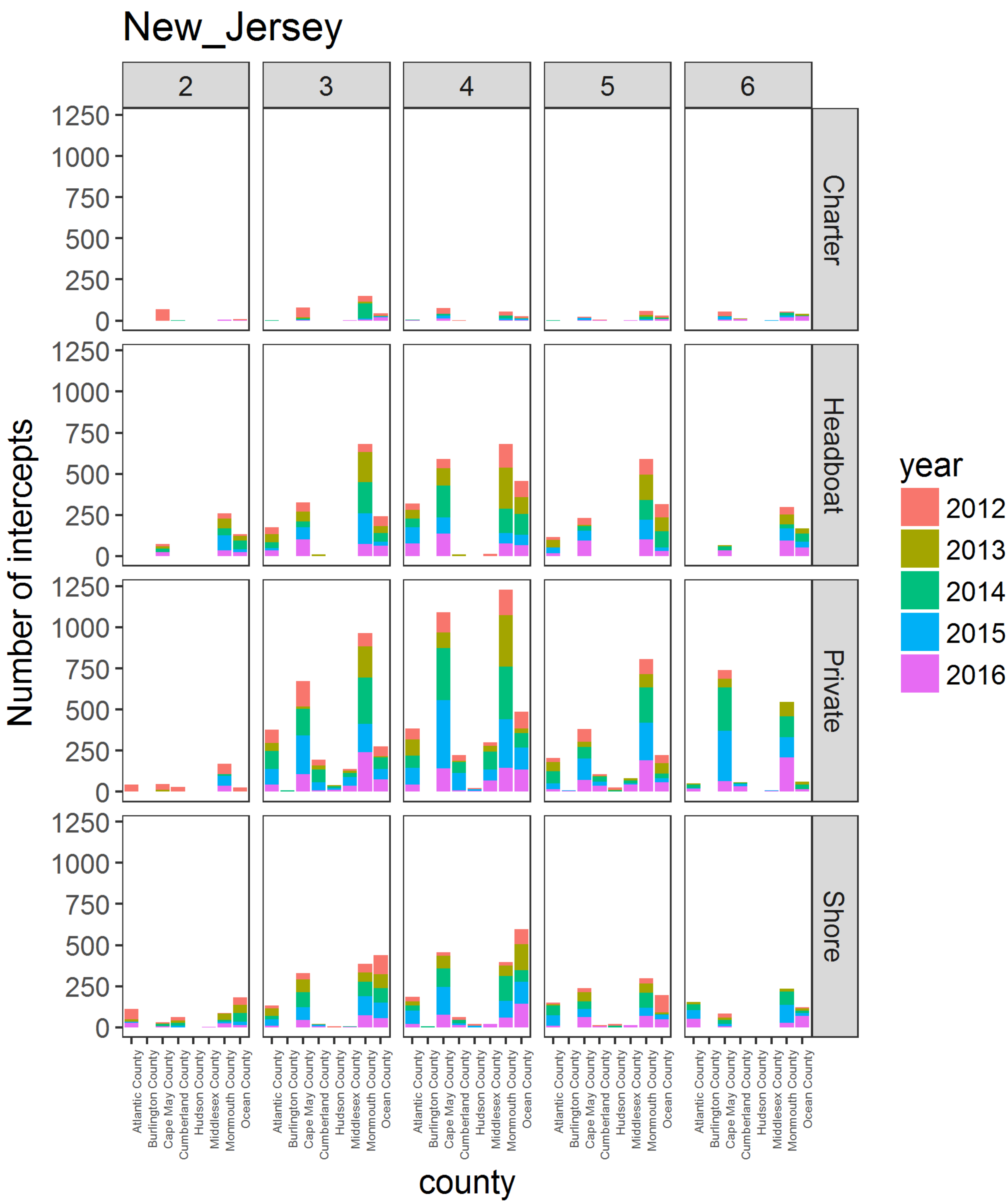


Rhode_Island
2
3
4
5
6
Charter
Headboat
Private
Shore
Number of intercepts
1000
500
0
Bristol County
Kent County
Newport County
Providence County
Washington County
county
year
2012
2013
2014
2015
2016

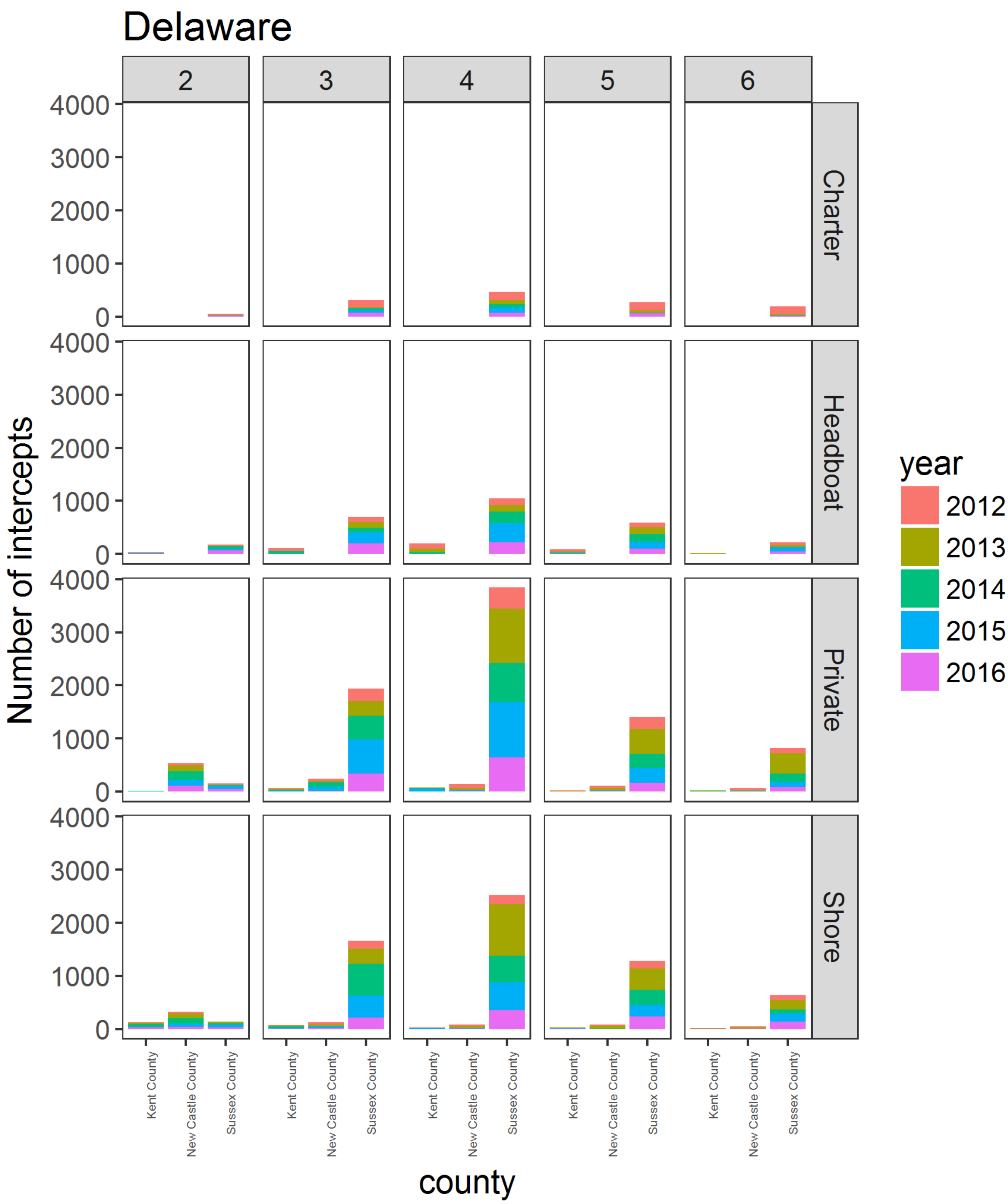


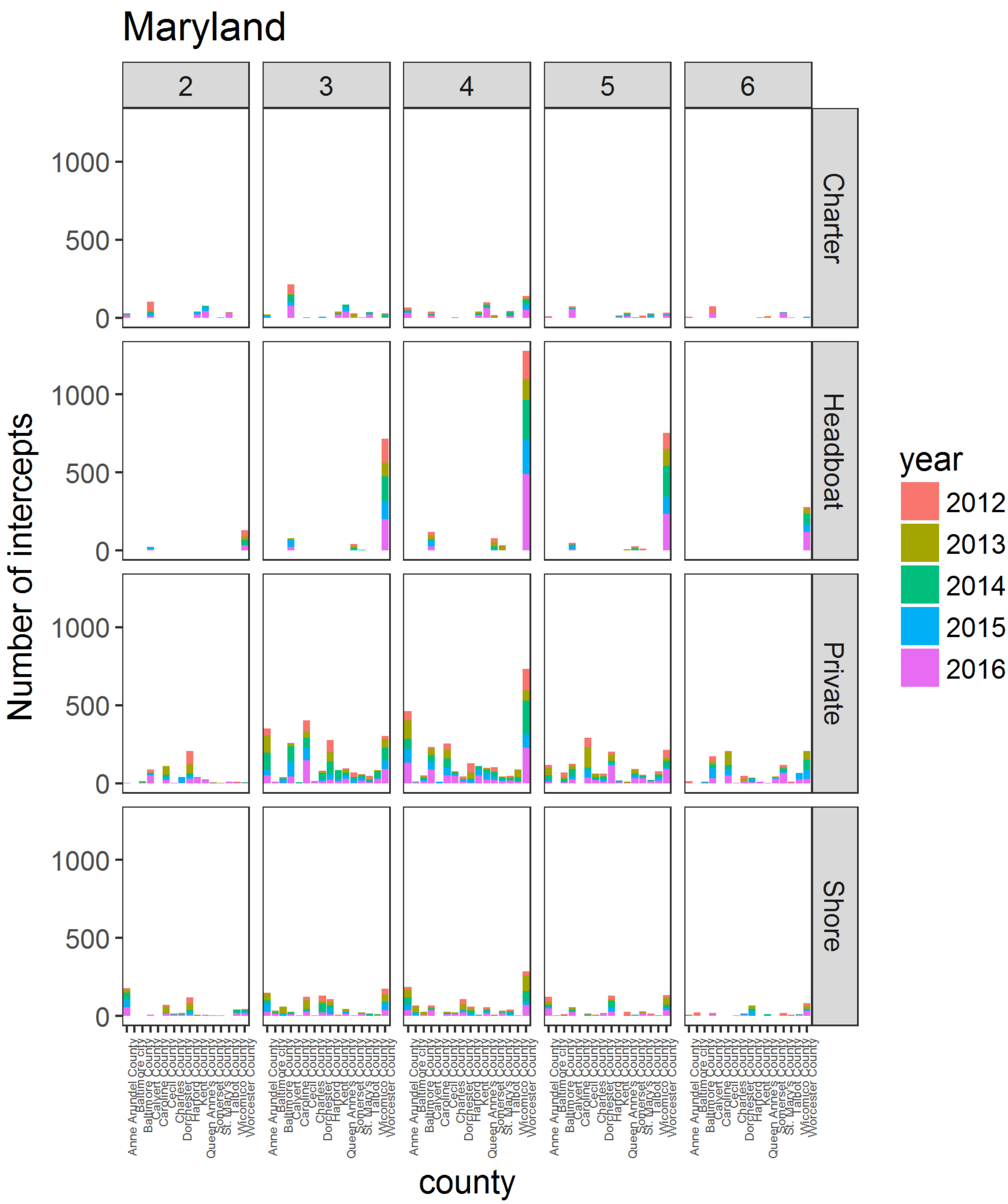
Connecticut
2
3
4
5
6
1000
750
500
250
0
Charter
Headboat
Private
Shore
Number of intercepts
year
2012
2013
2014
2015
Middlesex County
New Haven County
New London County
county


New_York
2
3
4
5
6
Charter
Headboat
Private
Shore
Number of intercepts
2000
1000
0
year
2012
2013
2014
2015
2016
Bronx County
Kings County
Nassau County
New York County
Queens County
Richmond County
Suffolk County
Westchester County
county

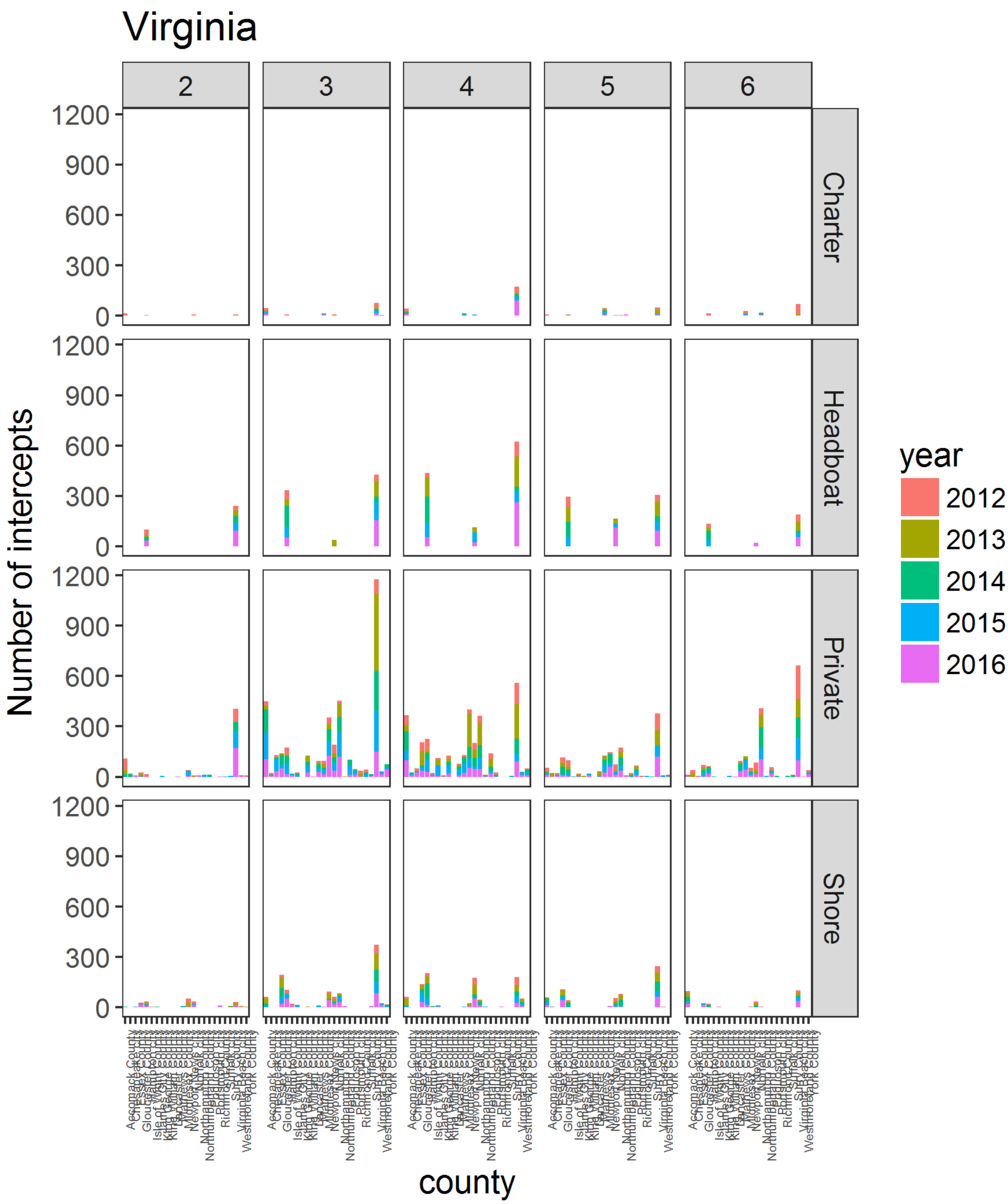


New_Jersey
2
3
4
5
6
Charter
Headboat
Private
Shore
Number of intercepts
1250
1000
750
500
250
0
county
Atlantic County
Burlington County
Cape May County
Cumberland County
Hudson County
Middlesex County
Monmouth County
Ocean County
year
2012
2013
2014
2015
2016


Delaware
2
3
4
5
6
4000
3000
2000
1000
0
Charter
Headboat
Private
Shore
Number of intercepts
year
2012
2013
2014
2015
2016
Kent County
New Castle County
Sussex County
county

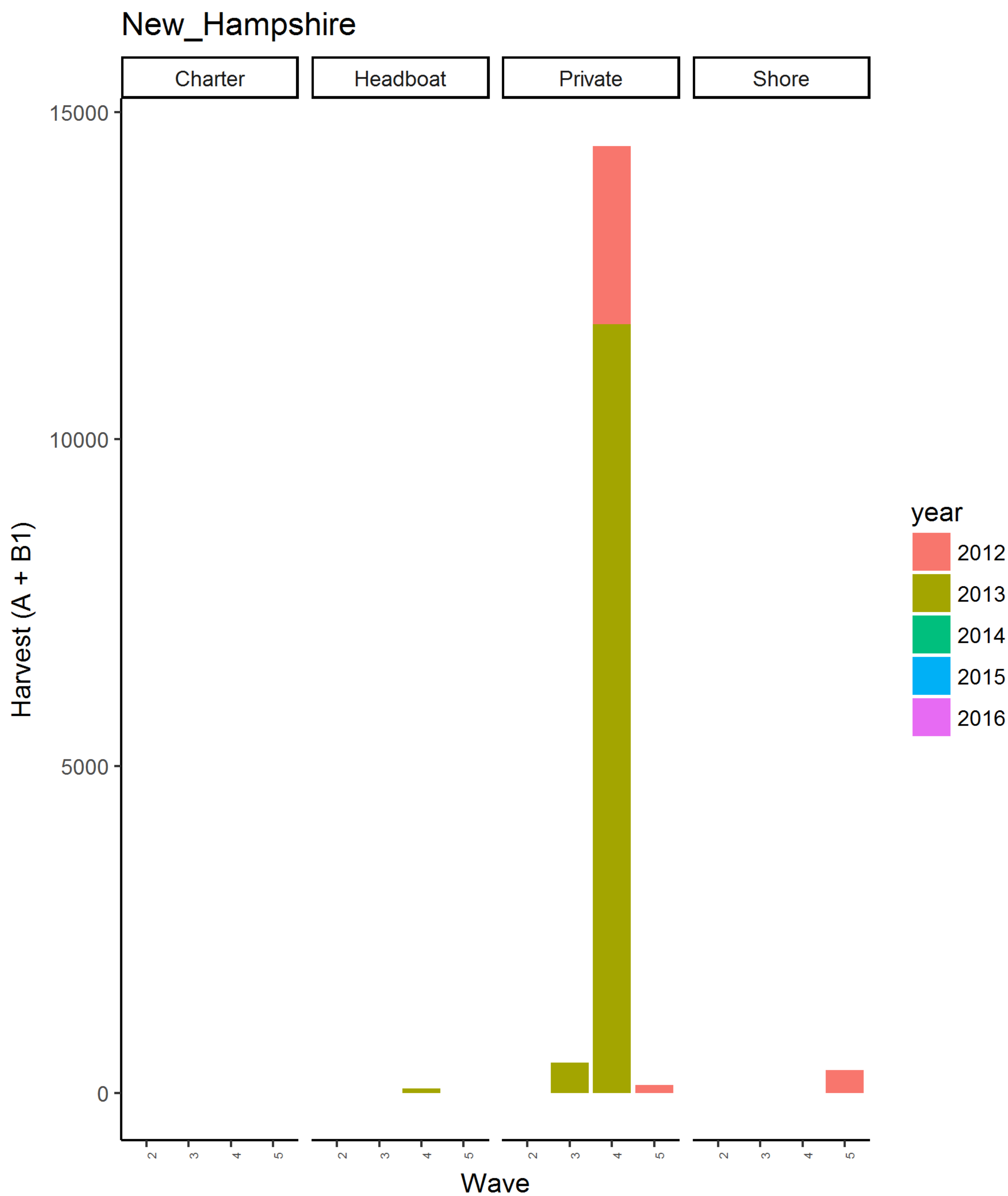


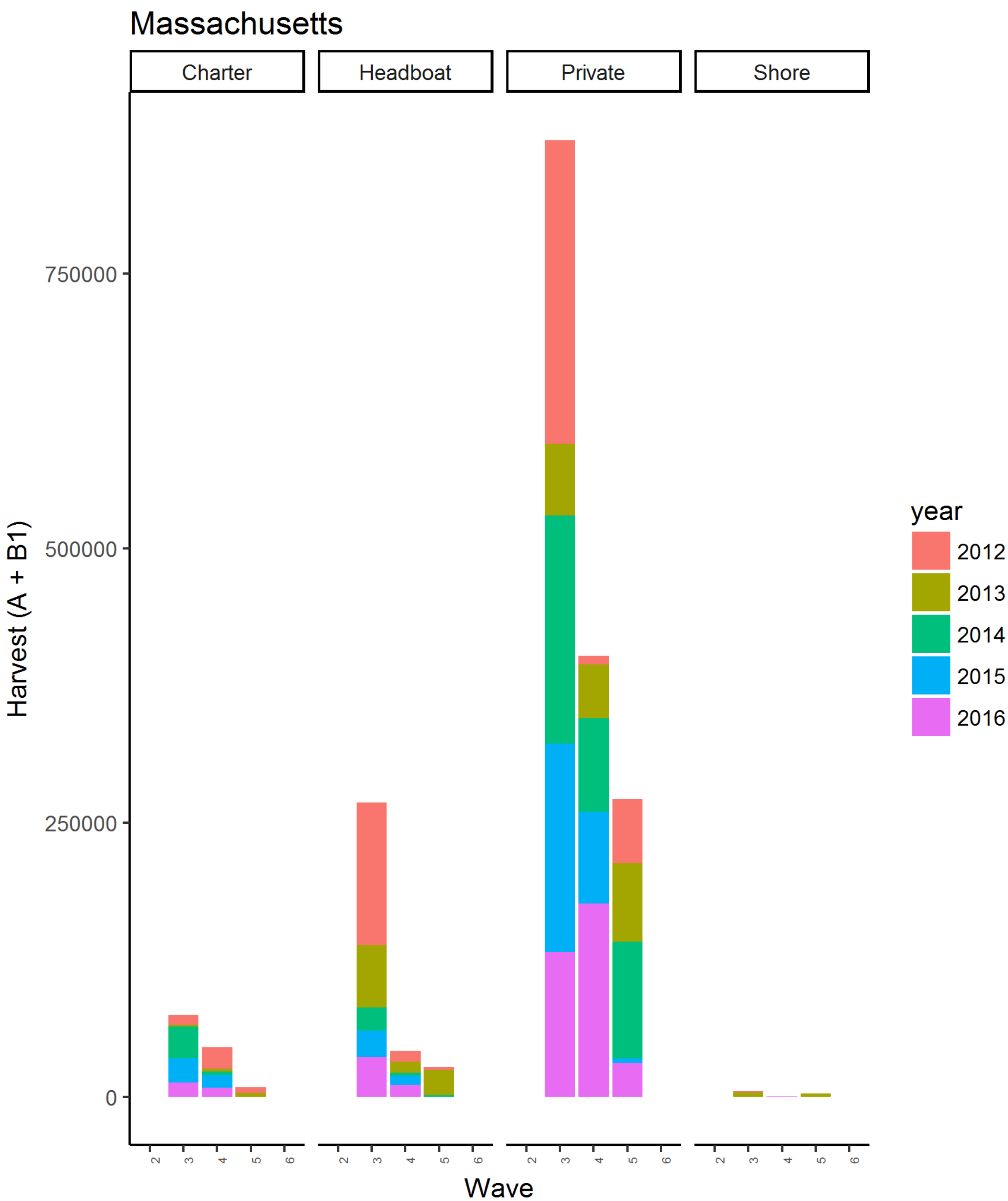
Maryland
2
3
4
5
6
Charter
Headboat
Private
Shore
Number of intercepts
1000
500
0
year
2012
2013
2014
2015
2016
Anne Arundel County
Baltimore city
Baltimore County
Calvert County
Caroline County
Cecil County
Charles County
Dorchester County
Harford County
Kent County
Queen Anne's County
Somerset County
St. Mary's County
Talbot County
Wicomico County
Worcester County
county


Virginia
2
3
4
5
6
Charter
Headboat
Private
Shore
1200
900
600
300
0
Number of intercepts
county
year
2012
2013
2014
2015
2016

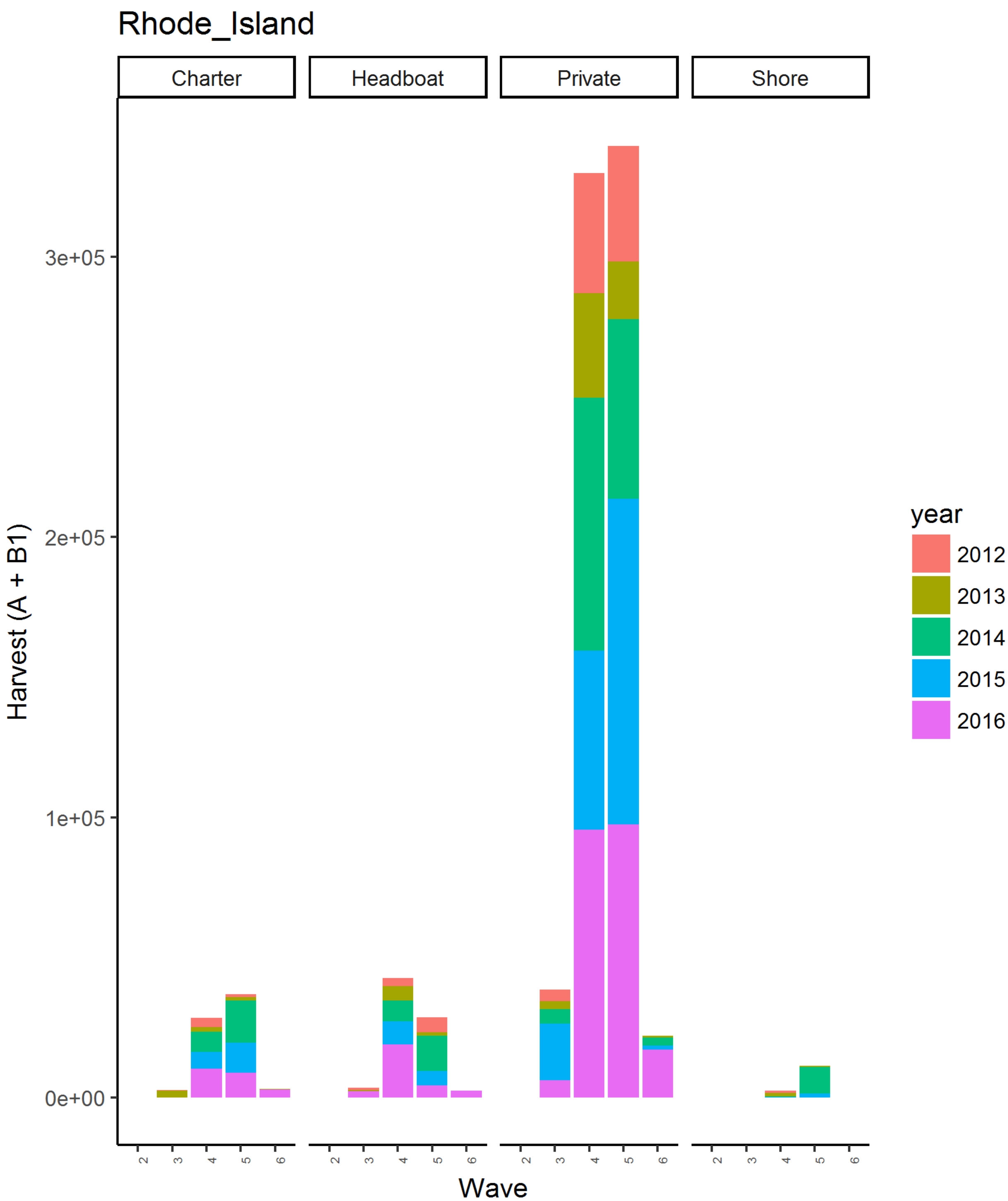
Harvest 2012-2016

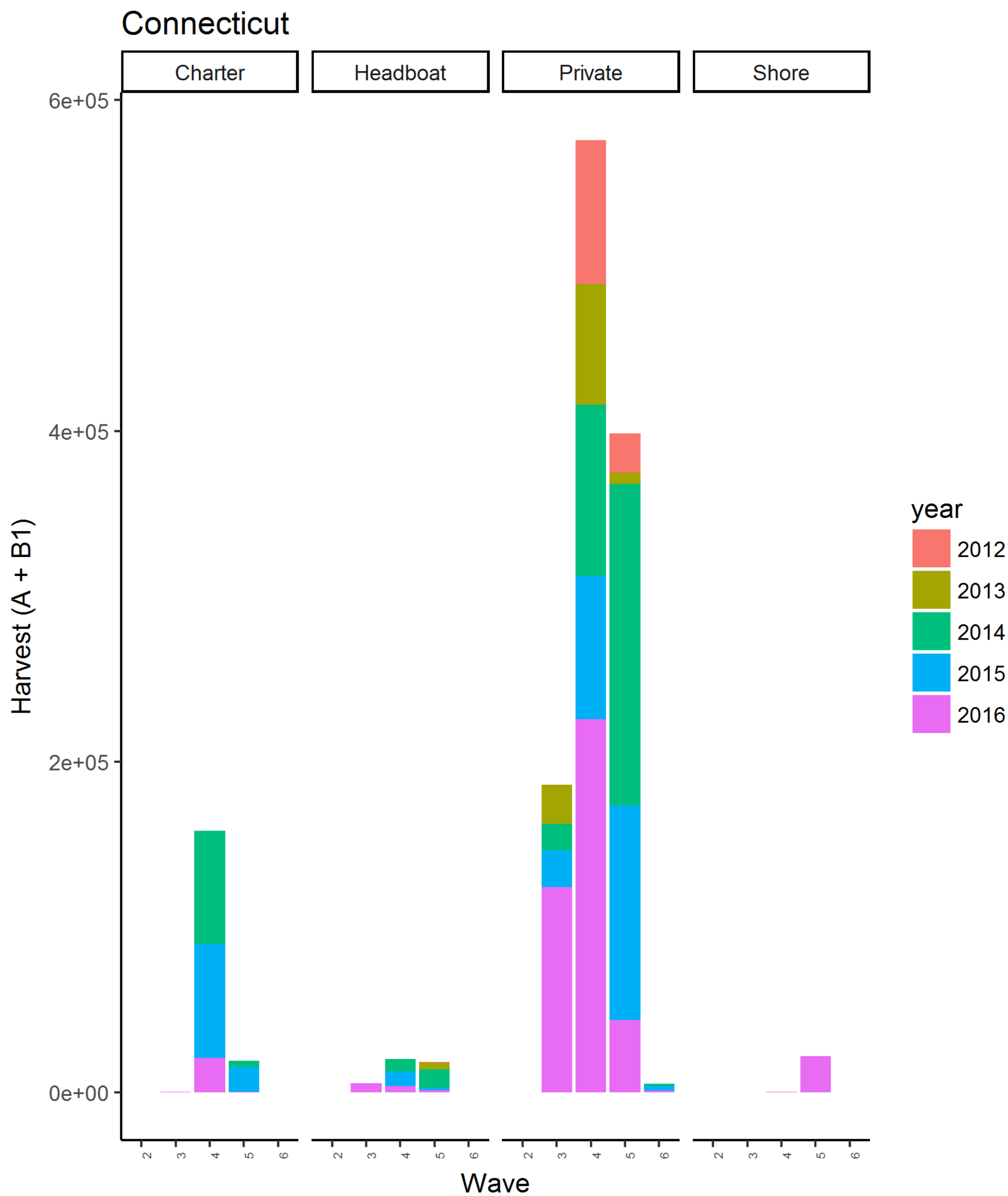
Visual summary of MRIP harvest estimates by year, state, county, wave, and mode (charter, headboat, private, shore).

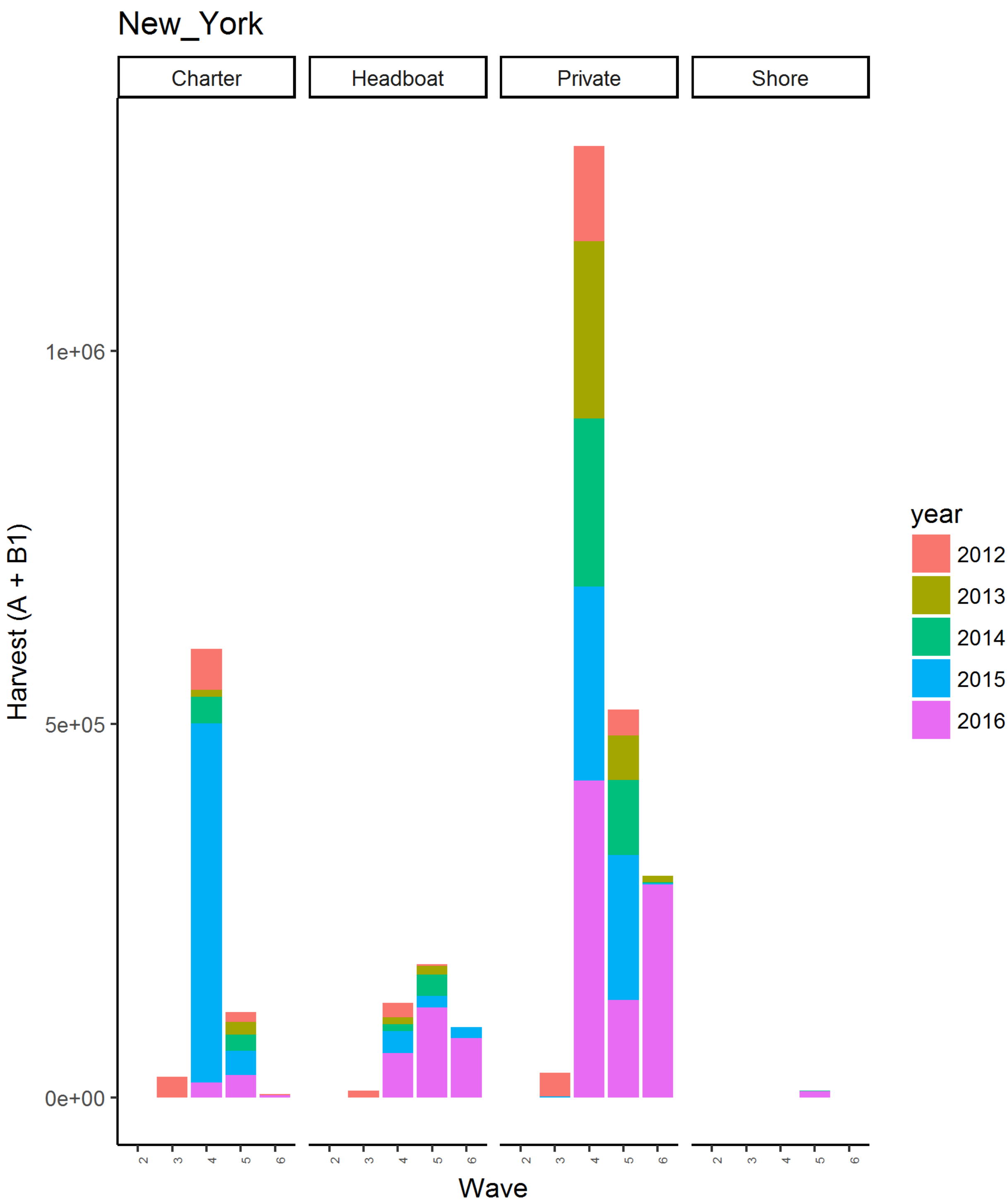


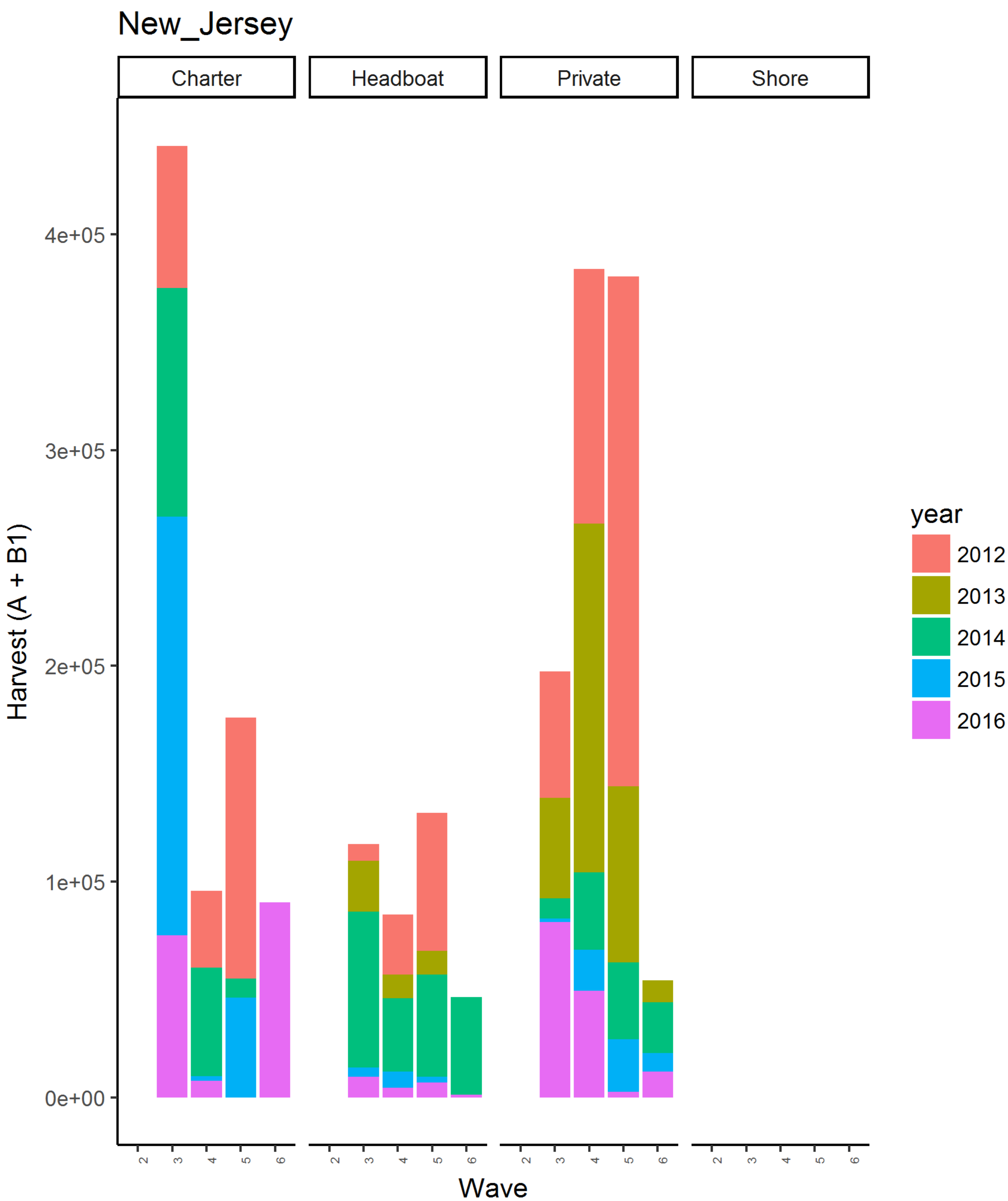


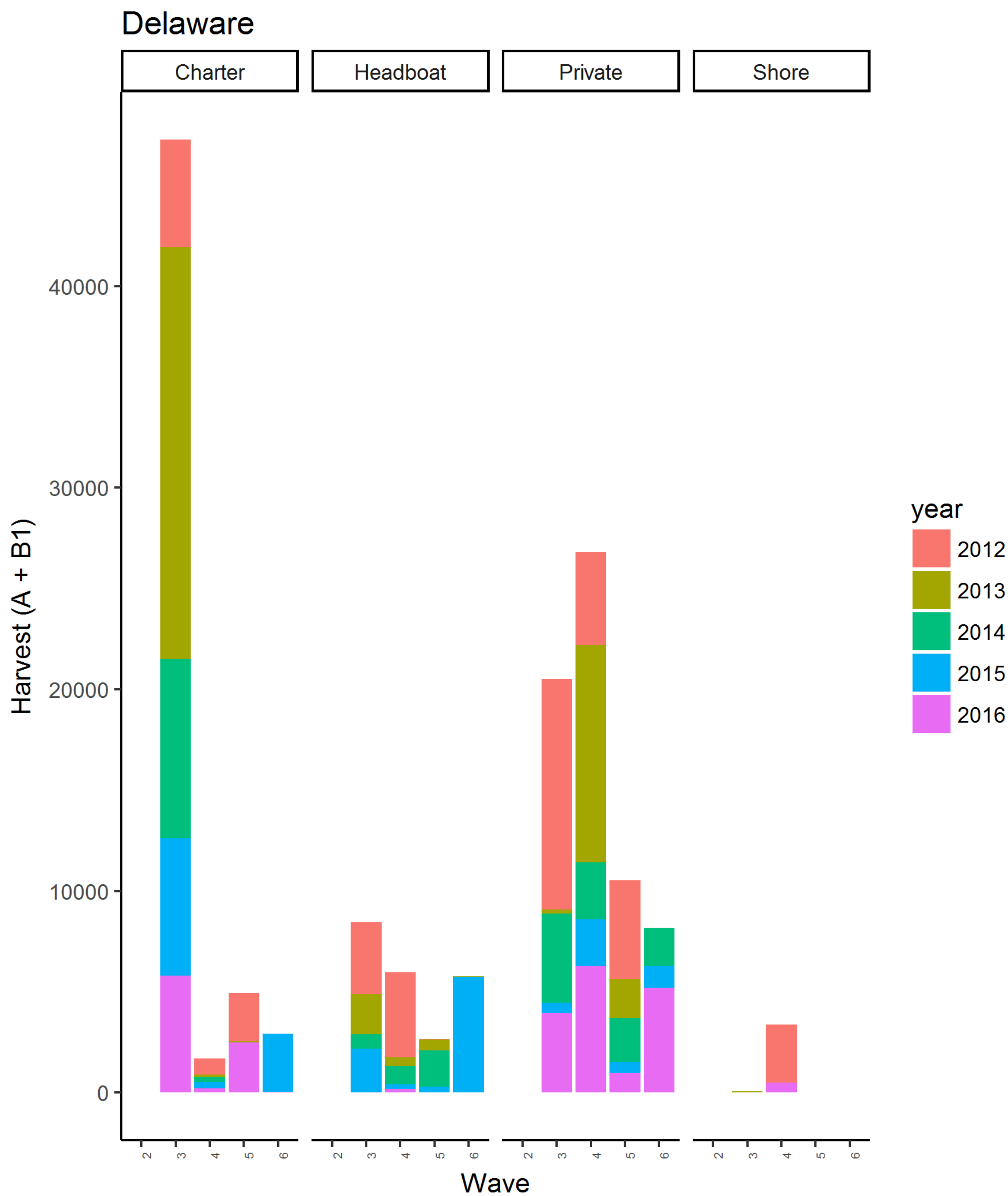
Massachusetts
Charter
Headboat
Private
Shore
750000
500000
250000
0
Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

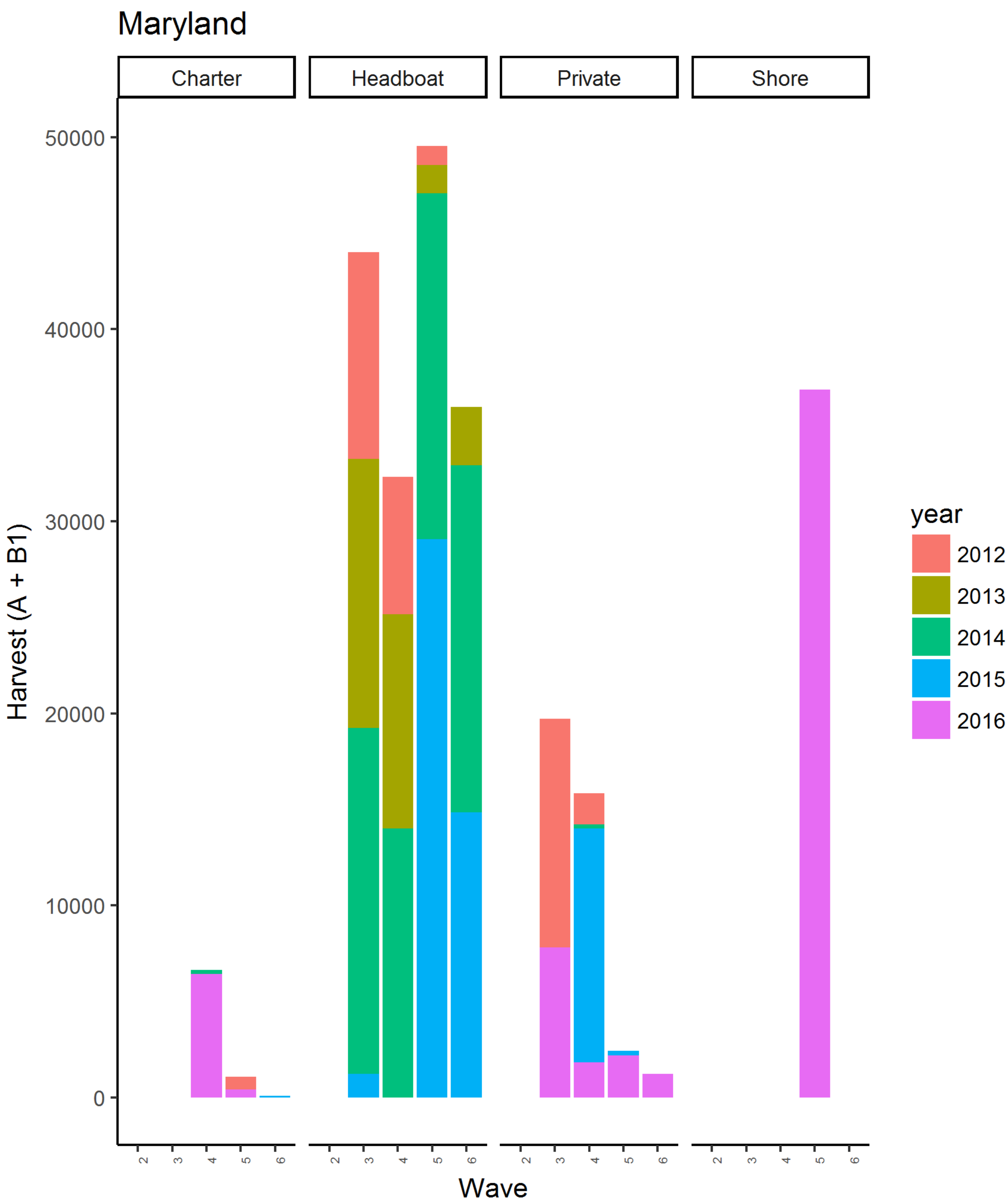

Rhode_Island
Charter
Headboat
Private
Shore
Harvest (A + B1)
3e+05
2e+05
1e+05
0e+00
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


Connecticut
Charter
Headboat
Private
Shore
6e+05
4e+05
2e+05
0e+00
Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

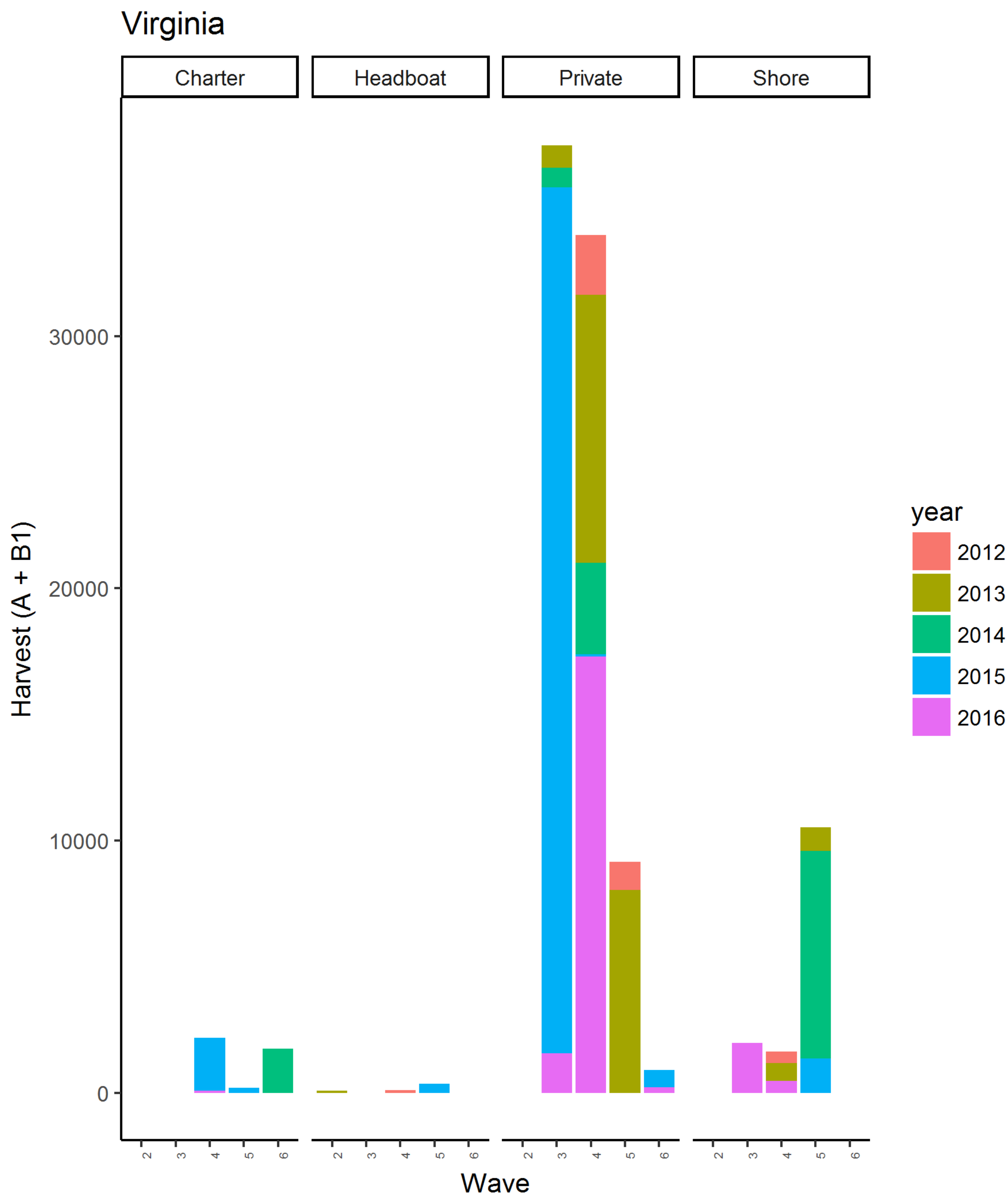

New_York
Charter
Headboat
Private
Shore
1e+06
5e+05
0e+00
Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


New_Jersey
Charter
Headboat
Private
Shore
4e+05
3e+05
2e+05
1e+05
0e+00
Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


Delaware
Charter
Headboat
Private
Shore
Harvest (A + B1)
40000
30000
20000
10000
0
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016



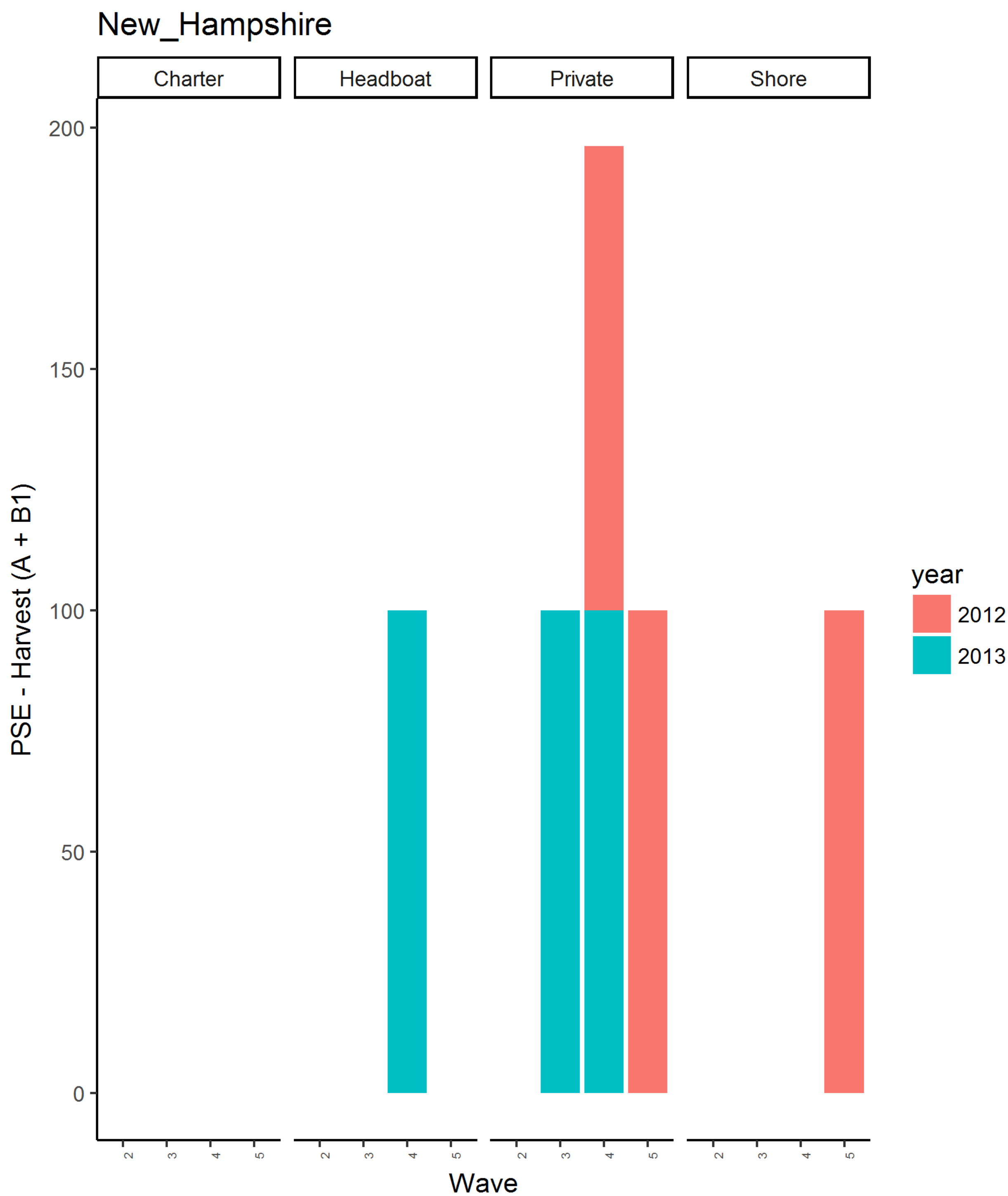
Maryland
Charter
Headboat
Private
Shore
50000
40000
30000
20000
10000
0
Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

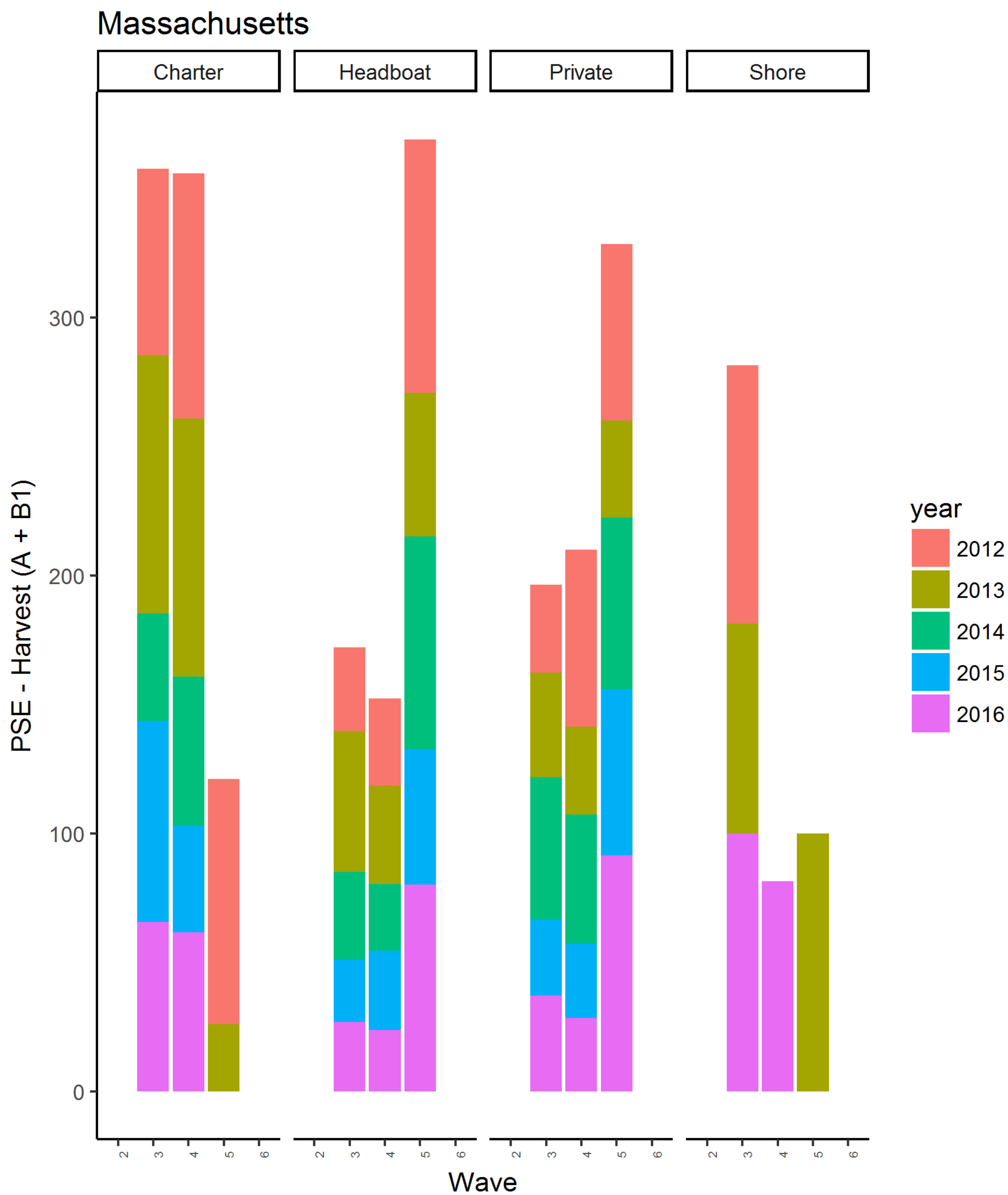


Virginia
Charter
Headboat
Private
Shore
Harvest (A + B1)
30000
20000
10000
0
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

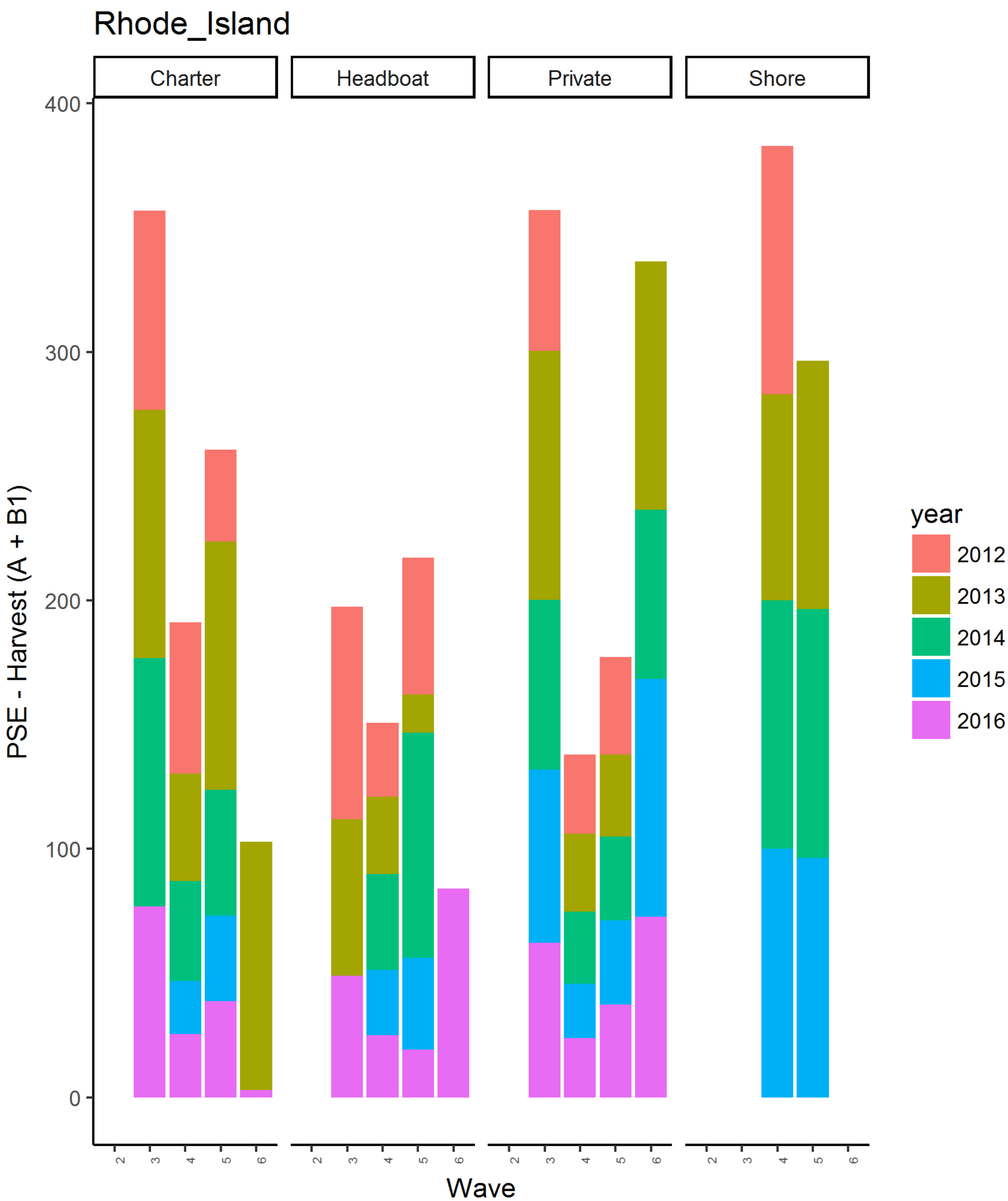
Harvest PSE comparison

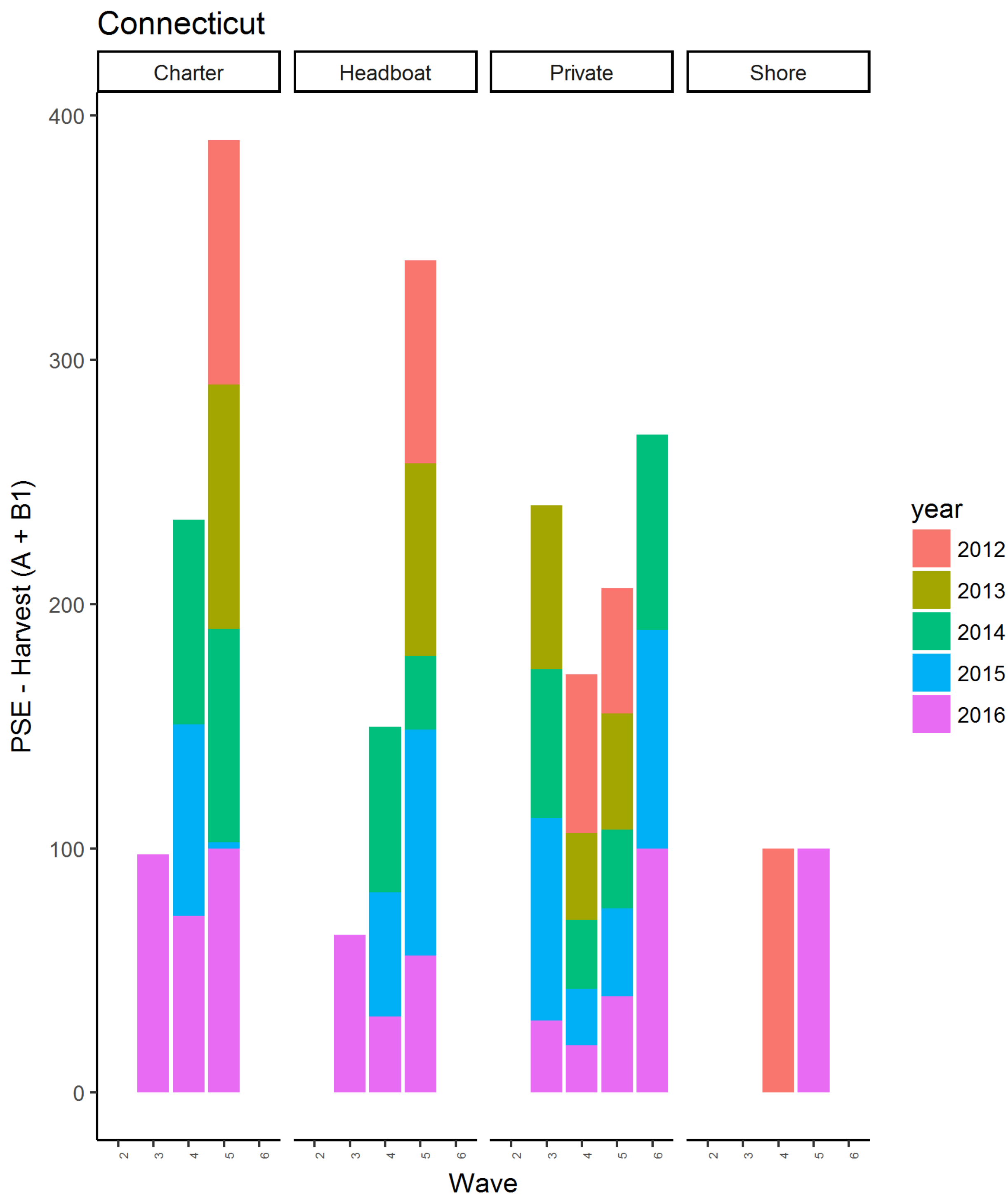
Visual summary of MRIP PSE estimates for harvest (A+B1) by year, state, county, wave, and mode (charter, headboat, private, shore).



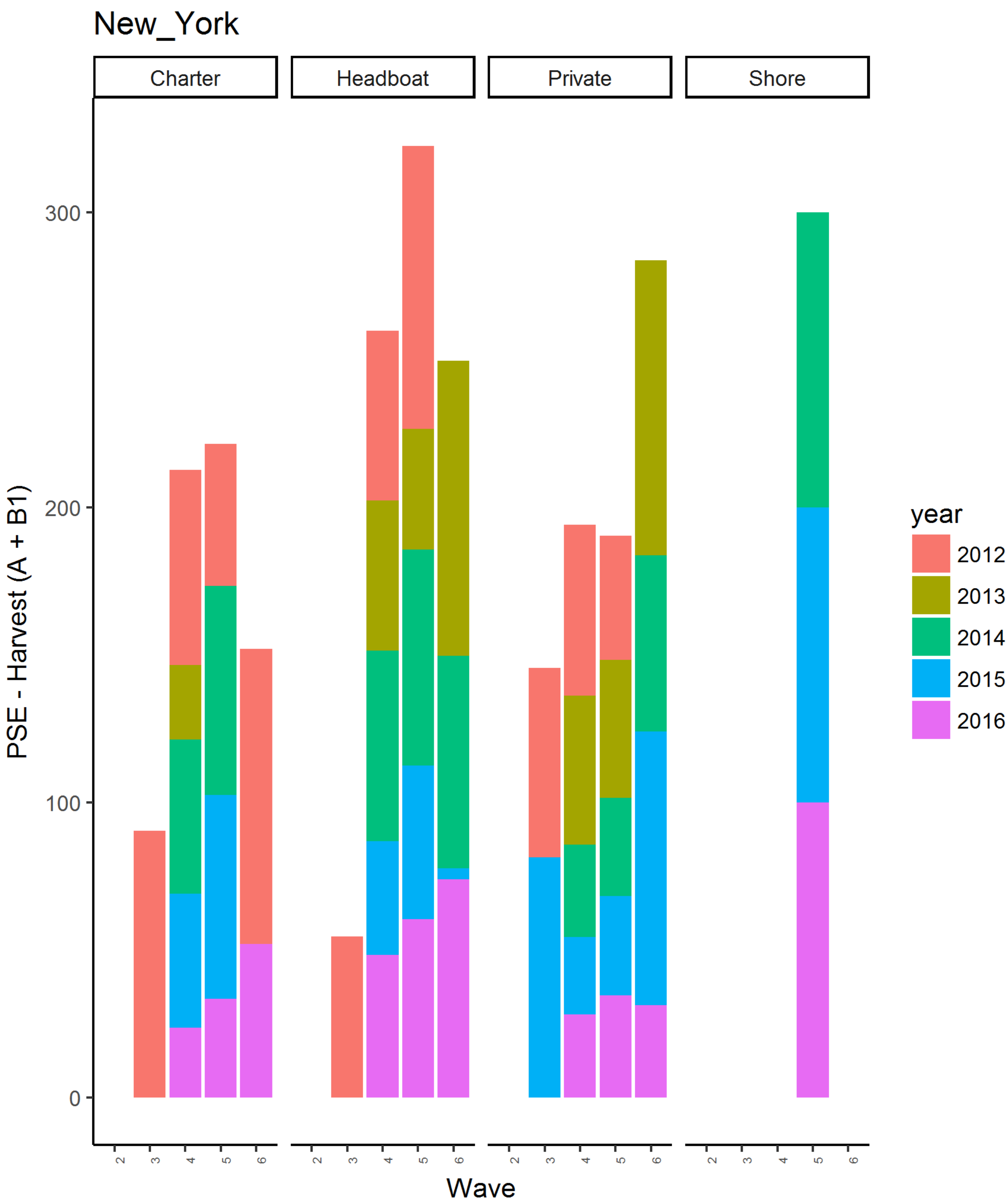


Massachusetts
Charter
Headboat
Private
Shore
PSE - Harvest (A + B1)
0
100
200
300
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

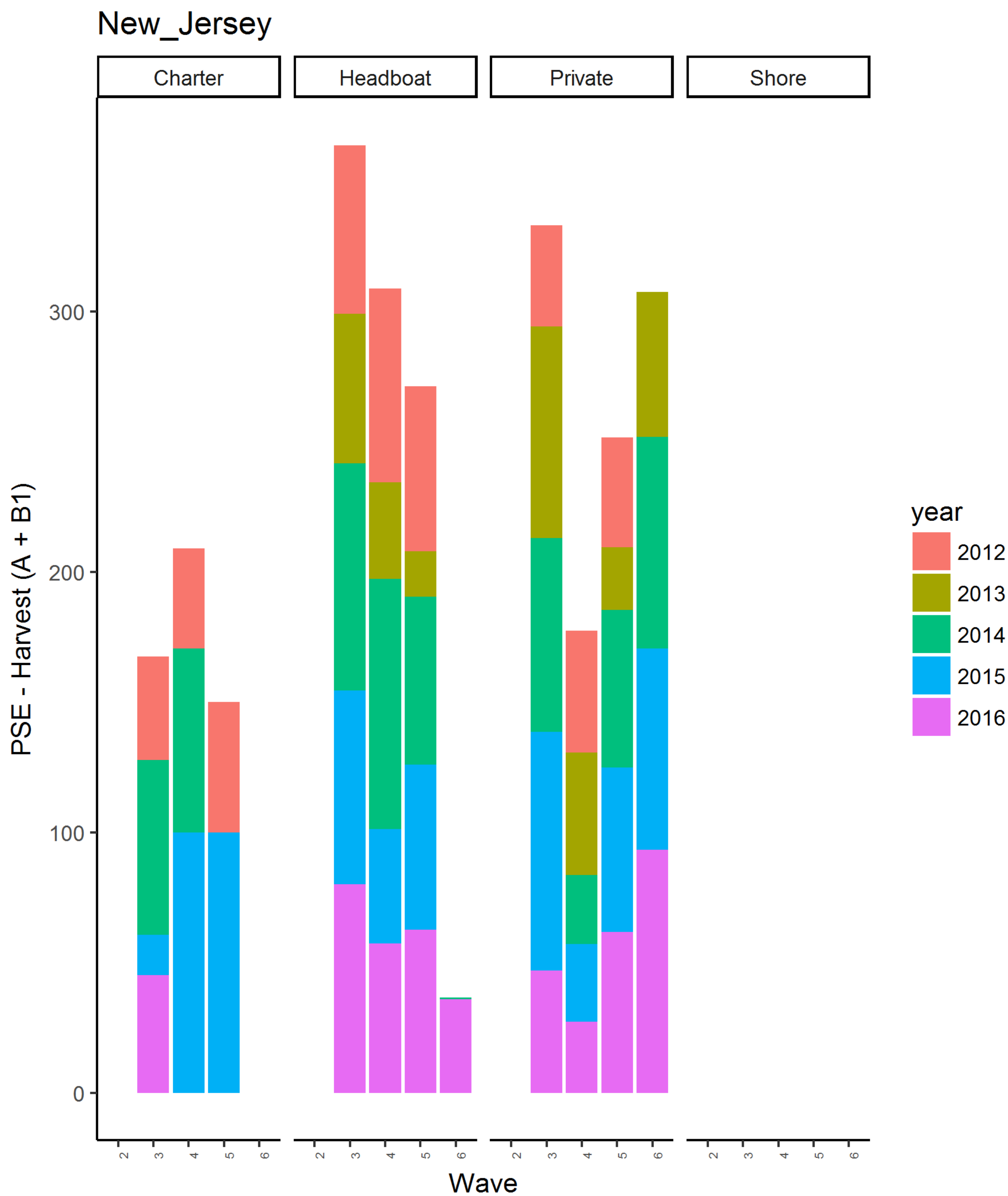

Rhode_Island
Charter
Headboat
Private
Shore
400
300
200
100
0
PSE - Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

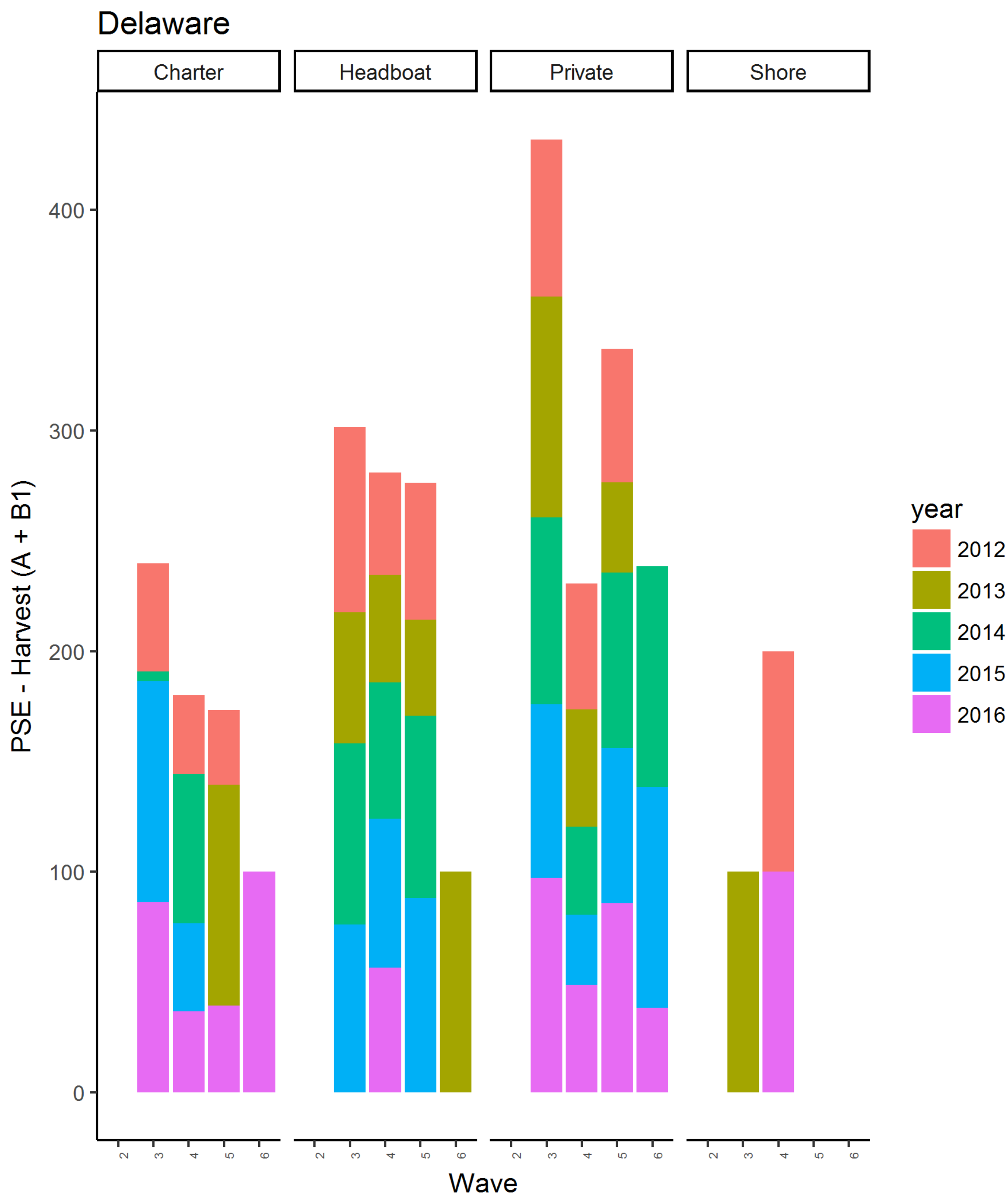


Connecticut
Charter
Headboat
Private
Shore
400
300
200
100
0
PSE - Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

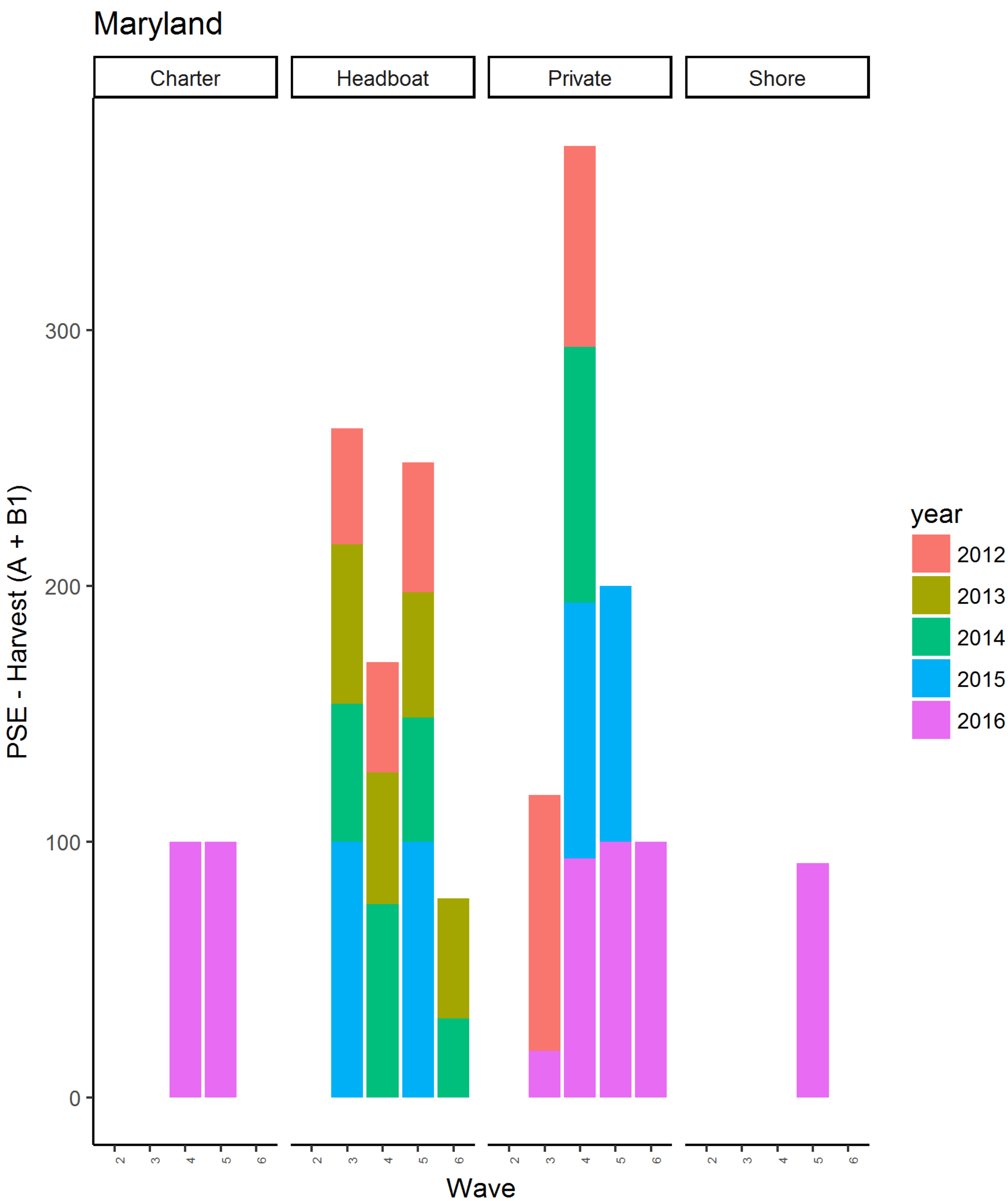


New_York
Charter
Headboat
Private
Shore
300
200
100
0
PSE - Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

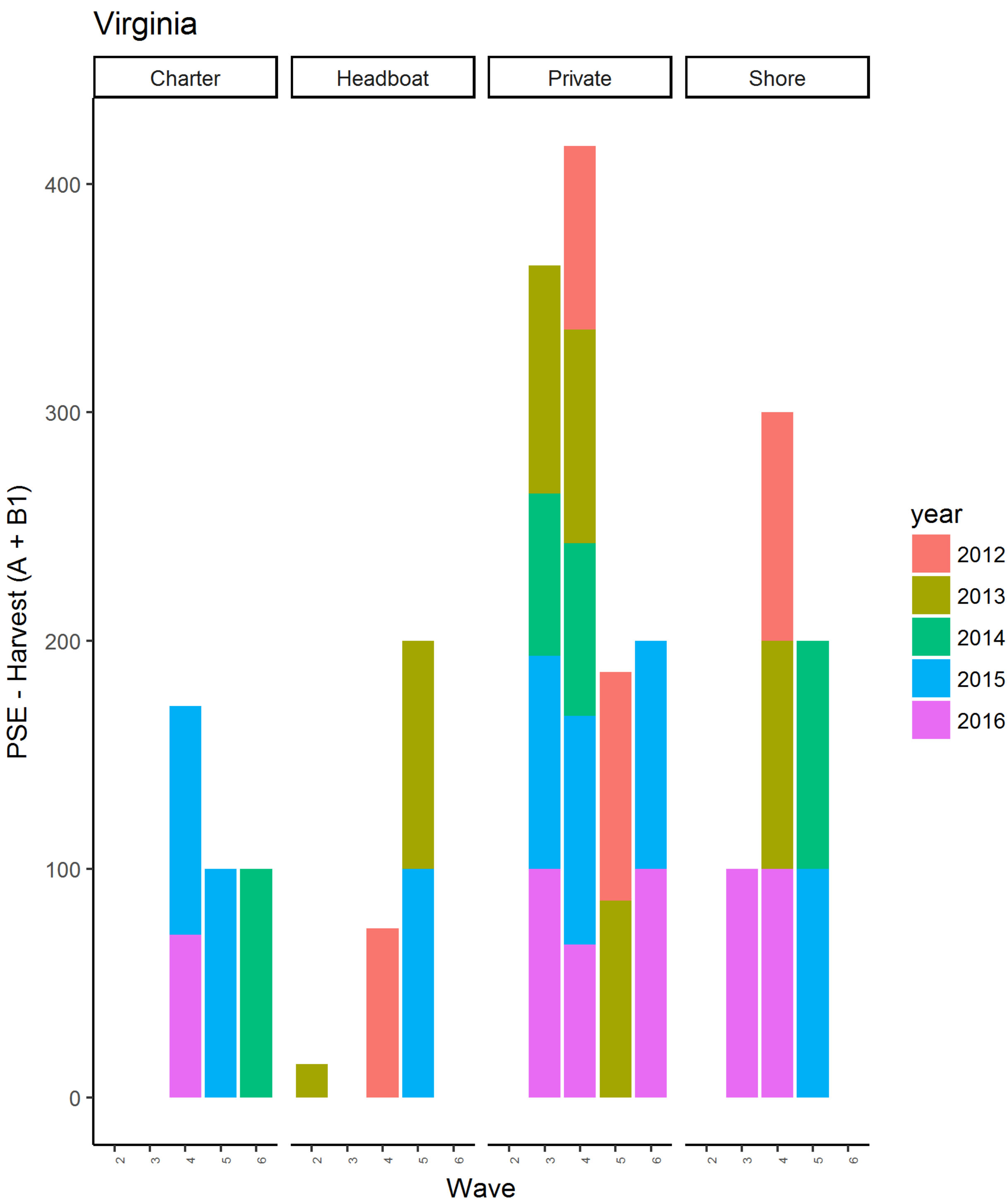

New_Jersey
Charter
Headboat
Private
Shore
PSE - Harvest (A + B1)
300
200
100
0
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016



Delaware
Charter
Headboat
Private
Shore
PSE - Harvest (A + B1)
0
100
200
300
400
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

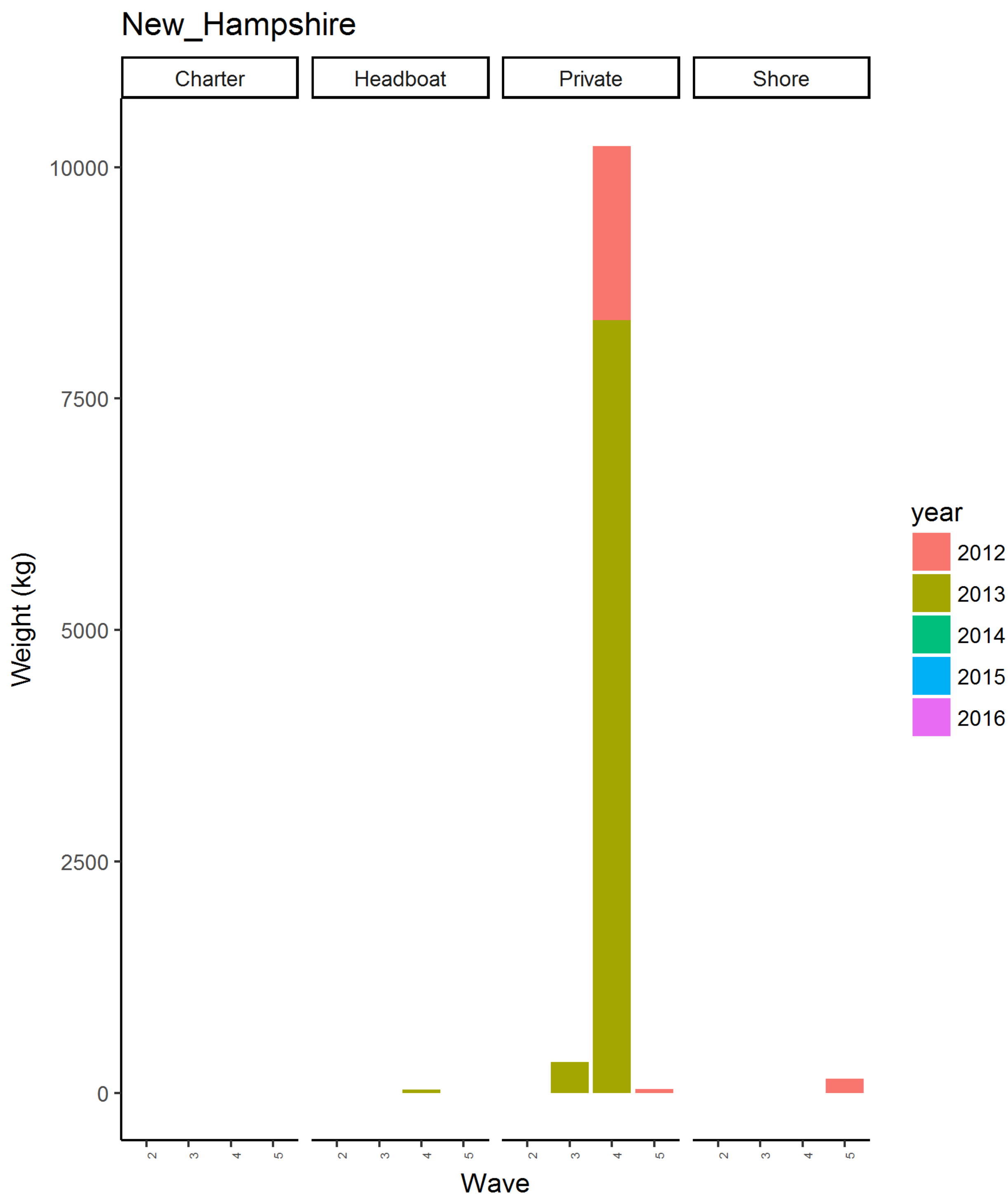


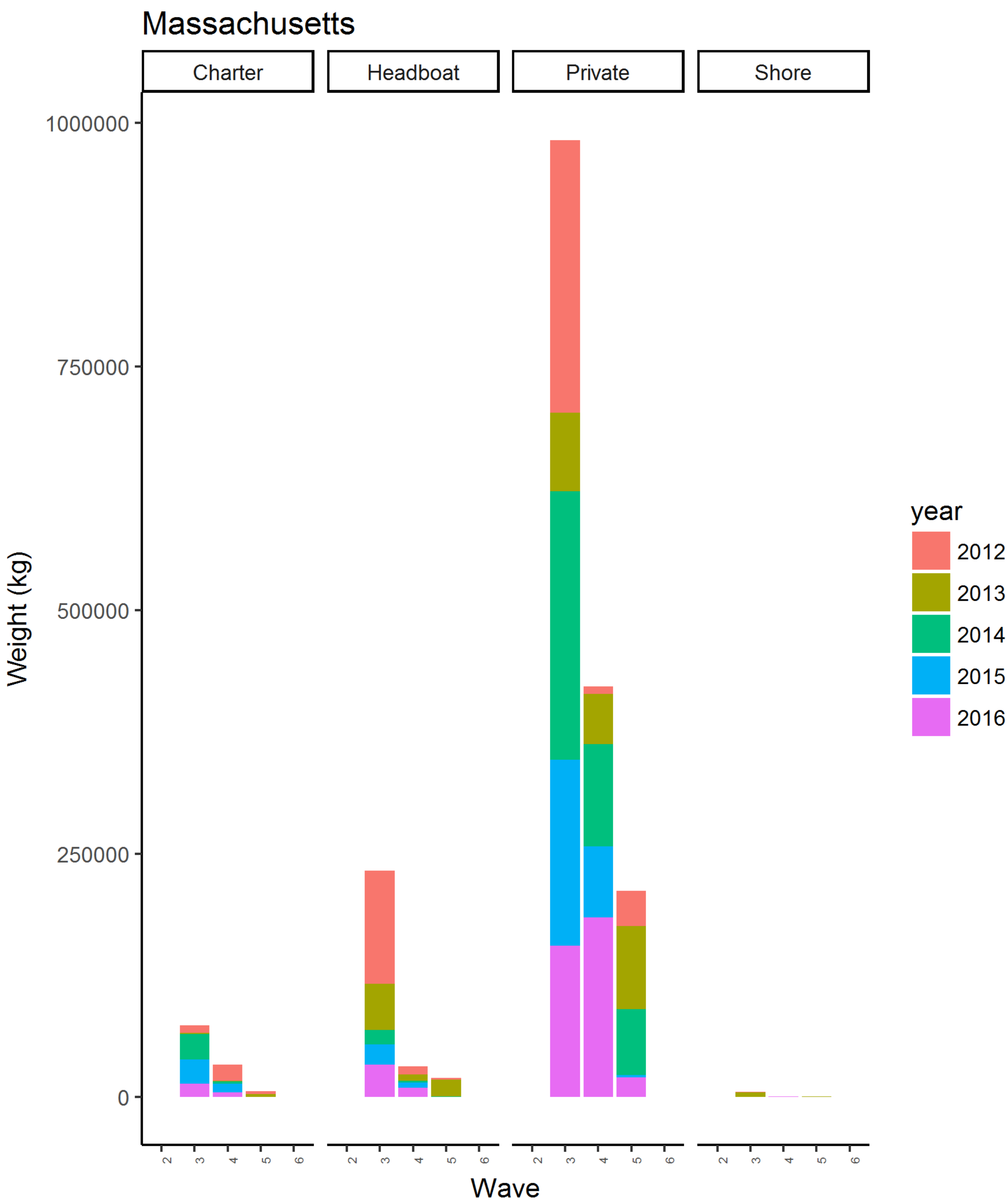
Maryland
Charter
Headboat
Private
Shore
PSE - Harvest (A + B1)
300
200
100
0
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


Virginia
Charter
Headboat
Private
Shore
400
300
200
100
0
PSE - Harvest (A + B1)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

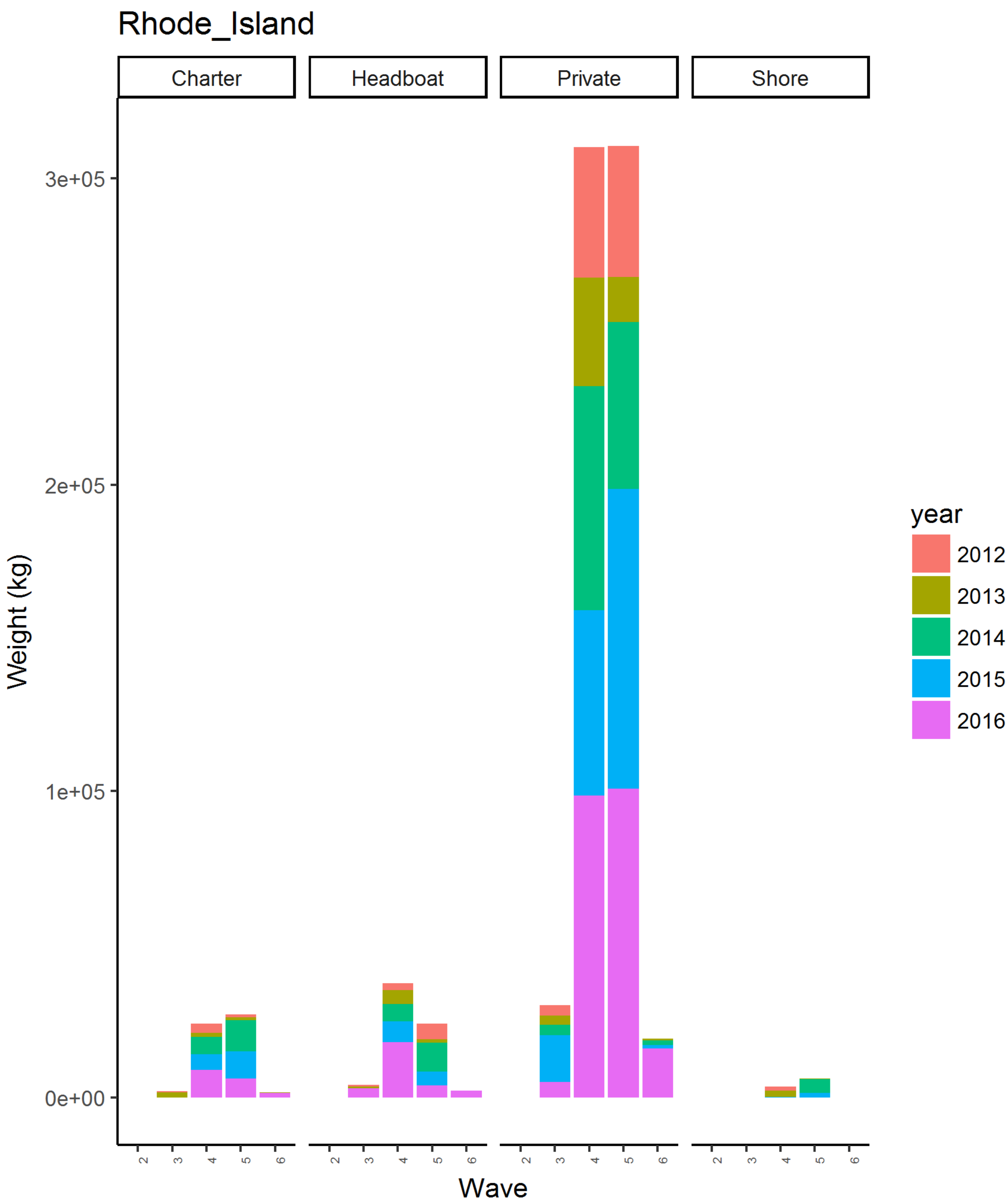
Harvested Weight 2011-2016

Visual summary of MRIP harvest estimates by year, state, county, wave, and mode (charter, headboat, private, shore).

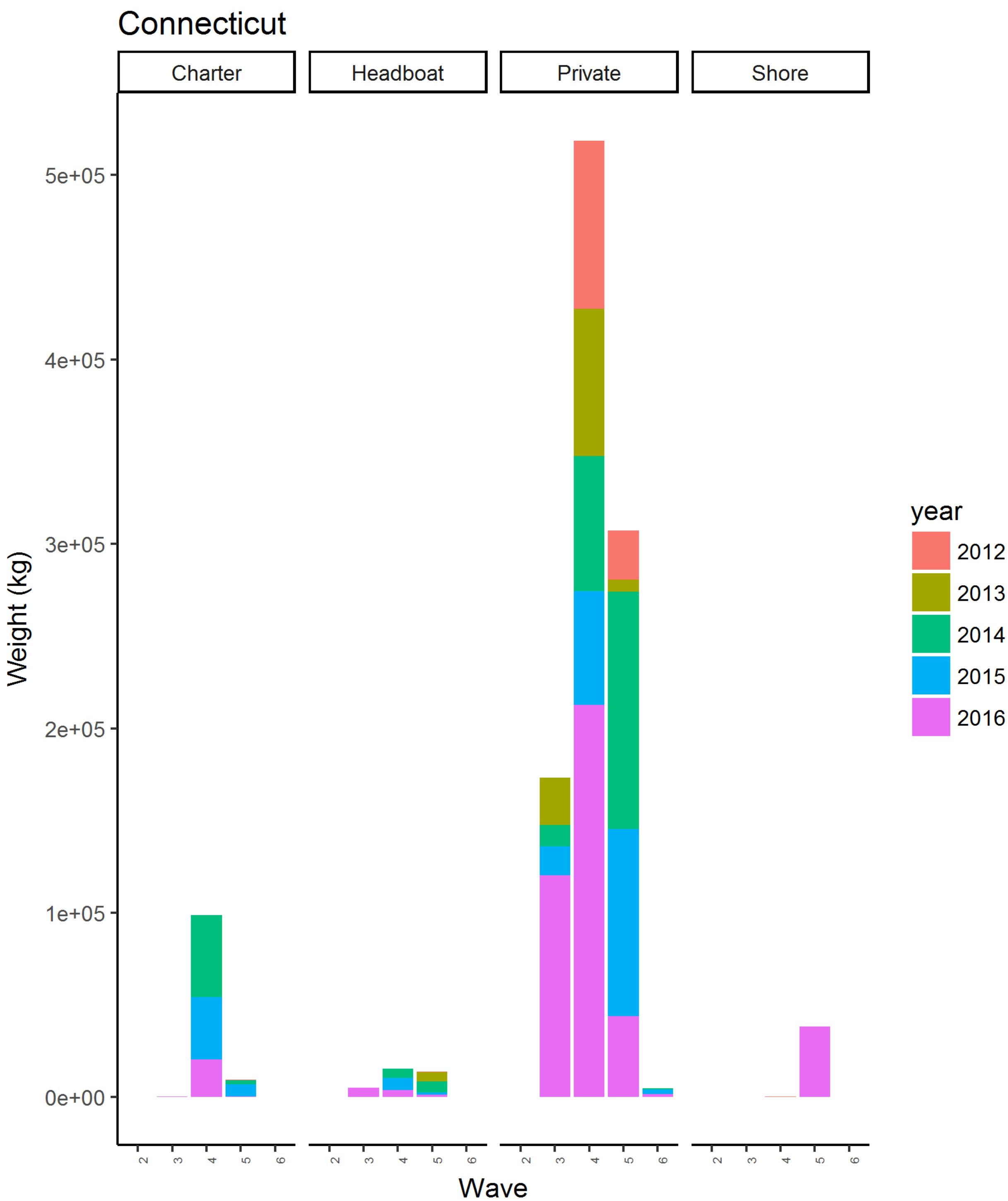




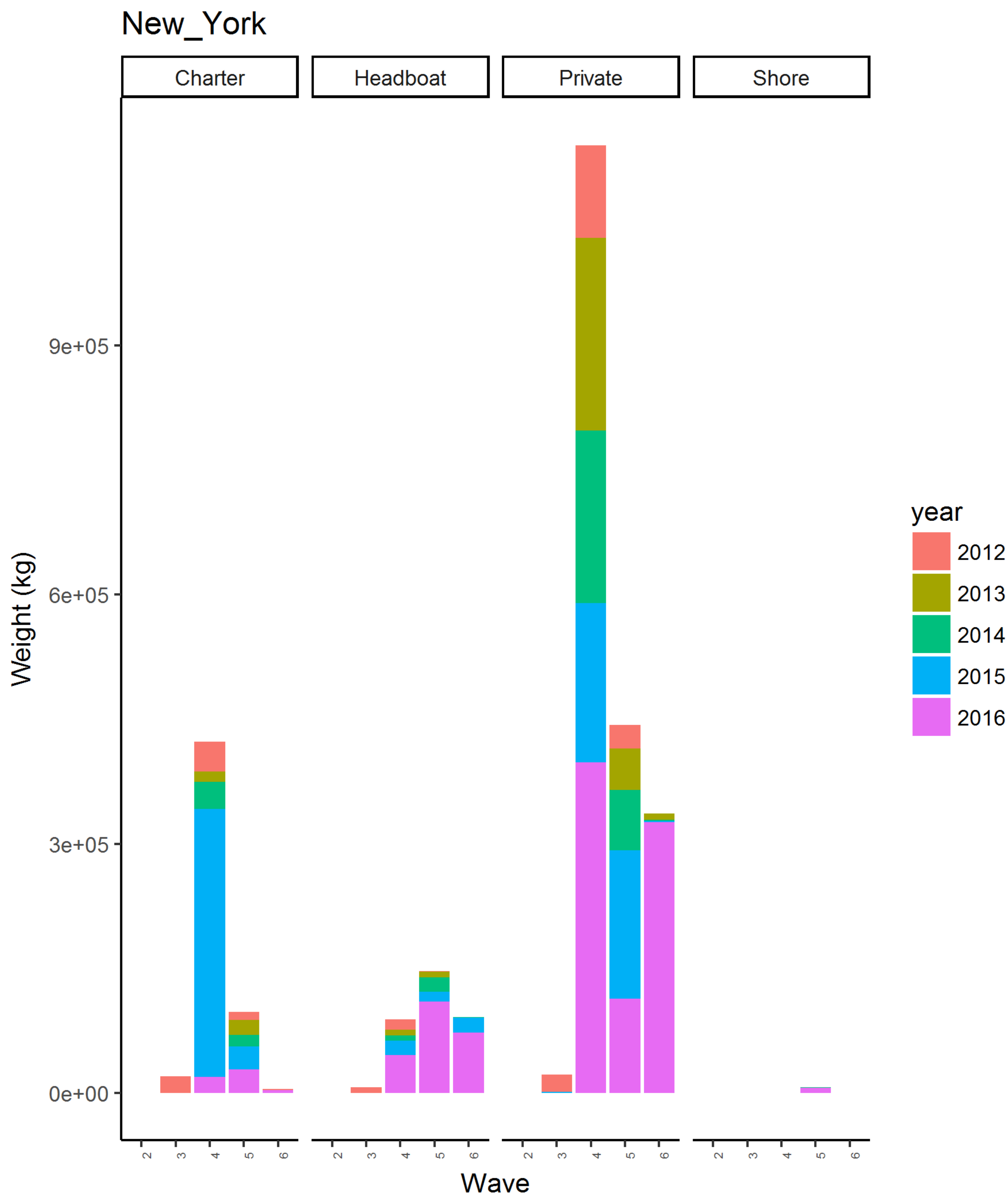
Massachusetts
Charter
Headboat
Private
Shore
1000000
750000
500000
250000
0
Weight (kg)
Wave
year
2012
2013
2014
2015
2016



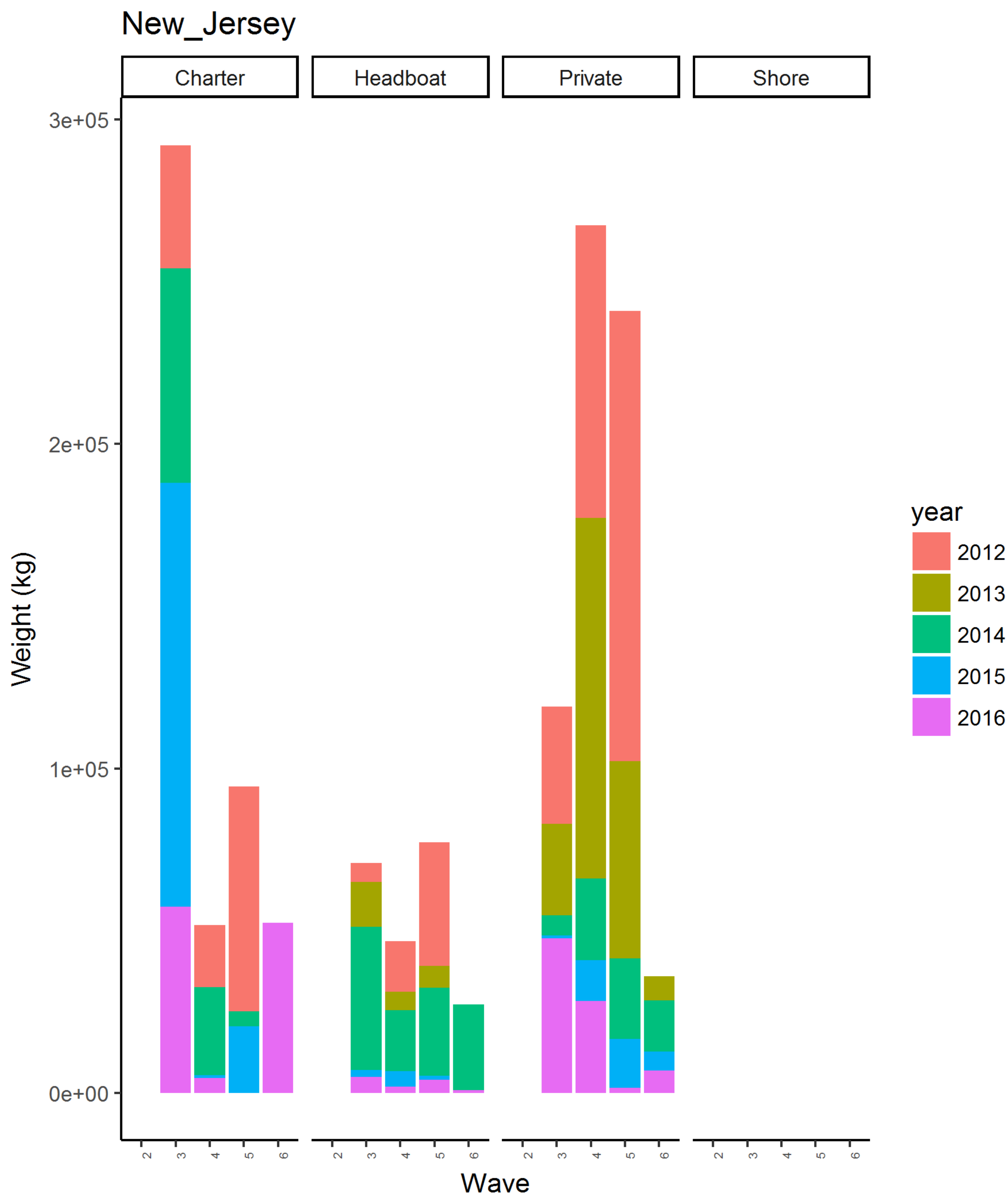
Rhode_Island
Charter
Headboat
Private
Shore
3e+05
2e+05
1e+05
0e+00
Weight (kg)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

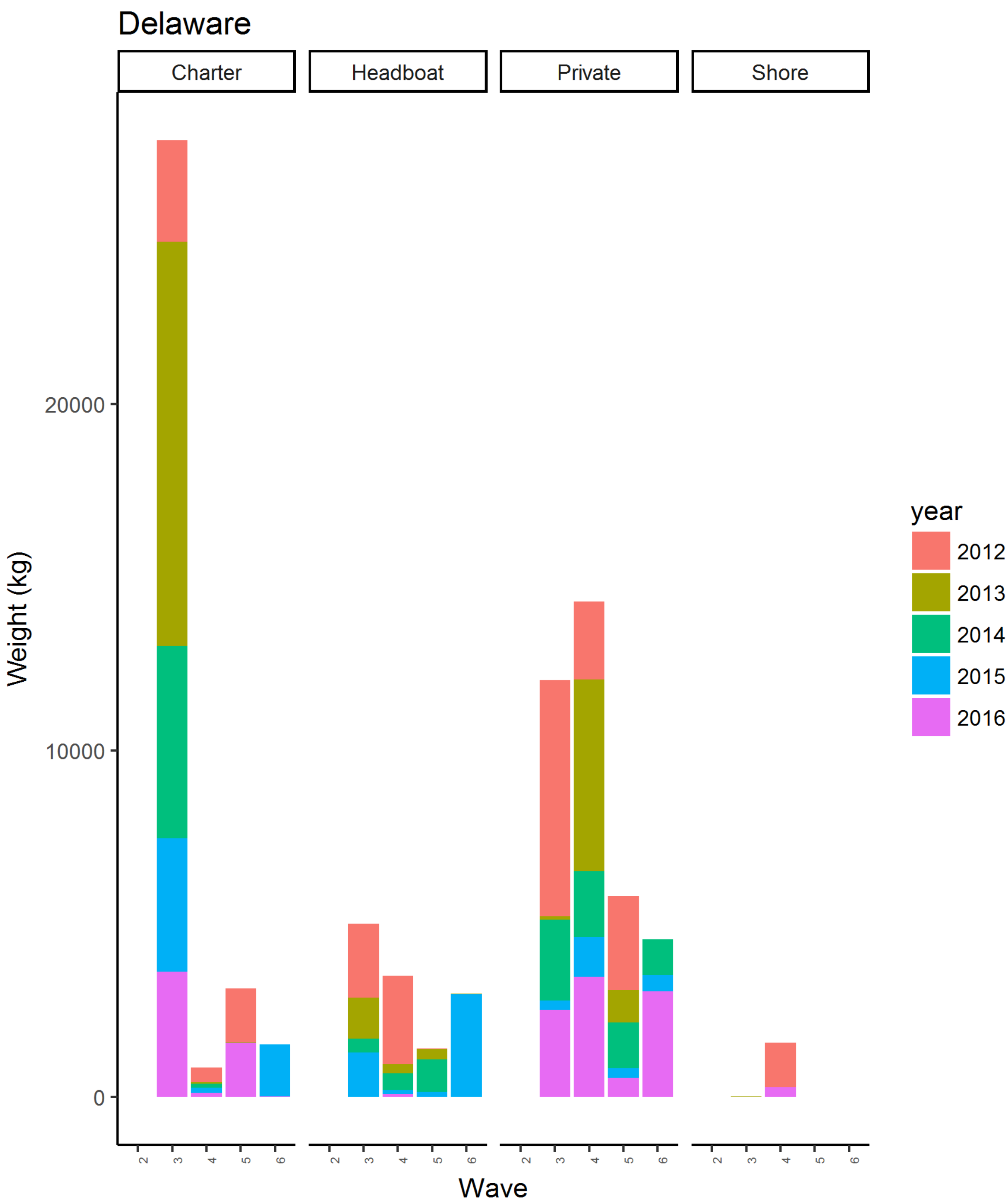


Connecticut
Charter
Headboat
Private
Shore
Weight (kg)
5e+05
4e+05
3e+05
2e+05
1e+05
0e+00
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

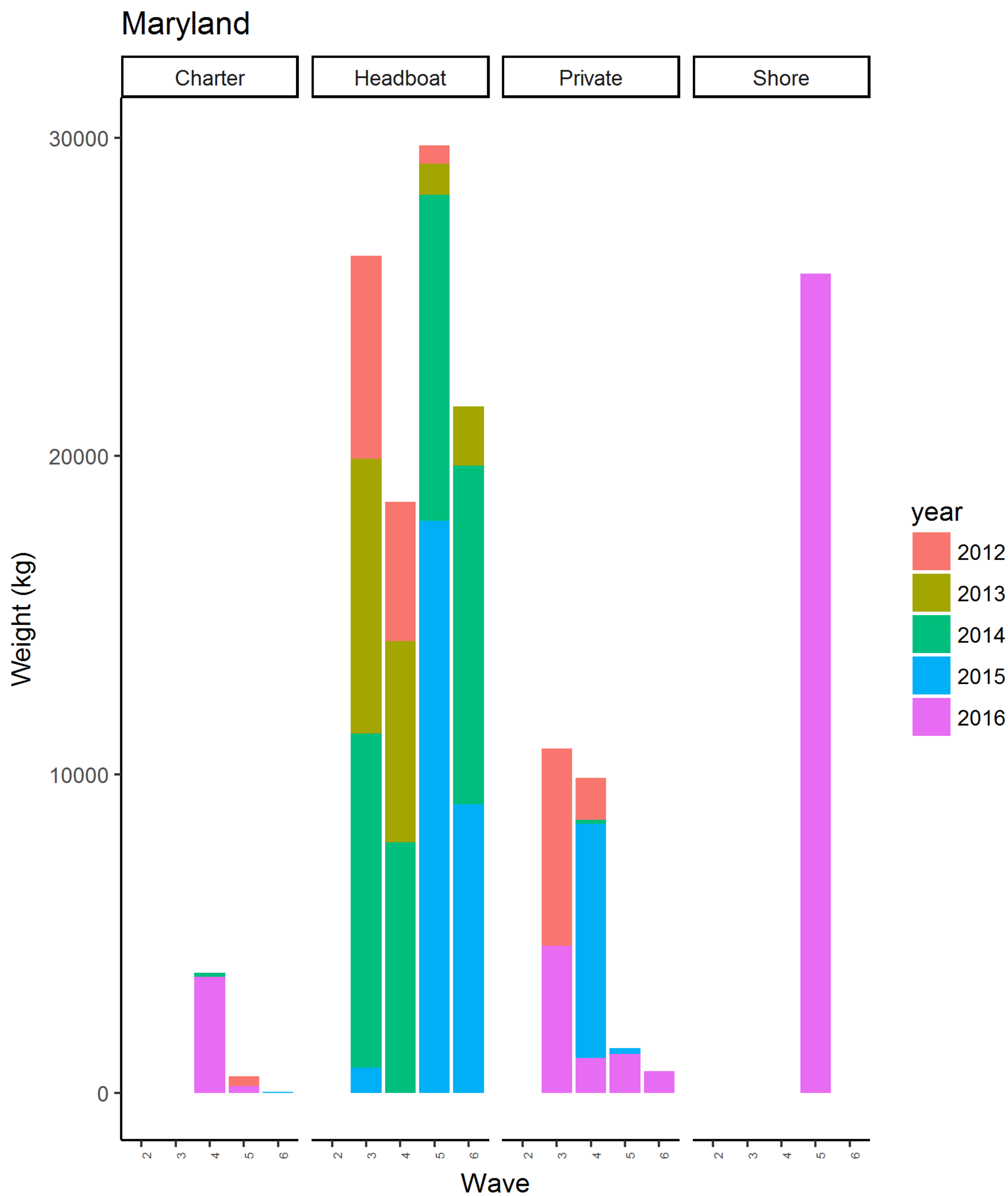


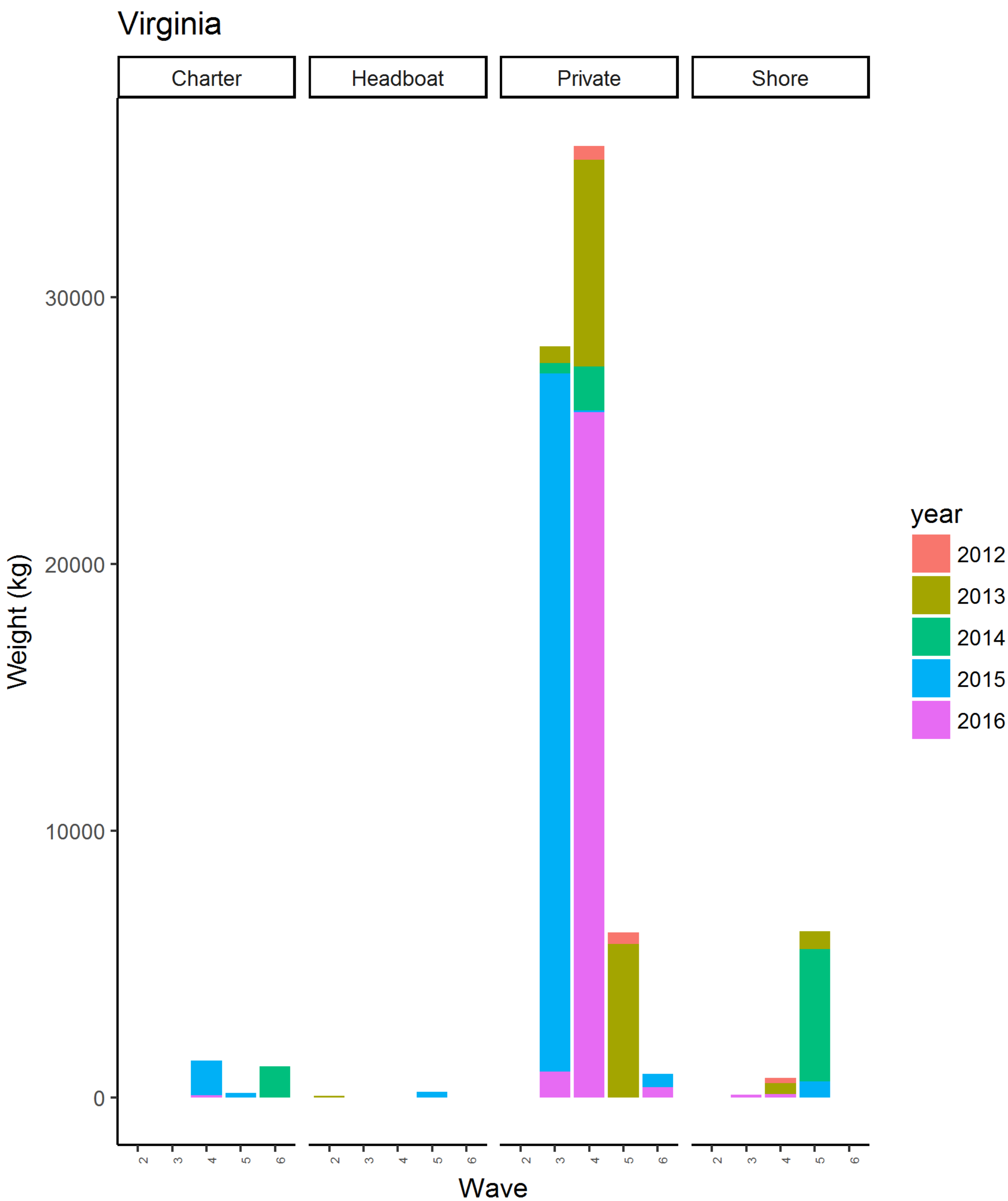
New_York
Charter
Headboat
Private
Shore
9e+05
6e+05
3e+05
0e+00
Weight (kg)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


New_Jersey
Charter
Headboat
Private
Shore
3e+05
2e+05
1e+05
0e+00
Weight (kg)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016



Delaware
Charter
Headboat
Private
Shore
Weight (kg)
20000
10000
0
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


Maryland
Charter
Headboat
Private
Shore
30000
20000
10000
0
Weight (kg)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016


Virginia
Charter
Headboat
Private
Shore
30000
20000
10000
0
Weight (kg)
2
3
4
5
6
Wave
year
2012
2013
2014
2015
2016

NY BSB summary from 2012-2016
- MRIP data -

April 12, 2017

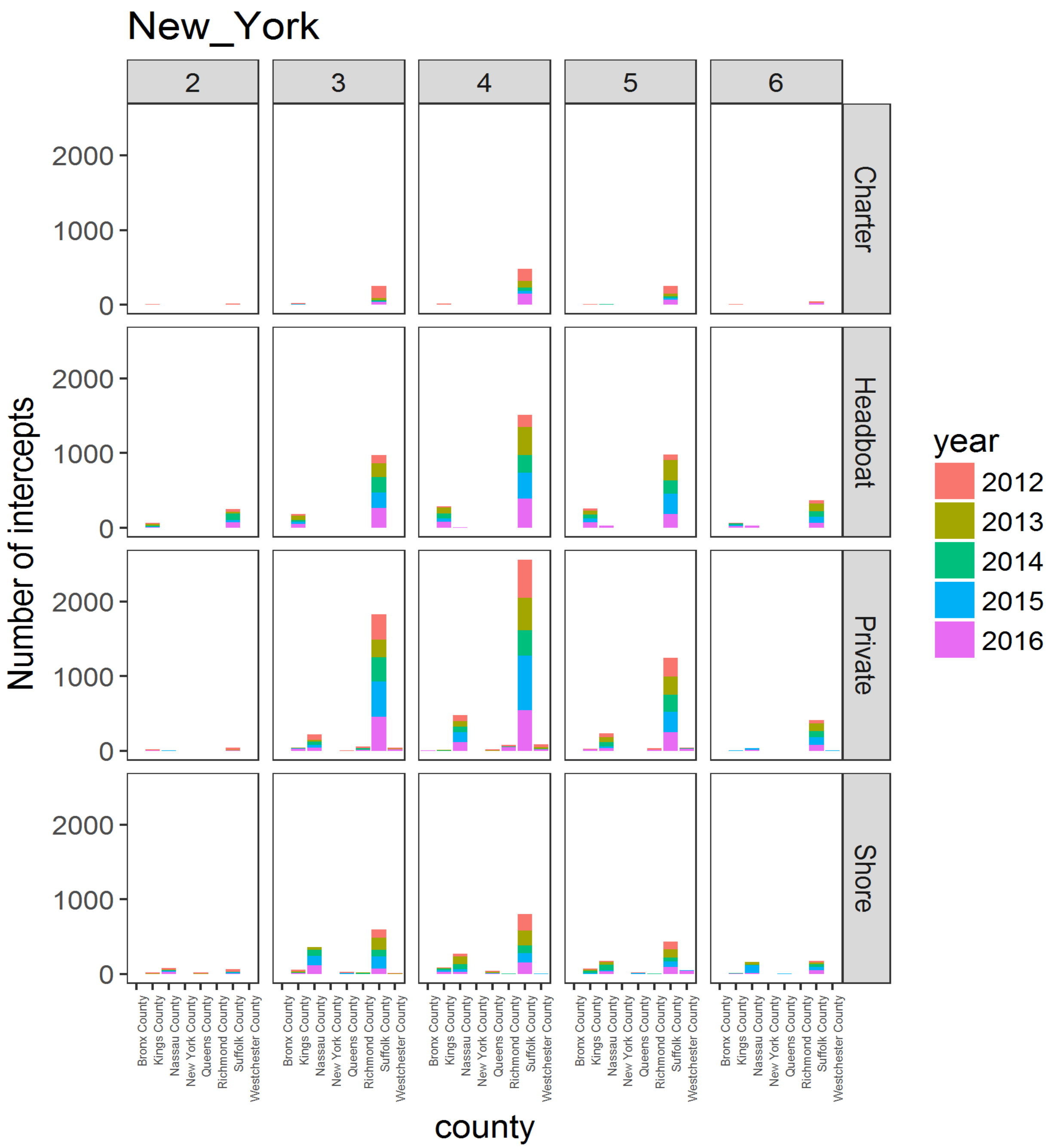
The total number of intercepts is pulled from the MRIP data, using id_code as the unique identifier, and aggregating by year, wave, county, and mode_fx. These intercepts may not have had any catch.

		State									
Mode_fx	**Year**	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA
Charter	2012	222	315	493	237	270	517	341	629	320	271
Charter	2013	86	106	173	100	48	177	55	155	106	87
Charter	2014	227	270	396	695	62	84	189	130	263	71
Charter	2015	106	166	504	458	31	74	109	169	231	95
Charter	2016	150	307	489	422	126	284	137	219	637	177
Headboat	2012	264	717	1172	236	272	511	905	607	588	460
Headboat	2013	162	815	1490	539	357	1187	1353	515	509	801
Headboat	2014	227	766	1227	663	221	954	1292	595	753	599
Headboat	2015	147	702	1224	691	257	1068	1083	834	647	636
Headboat	2016	235	825	1297	787	773	1308	1144	641	1143	943
Private	2012	627	778	1407	737	812	1560	1435	1278	1128	1803
Private	2013	457	443	3438	654	833	1218	1319	2411	1390	2169
Private	2014	906	674	2417	550	1190	1212	2621	1932	1652	2185
Private	2015	748	586	2888	708	1166	1841	2775	2422	1371	2393
Private	2016	639	681	1888	554	2106	1762	1878	1407	2034	2243
Shore	2012	462	570	661	823	385	698	775	746	495	470
Shore	2013	582	285	1421	640	210	790	899	2156	855	778
Shore	2014	417	280	748	604	340	606	1136	1694	552	590
Shore	2015	405	258	541	573	330	783	1277	1508	509	563
Shore	2016	533	239	739	389	508	737	978	1083	847	766

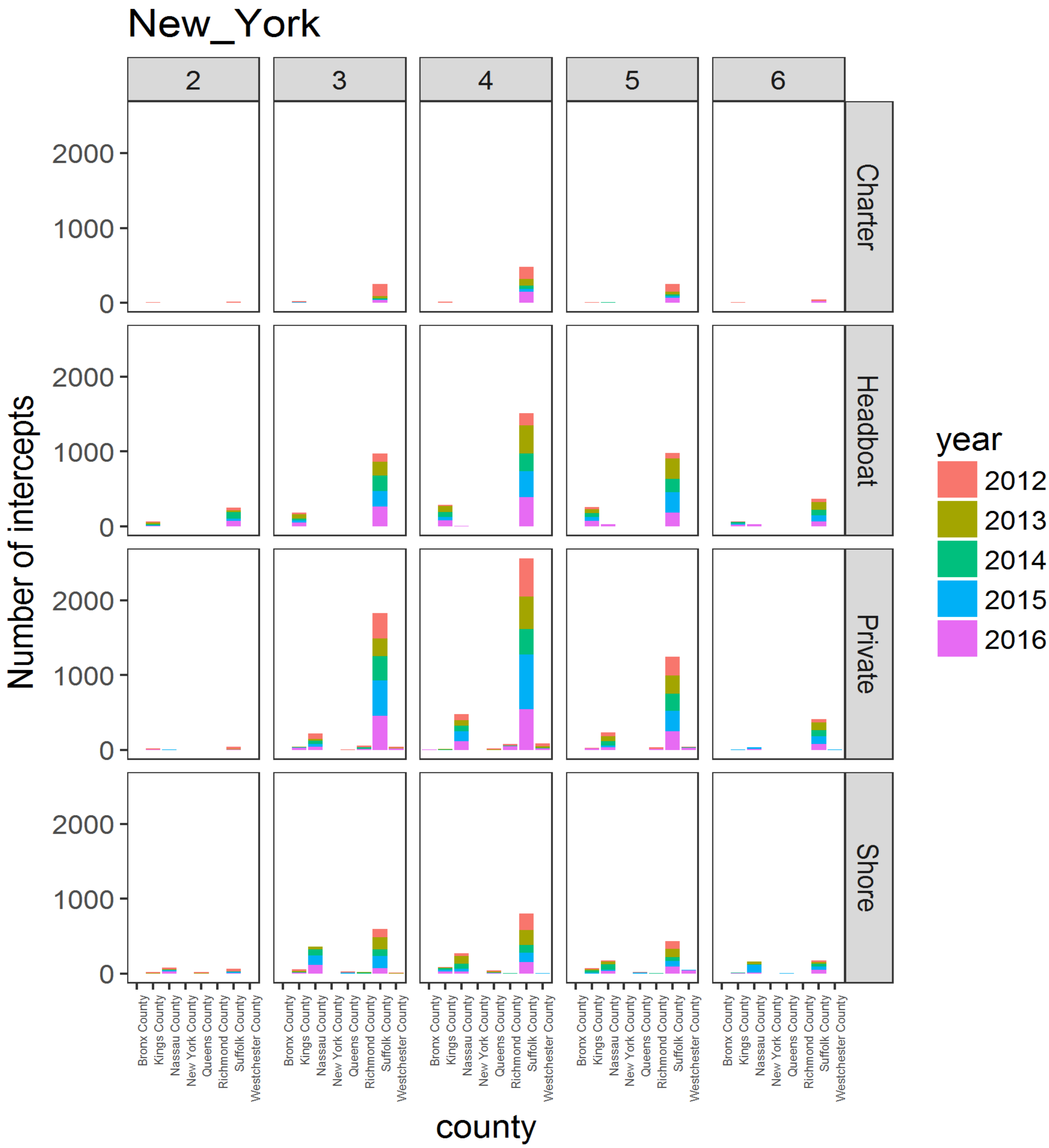
All intercepts 2012-2016

Visual summary of MRIP intercepts by year, county, wave, and mode (charter, headboat, private, shore). These are data exclusively from the trip .csv files and are irrespective of target, harvested or discarded species; simply the total number of intercepts.

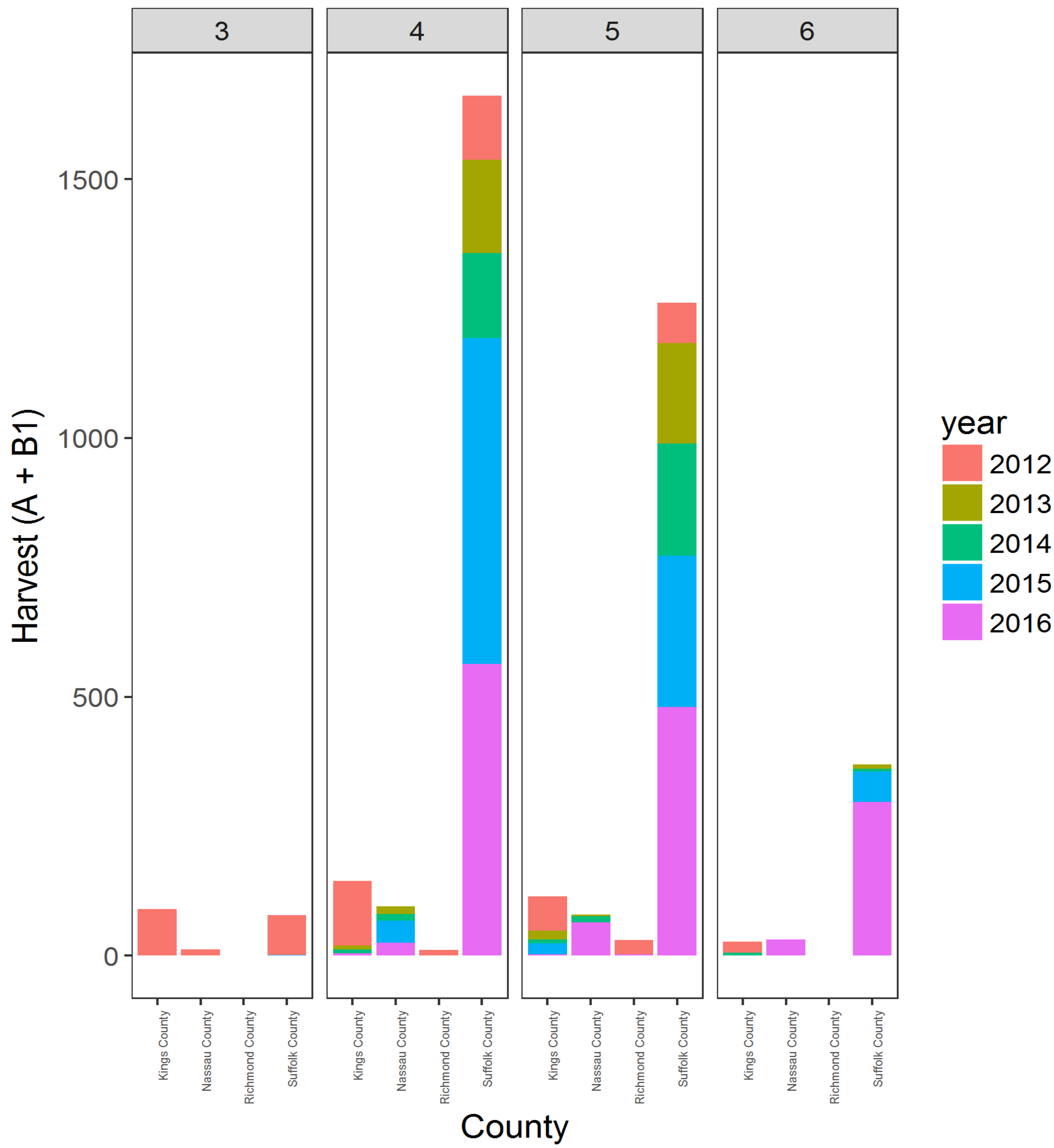
This is just for NY:



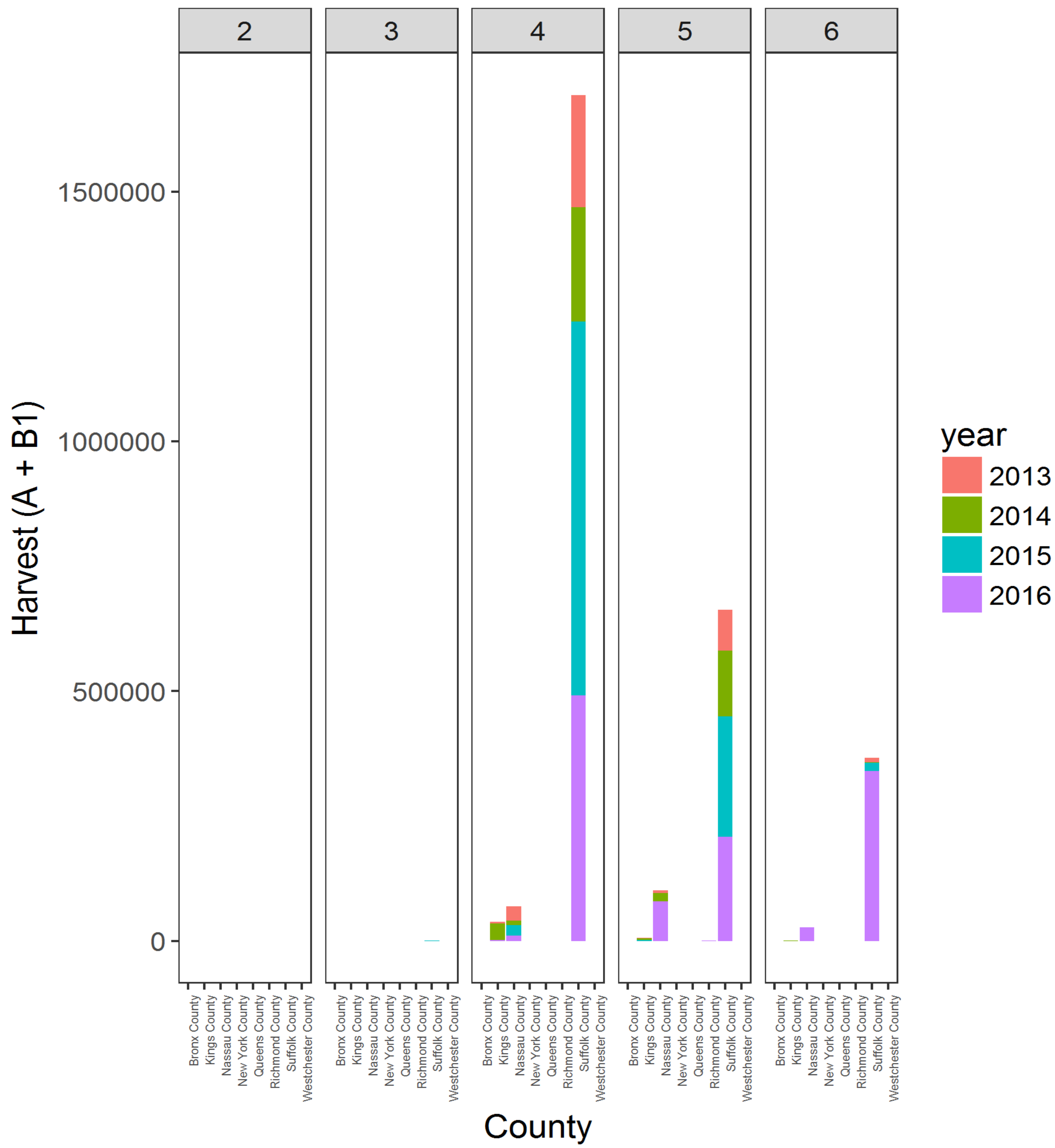
Number of intercepts that reported BSB either harvested or discarded for NY.



Raw harvest data for BSB from NY (i.e., harvest.A.B1) by wave and county.



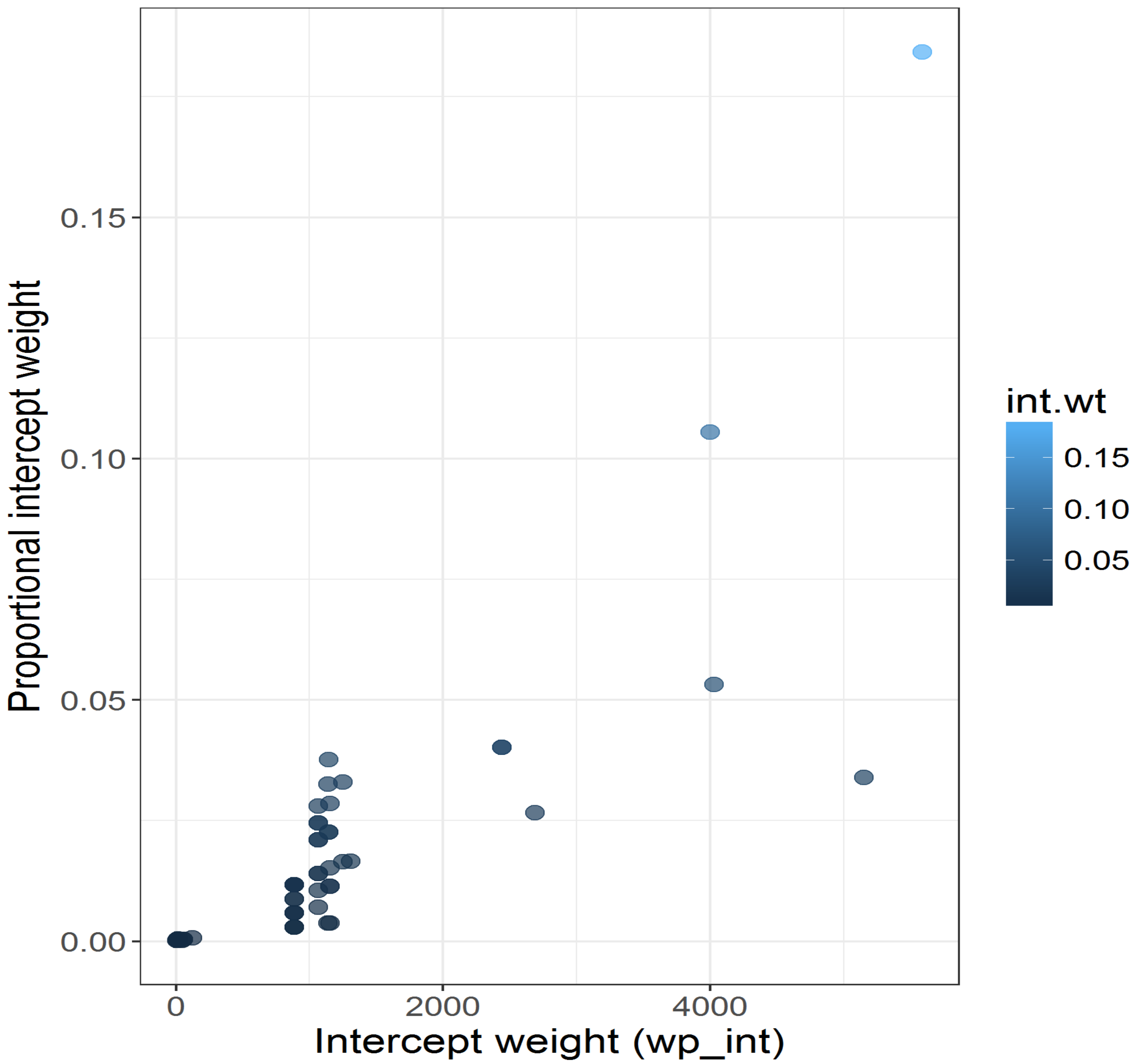
Expanded catch data for BSB from NY (i.e., harvest.A.B1 * wp_int) by wave and county.



Raw harvest data (harvest.A.B1) for BSB from NY for wave 6, from 2012-2016.

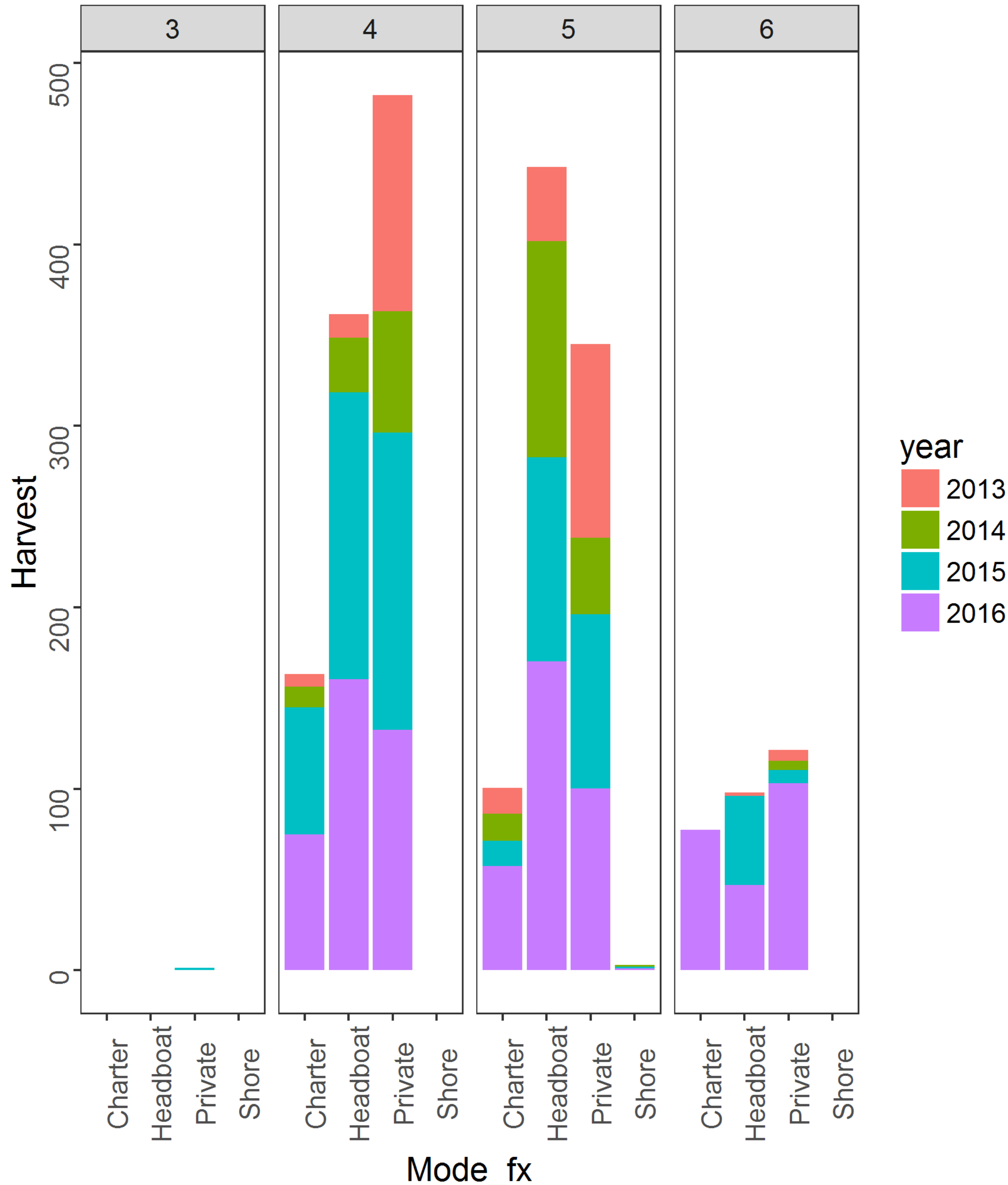
mode_fx	2012	2013	2014	2015	2016
Charter	21	0	0	0	94
Headboat	0	2	6	49	80
Private	0	6	6	9	154

Individual intercept weight for NY in wave 6, from 2016. Total number of intercepts during this wave was 56, but approximately 30% of the weight was assigned to 2 intercepts, one with 8 fish harvested, the other 10 (both from Suffolk County). The two intercepts that made up about 30% of the intercept weight were both private trips.



Harvest (A + B1) PSE for NY is about 16% for the year, all modes and waves combined. If you break it down by mode and wave, all PSEs are higher, ranging from 17.4-89.7.

Total (raw) BSB harvest reported by MRIP by wave and mode in Suffolk County, NY, with years indicated by different colors.



In Suffolk County, NY - total number of intercepts by year, wave, and mode_fx.

wave	mode_fx	2012	2013	2014	2015	2016
2	Charter	281	37	31	65	140
2	Headboat	318	310	422	283	565
2	Private	710	321	374	492	595
2	Shore	563	477	436	325	451
3	Charter	977	205	696	483	770
3	Headboat	1477	1966	1974	1891	2100
3	Private	2937	3651	4792	5157	3947
3	Shore	1557	2309	2210	2145	1794
4	Charter	1133	483	1211	990	1222
4	Headboat	2334	3302	2908	3144	3347
4	Private	4628	6399	6253	7114	4978
4	Shore	2088	3783	2573	2516	2241
5	Charter	801	239	353	287	492
5	Headboat	1323	1754	1627	1542	1716
5	Private	2358	2709	2588	2675	2374
5	Shore	1407	1475	1308	1044	1272
6	Charter	384	74	48	72	176
6	Headboat	246	362	328	395	585
6	Private	892	1243	1290	1388	1187
6	Shore	444	549	415	684	548

In Suffolk County, NY - the number of intercepts with BSB catch across the past 5 years:

wave	mode_fx	2012	2013	2014	2015	2016
2	Charter	12	0	0	0	0
2	Headboat	35	24	87	32	74
2	Private	27	5	2	1	6
2	Shore	34	4	5	16	5
3	Charter	162	35	13	4	41
3	Headboat	107	190	206	203	268
3	Private	342	233	331	467	459
3	Shore	111	160	85	164	74
4	Charter	159	94	41	35	150
4	Headboat	160	374	238	343	394
4	Private	512	432	339	735	544
4	Shore	219	198	105	125	154
5	Charter	108	39	19	22	67
5	Headboat	75	274	175	270	188
5	Private	251	239	232	272	251
5	Shore	102	112	56	72	94
6	Charter	20	0	0	3	22
6	Headboat	43	105	70	78	70
6	Private	44	103	84	104	80
6	Shore	26	20	39	44	49

Kirby Rootes-Murdy

From: Kevin Slattery <kevineslattery@gmail.com>
Sent: Tuesday, May 02, 2017 3:45 PM
To: Kiley Dancy; Kirby Rootes-Murdy
Subject: Level the playing field for Massachusetts Charter Captains ...

Black Sea Bass Board Members,

My name is Kevin Slattery and I am a Charter captain from Onset Massachusetts. Most of my business for the past 10 years has been taking people out fishing for Porgies and Black Sea Bass. I am writing the board in regards to the 2017 Black Sea Bass Allocation.

Last year (April 2016) when the states in the Northern Sector put forward their regulations to create a 23% cut , I and virtually everyone I spoke to, recognized that the regulations put forward by Connecticut and NY were not going to result in a cut. It was obvious they were not intended to. They were designed to create the biggest possible overage, which would then be kept when the new fish from the 2016 stock assessment were added. This is exactly what happened. Connecticut, for example, put forward regulations that the 'technical committee' approved that resulted in a **100% increase** when they were supposed to cut 23%. Anyone with any sense of what was going on saw this coming a mile away. You, the members of the Black Sea Bass board, saw this happen just as you saw New York come up with regulations that put them 300+% over the year before. The Idea that a one inch increase in fish size could somehow drastically cut the number of fish caught was so obviously wrong that anyone could see it.How could no one have asked the question"will effort increase ?" Did you, members of the Black Sea Bass Board, think of this question. I think you must have, but chose not to ask it. How did the 'technical committee not think to ask this question ?

The system of 'ad hoc regional management' was a complete failure at fairly distributing the resource between the states.<u>This is possibly the only fishery management plan ever designed that has incentives to exceed your quota</u>. (The commercial side of the Black Sea Bass fishery for this area has sensible rules that take last years overages off of this years state quota.) I can only only guess that the idea was to have the 'technical committee' act as a check on total quota grabbing. They have failed miserably. Think about being 123% off . Are you members of the Black Sea Bass Board going to endorse this horrible 'science' by continuing with 'status quo'. Are you going to legitimize the quota grab that has happened over the 'ad hoc' years?

Please look at the 2017 regulations of the states in the Northern Sector. I will put them of the bottom of this letter. Note that I, as a 'for hire' captain in Massachusetts have a 3 month and 9 day season of 5 fish. A Captain in my neighboring state of Connecticut has 8 MONTHS of 8 fish me and gets to start 3 weeks before me. He will continue fishing for 4 MONTHS after we are closed. (He gets to do this because the 'technical committee' approved a plan that resulted on a 100% increase in Connecticut's quota last year) When NJ opens Black Sea Bass season in May they will be able to catch 10 fish (at 12") . When the NY captains are making money during (the mysterious) wave 5 and 6 I will have been out of business for months. This is not fair.

On the question of fairness, I draw your attention to the ASMFC Charter for Interstate Fishery Management Plans. This document can be found on the ASMFC website. Evev casual reading of this document raises questions about how the entire Black Sea Bass management plan is handled. Has anyone considered the socio-economic impacts? Why is there no public notice? The section that does <u>not</u> raise any question, though, is the one I would like you to look at.

Section Six. Standards and Procedures for Interstate Fishery Management Plans

<u>(7) Fairness & equity. (ii) Fishery resources shall be fairly and equitably allocated or assigned among the states.</u>

Members from the MAFMC are similarly guided by the mission statement in 2014 - 2018 Strategic Plan
<u>Strategy 14.5. Develop management strategies that ensure fair access to recreational fisheries throughout their range.</u>

<u>Also one of the "Core Values" listed is "Fairness"</u>

In the oath that members take is the following "I recognize my responsibility to serve as a knowledgeable and experienced trustee of the Nation’s marine fisheries resources, being careful to <u>balance competing private or regional interests"</u>...."I commit myself to uphold the provisions, standards, and requirements of (the) Magnuson-Stevens...Act"

This seems pretty straightforward. Your organizations are chartered to 'fairly and equitably' allocate resources. Can you, members of the Black Sea Bass board stand behind 'status quo' regulations and say they are 'fair and equitable'? I, personally, wouldn't want to try.

You , the Black Sea Bass board, are also being asked to consider an "experimental" fishery for waves one and two. This is obviously yet another quota grab by large party boat interests in NY. It would be absolutely wrong on a lot of levels for this board to even consider this nonsense. New York at this time has a completely outsized share of the Black Sea Bass resource.Look at the numbers. NY wants to add 60 new days at 15 fish.Massachusetts only has a total season of 3 months at 5 fish. Particularly unbelievable is the part about 'no discards'. Does anyone think this is going to happen? Who is going to be watching ? Will there be monitors on board? This board cannot in good conscience transfer more quota to NY when the regulations are this lopsided already. Do they really need to catch 15 fish for this experiment? We are catching 5 fish here in Massachusetts, and that is considered enough for us. Please also note that unlike most of the regulations on Black Sea Bass , there is time for public comment on this. Hearings need to be held in each state that will be losing quota. We are talking about next year.

For at least the second year in a row wave 5 and 6 data was provided 'too late' to do anything except 'emergency' action based on 'estimates'.These estimates were never available for public comment. Immediately after achieving the goal of 'status quo' on the ad hoc quota grab, the real numbers came out. This is an obvious manipulation of the system. We are talking 4 months here since the season closed. These numbers could not be added up in 4 months and no one has a problem with that? Black Sea Bass Regulations are still on the table now in May. Do what your charter instructs you to do and create a fair allocation between the states. Close down wave 6 if the data cannot be available in time to make the next years decisions. (Spread that quota around.)

Massachusetts fishermen have a long history of switching from one fishery to another to stay in business. Whaling to whale watching. Cod to haddock. Flounder to Fluke,etc. Unfortunately we are out of choices in the recreational sector. Fluke is down one fish and up one inch for absolutely no reason. Porgies are cut from 100 to 45 even while they are under harvested. We have a bag limit of 0 on Cod.(North of the Cape) Striped bass are down to one and we don't have the opportunity to play games with 'tags' or 'trophy fish'.What are we supposed to fish for, slime eels, dogfish, perriwinkles?As a side note, unlike other states where it is up to the customers whether or not they want to comply with the law, Massachusetts holds the Captain of a for hire vessel responsible for what is caught on his boat, and they do issue fines. Black Sea Bass are an overabundant fish . There is no reason except politics and bad science for Massachusetts to not have the same regulations as other states, (such as Connecticut)

Board members, You still have time to do the right thing here.You can either comply with the clear mandates of your respective charters,or not. If you do not, please do not expect me, or the other for hire Captains in Massachusetts to quietly go out of business so out of state fishermen can continue to make money.They certainly wouldn't and neither would you. Do the right thing.

Kevin Slattery
F/V Maureen Ann
Onset MA.

CONNECTICUT

Black Sea Bass: 15-inch minimum (Excluding Tail Fin Filament/Tendril), 5 fish bag limit, Open May 1 to December 31 *FOR HIRE * 8 FISH May 1 to December 31 (Pretty fair)

Massachusetts

Black Sea Bass: May 21 – August 31, 5 fish, 15-inch minimum (Pathetic)

New Jersey

Black Sea Bass: 12-1/2” minimum open 5/26-6/18 (10 fish); 12-1/2” minimum open 7/1-8/31 (2 fish); 12-1/2” minimum open 10/22-12/31 (15 fish) (Made to order for the big boats. Private anglers should be screaming)

New York

Black Sea Bass: 15" minimum size; 3/angler, June 27 - Aug 31; 8/angler, Sept 1 - October 31; 10/angler Nov 1 - Dec 31. (Same as above plus little to no enforcement)

Rhode Island

Black Sea Bass: 15-inch minimum. May 25 – August 31, 3 fish. September 1 – September 21, 7 fish. September 22 – October 21, CLOSED. October 22 – December 31, 7 fish. (Rough)

Atlantic States Marine Fisheries Commission

ISFMP Policy Board

May 11, 2017
8:00-10:30 a.m.
Alexandria, 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. Grout)*	8:00 a.m.
2.	Board Consent *(D. Grout)* • Approval of Agenda • Approval of Proceedings from February 2017	8:00 a.m.
3.	Public Comment	8:05 a.m.
4.	Update from Executive Committee (*D. Grout*)	8:15 a.m.
5.	Review and Consider New Jersey Appeal of Addendum XXVIII to the Summer Flounder Fishery Management Plan **Final Action**	8:20 a.m.
6.	Update on Climate Change Working Group (*T. Kerns*)	8:55 a.m.
7.	Review and Discuss 2017 Commissioner Survey Results (*D. Tompkins*)	9:00 a.m.
8.	Committee Report on Safe Harbor Landings (*J. Gilmore*) **Possible Action**	9:15 a.m.
9.	Update on the Marine Recreational Information Program Transition of the Fishing Effort Survey and APAIS (*D. Van Voorhees*)	9:30 a.m.
10.	Review and Consider Approval of Standard Meeting Practices (*T. Kerns*) **Action**	9:50 a.m.
11.	Progress Update on the 2017 Sturgeon Benchmark Stock Assessment (*K. Drew*)	9:55 a.m.
12.	Review and Consider Approval of the Assessment Schedule (*S. Madsen*) **Action**	10:00 a.m.
13.	Standing Committee Reports • Law Enforcement Committee (*M. Robson*) • Habitat and Artificial Reefs (*L. Havel*) • Atlantic Coastal Fish Habitat Partnership (*L. Havel*)	10:05 a.m.
14.	Review Non- Compliance Findings (if necessary) **Final Action**	10:20 a.m.
15.	Other Business/Adjourn	10:25/10:30 a.m.

The meeting will be held at the Westin, 400 Courthouse Square, Alexandria, Virginia; 703-253-8600

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEETING OVERVIEW

ISFMP Policy Board Meeting
Thursday May 11, 2017
8:00-10:30 a.m.
Alexandria, Virginia

Chair: Doug Grout (NH) Assumed Chairmanship: 10/15	Vice Chair: Jim Gilmore (NY)	Previous Board Meeting: February 1, 2017
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 February 1, 2017

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 (8:15-8:20 a.m.)
Background • The Executive Committee will meet on May 10 , 2017
Presentations • D. Grout will provide an update of the committees work
Board action for consideration at this meeting • none

5. Review and Consider New Jersey Appeal of Addendum XXXVIII to the Summer Flounder Fishery Management Plan (8:20-8:55 a.m.) Final Action
Background • Summer Founder Addendum XXVIII was approved in February 2017 (**briefing materials**). The addendum established a regional management approach for the recreational summer flounder fishery in 2017. • New Jersey is appealing the approval of the addendum (**briefing materials**). • Following the Appeal Process (briefing materials), Commission leadership reviewed the appeal and determined the appeal should be considered by the ISFMP Policy Board under criterion 2, failure to follow process, specifically New Jersey's claim regarding the error in the text of the Draft Addendum (**briefing materials**).

Presentations

- T. Kerns will present a background on the development of the management program as well as a summary of the justification provided in the record for the management board's action. The ISFMP Director will also present the potential impacts of the appeal on other affected states
- New Jersey will present their rationale for appealing the decision under criterion 2, specifically New Jersey's claim regarding the error in the text of the Draft Addendum, and provide a suggested solution.

Board discussion for consideration at this meeting

- Consider the Appeal of Addendum XXVIII to the Summer Flounder FMP

6. Update on Climate Change Working Group (8:55-9:00 a.m.)

Background

- The Climate Change Work Group was tasked with developing science, policy and management strategies to assist the Commission with adapting its management to changes in species abundance and distribution resulting from climate change impacts.
- In fall of 2016 the Work group met via conference call to brainstorm how to address the Policy Board task.
- On January 2017 the working group met to make recommendations to include in the white papers to address the Policy Boar task
- In May the working group met to continue to develop drafts of science and policy white papers.

Presentations

- T. Kerns will review the Climate Change Workgroup Progress

Board action for consideration at this meeting

- none

7. ASMFC Commissioner Survey Results (9:00-9:15 a.m.)

Background

- The Commissioners completed a survey of Commission performance for the eighth year as included in the ASMFC Action Plan (**briefing materials**)
- The survey measures the Commissioners' opinions regarding the progress and actions of the Commission in the previous year

Presentations

- D. Tompkins will present a summary of the survey results highlighting significant changes from previous years' surveys

Board actions for consideration at this meeting

- Determine if any action is required given the survey results

8. Committee Report on Safe Harbor Landings (9:15-9:30 a.m.) Possible Action

Background

- New York has developed a guidance document for vessels requesting safe harbor landings in New York.
- A subcommittee met to review other state practices related to safe harbor and safe harbor landing practices. The subcommittee suggested a guidance document be drafted for states to assist in setting guidelines for safe harbor and quota transfers related to safe harbor (**supplemental materials**).

Presentations

- J. Gilmore will present the recommendations from the subcommittee.

Board action for consideration at this meeting

- Consider establishing general guidelines for safe harbor and quota transfers related to safe harbor

9. Update on Marine Recreational Information Program Transition of the Fishing Effort Survey and APAIS (9:30-9:50 a.m.)

Background

- A study indicated mail based surveys do a better job than the current Coastal Household Telephone Survey (CHTS) to capture recreational fishing trips (fishing effort) by reaching a broader population of anglers, getting more accurate information from respondents, and delivering higher response rates. NOAA Fisheries developed a Transition Plan to move from the CHTS to mail based survey. The FES Transition Plan ensures the new numbers are incorporated into stock assessments and management in a timely fashion, but also in a way that is scientifically sound, statistically robust, and ensures the sustainability of recreational fishing.

Presentations

- D. Van Voorhees will present an update on the progress of the MRIP transition and the APAIS calibrations

Board action for consideration at this meeting

- None

10. Review and Consider Approval of Standard Meeting Practices (9:50-9:55 a.m.) Action

Background

- Following Commissioner training on meeting practices, the Policy Board directed staff to develop draft operating procedures to make Commission meetings more effective and efficient.
- The draft standard meeting practices were reviewed by the Executive Committee and recommended for consideration by the ISMFP Policy Board (**briefing materials**).

Presentations

- T. Kerns will present the SOPPs

Board action for consideration at this meeting

- Approve the Standard Meeting Practices

11. Progress Update on the 2017 Sturgeon Benchmark Stock Assessment (9:55-10:00 a.m.)
Background • The Benchmark stock assessment for sturgeon is schedule to undergo peer review in the fall of 2017.
Presentations • K. Drew will present a progress report for the assessment
Board action for consideration at this meeting • None

12. Review and Consider Approval of the Assessment Schedule (10:00-10:05 a.m.) Action
Background • The ASC has recommendations to the ISFMP Policy Board regarding the ASMFC Stock Assessment Peer Review Schedule (**briefing materials**).
Presentations • S. Madsen will review the stock assessment schedule
Board action for consideration at this meeting • Approve the stock assessment schedule

13. Standing Committee Reports (10:05-10:20 a.m.)
Background • The Law Enforcement Committee met on May 9, 2017. • The Habitat Committee met on May 2-3, 2017 • The Artificial Reef Committee met on February 7-8, 2017 with the Gulf States Marine Fisheries Commission's Artificial Reef Committee • The Atlantic Coastal Fish Habitat Partnership met on May 4-5, 2017.
Presentations • An overview of LEC activities will be presented by M. Robson and an overview of Habitat Committee, Artificial Reef Committee and the ACFHP will be presented by L. Havel
Board action for consideration at this meeting • None

9. Review Non-Compliance Findings (if necessary) Final Action

10. Other Business

11. Adjourn

Atlantic States Marine Fisheries Commission

Business Session

May 11, 2017
10:30 – 11:00 a.m.
Alexandria, 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/Introductions (*D. Grout*)	10:30 a.m.
2.	Board Consent • Approval of Proceedings from January 2017	10:35 a.m.
3.	Public Comment	10:45 a.m.
4.	Review Noncompliance Findings (if necessary) **Final Action**	10:50 a.m.
5.	Other Business/Adjourn	10:55 p.m.

The meeting will be held at the Westin Alexandria 400 Courthouse Square Alexandria, VA; 703.253.8600