Atlantic States Marine Fisheries Commission

Atlantic Striped Bass Management Board

October 29, 2013
8:30 a.m. – 12:00 p.m.
St. Simons Island, Georgia

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 (*T. O'Connell)* 8:30 a.m.

2. Board Consent 8:35 a.m.
   - Approval of Agenda
   - Approval of Proceedings of August 2013 Board meeting

3. Public Comment 8:40 a.m.

4. 2013 Atlantic Striped Bass Stock Assessment Report **Action** 8:45 a.m.
   - Presentation of Stock Assessment Report *(G. Nelson)*
   - Presentation of Peer Review Panel Report *(C. Jones)*
   - Consider acceptance of benchmark stock assessment and peer review report for management use

5. Discussion of Management Response to the Stock Assessment Results 9:45 a.m.
   (T. O'Connell)

6. Consider 2013 FMP Review and State Compliance (*M. Waine)* **Action** 11:45 a.m.

7. Other Business/Adjourn 12:00 p.m.

The meeting will be held at the King and Prince Beach & Golf Resort,
201 Arnold Street, St. Simons Island, GA; 800.342-0212

Atlantic States Marine Fisheries Commission

MEETING OVERVIEW

Atlantic Striped Bass Management Board Meeting
Tuesday, October 29, 2013
8:30a.m. – 12:00p.m.
St. Simons Island, Georgia

Chair: Tom O'Connell (MD) Assumed Chairmanship: 02/12	Technical Committee Chair: Alexei Sharov (MD)	Law Enforcement Committee Rep: Kurt Blanchard (RI)
Vice Chair: Doug Grout	Advisory Panel Chair: Kelly Place (VA)	Previous Board Meeting: August 6, 2013
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, NMFS, USFWS (16 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from August 2013 Meeting

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. 2013 Atlantic Striped Bass Stock Assessment Report (8:45 – 9:45 a.m.)

Background

- In July 2013, the striped bass benchmark stock assessment was peer reviewed at the 57th SAW/SARC with preliminary 2012 data. (**Briefing CD**)
- The benchmark stock assessment was updated by the Stock Assessment Subcommittee with finalized 2012 data. (**Briefing CD**)

Presentations

- Stock Assessment Overview by G. Nelson
- Peer Review Panel Report by C. Jones

Board Actions for Consideration

- Accept the Stock Assessment Report and Peer Review Report for management use.

5. Discussion of Management Response to the Stock Assessment Results (9:45 – 11:45 a.m.)

Background

- In respond to the final benchmark assessment results, the Board is considering the next steps for striped bass management, including consideration of measures to reduce fishing mortality.

Presentations

- Discuss management action timelines by M. Waine

6. Consider 2013 FMP Review and State Compliance (11:45 a.m. – 12:00 p.m.) Action

Background

- State Compliance Reports are due on June 15 (**Briefing CD)**
- The Plan Review Team reviewed each state report and drafted the 2013 FMP Review (**Supplemental Materials**)

Presentations

- Overview of the 2013 Fishery Management Plan Review by M. Waine

Board actions for consideration at this meeting

- Accept the 2013 Fishery Management Plan Review

7. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC STRIPED BASS MANAGEMENT BOARD

Crowne Plaza Hotel - Old Town
Alexandria, Virginia
August 6, 2013

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

2. **Motion to adjourn** by consent (Page 13).

ATTENDANCE

Board Members

Terry Stockwell, ME, proxy for P. Keliher (AA)
Rep. Walter Kumiega, ME (LA)
Steve Train, ME (GA)
G. Ritchie White, NH (GA)
Doug Grout, NH (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Rep. Sarah Peake, MA (LA)
Paul Diodati, MA (AA)
Bill Adler, MA (GA)
Mark Gibson, RI, proxy for R. Ballou (AA)
Bill McElroy, RI (GA)
Rick Bellavance, RI, proxy for Rep. Martin (LA)
Rep. Craig Miner, CT (LA)
David Simpson, CT (AA)
Lance Stewart, CT (GA)
James Gilmore, NY (AA)
Anthony Rios, NY, proxy for Sen. Boyle (LA)
Pat Augustine, NY (GA)
Russ Allen, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Albano (LA)
Leroy Young, PA, proxy for J. Arway (AA)
Loren Lustig, PA (GA)
Mitchell Feigenbaum, PA, proxy for Rep. Vereb (LA)
Bernie Pankowski, DE, proxy for Sen. Venables (LA)
Roy Miller, DE (GA)
Tom O'Connell, MD (AA)
Russell Dize, MD, proxy for Sen. Colburn (LA)
Bill Goldsborough, MD (GA)
Jack Travelstead, VA (AA)
Rob O'Reilly, VA, Administrative proxy
Cathy Davenport, VA (GA)
Bill Cole, NC (GA)
Louis Daniel, NC (AA)
Martin Gary, PRFC
Steve Meyers, NMFS
Bill Archambault, USFWS

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

Ex-Officio Members

Alexei Sharov, Technical Committee Chair
Kelly Place, Advisory Panel Chair

Staff

Robert Beal
Toni Kerns
Mike Waine

Guests

Michelle Duval, NC DMF
Wilson Laney, US FWS
Dick Brame, CCA
Charles Lynch, NOAA
Derek Orner, NOAA
Dan McKiernan, MA DMF
Cheri Patterson, NH F & G
Jeff Kaelin, Lund's Fisheries
Kelly Denit, NMFS
Fritz Rohde, NMFS
Robert Geisler, MSSA
Clint Waters, MSSA
Jeffrey Pierce, Alewife Harvesters of Maine
Darrell Young, Alewife Harvesters of Maine
Ed O'Brien, Chesapeake Beach, MD
Aaron Kornbluth, PEW Trusts
Joseph Gordon, PEW Trusts
Raymond Kane, CHOIR
Jim Price, CBEF
Patrick Paquette, MA Striped Bass Assn.
Benson Chiles, Chiles Consulting
Ken Hastings, Mason Springs Conservancy
Lynn Fegley, MD DNR

The Striped Bass Management Board of the Atlantic States Marine Fisheries Commission convened in the Presidential Ballroom of the Crowne Plaza Hotel Old Town, Alexandria, Virginia, August 6, 2013, and was called to order at 2:10 o'clock p.m. by Chairman Thomas O'Connell.

CALL TO ORDER

CHAIRMAN THOMAS O'CONNELL: My name is Tom O'Connell; and I welcome you to the Striped Bass Management Board Meeting.

APPROVAL OF AGENDA

CHAIRMAN O'CONNELL: All of you should have an agenda before you. The first order of business is to approve the agenda. Are there any suggested changes to the agenda? I've got one, Fish and Wildlife.

MR. BILL ARCHAMBAULT: Mr. Chairman, if time allows we would like to give a quick update on the '14 cooperative tagging cruise, where we are with that.

CHAIRMAN O'CONNELL: Sure, we'll put that under other business if time allows. Seeing no other comment, the agenda will stand approved. I want to mention this is our first meeting since the 2012 annual meeting in October. We do not have the proceedings from that meeting. If you recall, Joe's wife had an illness at that time and there were some issues.

Some of the proceedings were lost. Staff had prepared a meeting summary, and if you need to reference those in the future, contact myself or Mike. We do have a public comment period.

PUBLIC COMMENT

CHAIRMAN O'CONNELL: This is an opportunity for members of the public to provide the board comment on items that are not on the agenda.

We have one person that has signed up to speak at this time, Jim Price. Jim, if you would like to come up to the microphone. While Jim is coming up to the microphone, we do have a one-hour meeting time today. I'm going to try to keep us moving along. Jim, your write up was included n the board's packet of material, so if you could keep your comments to a couple minutes to highlight that, I appreciate it. Thanks.

MR. JAMES PRICE: My name is Jim Price; I'm president of the Chesapeake Bay Ecological Foundation. I would like to inform the board that the public was advised at a recent meeting of the Chesapeake Bay Program Sustainable Fisheries Goal Implementation Team that the team believes the ASMFC should be responsible for addressing the collapse of the Chesapeake Bay and Mid-Atlantic Coast striped bass forage base since ASMFC is responsible for managing striped bass and menhaden.

However, according to the ASMFC, the overfished status of menhaden is unknown, but overfishing is occurring. Although the ASMFC places a high priority, while continuing work on developing ecosystem reference points which would explicitly address the forage needs of menhaden predators such as striped bass, this work is anticipated to take some time because of its complexity.

It would be an understatement to say the board has been struggling with this issue for years. CBF has provided the ASMFC with a copy of our research summary and chart. We recommend that the ASMFC consider using biological reference points for the nutritional status of Chesapeake Bay striped bass as recommended by a recent published paper in the North American Journal of Fisheries Management.

That is a new piece of equipment, by the way, that has been developed. It is called a Bio-Impedance Analysis Meter. We can actually go out and check the health or the nutritional state of a fish without killing the fish or cutting it open. There has been sort of a breakthrough in the ability to do ecosystem management using this as one of the tools that would be able to determine whether there is enough forage for striped bass or not. I think it is a very important

issue for the board to consider, both Menhaden and Striped Bass Board. Thank you.

CHAIRMAN O'CONNELL: Were there any other members from the public that wanted to provide input to the board on items not on the agenda? The next item on the agenda is the review of some of the fisheries landings' data. As you may recall, we're in the process of peer reviewing the stock assessment that was completed this summer.

While that stock assessment and peer review is not available yet, some of the fisheries performance data is. Katie Drew is going to provide an overview of that. Then we're going to be just having a discussion in regards to preparing for the results of the stock assessment that will be available later this fall.

We had a motion postponed back in November of 2011 to take some action or consider some action, following the stock assessment completion. We'll be having that conversation today to manage the expectation as to what the timeline, what the pathway will be if the stock assessment suggests some management action should be taken. To begin that conversation, Katie is going to review some of the fisheries landings data, and then Mike is going to kind of bring us up to speed on the stock assessment and different pathways that we can take a look at if action is warranted this fall. Thanks, Katie.

FISHERY PERFORMANCE REVIEW OF LANDINGS AND INDICES

DR. KATIE DREW: As we just covered, I'm going to go over commercial landings, recreational landings, some of the adult indices as well as the juvenile indices, which have all been updated through 2012. This information was all included in the stock assessment. Then I'm just going to touch briefly on where we are with the assessment, and kind of what the next steps are in making sure it is available for management use.

Commercial landings was about 6.4 million pounds in 2012. This translates to about 839,000 fish, and it is 2 percent less than 2011. You can see in the graph the affects of having a quota system in place for striped bass in that landings have been fairly constant since the late 1990s. Recreational landings were about 1.49 million fish harvested in 2012, and about 5.37 million fish released alive.

If you assume a 9 percent mortality rate due to catch and release; that translates to about 483,000 fish that were killed by catch-and-release mortality. The total removals were slightly less than 2 million fish attributed to the recreational fishery. These total removals are 30 percent less than 2011, so it continues kind of the downward trend that we've seen in the recreational landings.

You can compare this to the about 839,000 fish caught by the commercial landings, and you can see that the fishery is still dominated, as usual by recreational landings. It is about two-thirds recreational and about one-third commercial, even with the recent decline in recreational landings.

These are the adult fishery-independent indices that are used in the assessment. We also have two that I'm not showing on this graph, the New York Ocean Haul Seine Survey and the Northeast Fisheries Science Center Bottom Trawl Survey. They end before – the last couple of years of those are not directly comparable to the complete time series because of gear changes.

We ended those time series in about 2008, so I'm only showing indices that have data through 2012. You can see from most of them there has been a decline in at least a recent couple of years. New Jersey is the only one who has shown a little bit of an uptick in 2012. These are the fishery-dependent indices that we use in the assessment.

This is the MRFSS CPUE on the left, which has continued to decline, and the Virginia Pound Net Index, which shows a small uptick from a low value in 2011. I am also going to go over the juvenile abundance indices that we review every year for signs of recruitment failure. Just as a reminder, recruitment failure is considered to

have occurred when the index falls below the trigger value for three consecutive years.

The trigger value is defined as the 25th percentile of each index over a set period of time. That set period of time is different between the different indices. Recruitment failure was not triggered for any of the indices that we reviewed this year. This is the Maine Index. It is not included in the assessment but is considered as part of the trigger review. It was slightly above average in 2012. It was below the Q1 trigger point in 2010 but above it in 2011 and 2012 and so was not triggered.

This is New York and New Jersey. The 2012 value was below the trigger for both states. For New York it was also below it in 2011, although that may show the effects of Tropical Storm Irene moving through, which happened during the sampling period. However, 2010 was above the value for both states, so neither of them was triggered this year.

This is Maryland and Virginia, 2012 was again below the Q1 reference point for both states, but 2011 and 2010 were above Q1 for both, so it was not triggered. In fact 2011 was fairly strong for both indices. This is North Carolina; again North Carolina is not used in the assessment, but is considered as part of the trigger exercises, and it has been above its Q1 reference point for all three years.

I'm going to switch gear a little and talk about next steps for the assessment. As our Chair mentioned, we are somewhat in limbo at the moment with this assessment. The review was completed, or the review workshop was completed in July. However, the final report is not available right now. It is expected to be available sometime in mid-September. The biggest change is really the new F reference points that were proposed in the assessment to be consistent with the current SSB reference points.

That is probably the biggest change for management consideration. Overall, the peer review seemed to find it acceptable for management use. However, until we get the final written report, we won't know all the details about what they considered acceptable, what they considered dubious or unacceptable, or what they had issues with that the board might want to consider going forward.

In addition, the model was run with preliminary 2012 data. We wanted to have something in place for 2012; but when we were completing the assessment, we did not have time to wait for the final data. The 2012 values of F and SSB that are coming out of the model right now are based on preliminary data.

The finalized data are available now at the moment, and we plan to update the model with those data prior to the October board meeting. When the October meeting comes around, we will have the complete stock assessment report, the complete peer review report, and an update with finalized 2012 data. But until then, it is not really ready for management use or management consideration. That is all I have, and I'll take questions.

CHAIRMAN O'CONNELL: Are there any questions or comments for Katie?

MR. LOREN W. LUSTIG: Yes, thank you for that excellent report. You mentioned I believe in your second or third slide that there was a 30 percent reduction in recreational landings. I believe the years being compared were 2011 and 2012. Could you give us some broad strokes of reasons why we have seen such a significant change? Thank you.

DR. DREW: I think probably the biggest effect; if you look at the graph, what you can see is that the blue bars represent the harvest, so that is what people actually land, and the red bars are what is on top of that that we assume died due to being released. It is really the releases that have dropped off.

In fact, it is even bigger when you actually look at the total number of releases and not just the percentage that we assume die. Probably this is an effect of the weak recruitment coming through; that those ones that are released are usually undersized, smaller fish; so with the

weaker recruitment that has been coming through the population, you've got less fish that are available to be caught that are undersized.

People are still catching the retainable ones, and those landings have not dropped off nearly as much. It is the smaller ones that people are releasing that just are not recruiting into the fishery as well. I think that is probably the big driver in terms of why these landings have dropped off.

MR. PATRICK H. AUGUSTINE: Thanks for the report, Dr. Katie. Have we used 9 percent as assumed mortality rate for the last three or four years or has that been constant for a longer period of time?

DR. DREW: We updated it for this assessment. The last time we were using 8 percent is based on the paper by Diodati and Richards; and the value of 8 percent is not what is actually in the paper. The final paper value was 9 percent, which is why we changed it this year. I think we were working off of some preliminary data for earlier years, which is why we used the 8 percent. But we did do a pretty thorough literature review on release rates, and it was consistent with a 9 percent mortality rate.

MR. AUGUSTINE: Okay, and to follow up, Mr. Chairman. Following up on Loren's comment about the recreational reduction; do you think or do we have any way of knowing whether or not the change to circle hooks has had any negative or positive impacts, or is it too early to tell what that switchover – where we've gone from J hooks primarily to circle hooks?

DR. DREW: I think there is not really a way to tell, because the problem is there are so many confounding factors in terms of releases and in terms of what causes release mortality. The fact is we have not really been able to track what proportion of the population is actually using circle hooks. I think we know there has been a general shift; but in terms of overall numbers of what is being released, that is not something we track or have an idea of.

MR. AUGUSTINE: The final technical one would be this would be based more on an ongoing study. Have we looked at the possible change in temperature in those areas where, for instance, north to south, where we've had a heat wave in New York for a period of time, and I think most up and down the coast, whether we'll see a related increase in release mortality.

I know that once the temperature gets over 68 or 70 degrees, boy, it is sure hell to keep these fish alive if you have had them on a line for a while. I'm wondering if that might be a study that someone might want to look at in the future. I think it would be of value.

DR. DREW: That was certainly one of the things we tried to look at with the release mortality this year; but the data just were not – most of the studies have focused on other factors, and so temperature was really hard to tease out from that, especially in saltwater. Also considering that the releases occur on a wave basis, which is basically a two-month time period, you would have to pick a temperature for that two-month time period. We had a time settling that, but it is something that the TC would like to see addressed further.

MR. WILLIAM A. ADLER: Could you go back to the slide on the commercial catches? What you are saying here is there are 839 fish landed, 6.4 million pounds; that was it? Okay thank you.

MR. O'REILLY: I just wanted to ask on that last slide with the red bars. Before the completely red bars, they are just released alive fish. One of the great concerns in 2011 was the large drop in the B2s or the fish that were released alive. That was talked about quite a bit heading into that meeting in Boston. It appears that maybe that has continued; that the number of fish released alive is still down overall except for perhaps 2011 that looks like.

I can't read the axis from here; but since that was such a huge point that was made several times, is that trend continuing that the B2s are just a smaller component that they were previously. A little follow up there is what do

the proportionate at age, what does that show in terms of abundance for, say, the four to eight year old; and also separately the eight plus, because the eight plus has been used as sort of a diagnostic for the health of the stock as well.

DR. DREW: Yes, the B2s have continued to decline, and that is where a majority of that big 30 percent drop is coming from. I am afraid I don't have the catch-at-age data right now available to answer the question in terms of how that has changed over time, but I think it is consistent with what we're seeing here, which is proportionally fewer, smaller, younger fish in the catch.

DR. MICHELLE DUVAL: Just one point of information for the board; North Carolina is required to update our assessment of the Albemarle-Roanoke stock as well, and that is in a very similar timeframe as the coast-wide assessment. I expect that at the annual meeting I will be able to give you a little bit more information on that. It is currently being reviewed.

Then, Katie, I was wondering – and this is an ignorant non-modeler question I have for you, but just in terms of shifts in distribution, this is kind of a larger-scale question that is touching many other species besides striped bass. I'm assuming that this model doesn't have a spatial component to account for something like that.

Are there models out there or have you all discussed trying to take into account shifts in distribution? I'll just say for North Carolina we had zero fish landed commercially or recreationally this year, zero. I'm just wondering if you have any insight on that. Thanks.

DR. DREW: Certainly, as you said, you are correct this model does not have a spatial component. It is something we tried to look into. It is something we're definitely interested in with striped bass; not only because of possible temperature or whatever induced shifts, but also because this is almost a three stock complex really that we're managing as a single spatial stock.

Right now the data that we have, even with our expensive tagging data, are not quite good enough to help us set up a model with migration and immigration components. I think it is something that we want to consider going further with in the future, but right now we can't handle those kinds of shifts.

MR. THOMAS FOTE: We make a lot of assumptions, and you make assumptions based on the fishery being consistent for the last 20 years. This fishery has completely changed in the last 20 years. If you look at New Jersey, 20 years ago most of the striped bass fishermen were catch-and-release fishermen.

They really were not keeping – they would take one home a week, maybe a few like that, but they were mostly doing catch and release. That is when our numbers were really high. When you started cutting down on summer flounder and a few other species where these people could go targeting in May and June and everything like that, they all of a sudden switched to be striped bass fishermen, but they were meat fishermen.

Also, the gas prices went up. A guy or a girl, when they get their fish that they're going to take home, they go in, they don't sit there. A matter of fact, a lot of the charterboat captains said as soon as you put your two-fish limit in New Jersey, we're heading to the dock. That is really what happens here.

That has changed the whole philosophy of catch and release that was bringing those big numbers that we had in the nineties and even the early two thousands. The other problem is we've switched this fishery to a different fishery. Back then we were using poppers, little buck tails, and basically targeting small fish. When you use a three-pound and four-pound bunker as big as you can get, you are looking for big fish and that is what people are fishing for.

They are targeting the big fish. They're not looking for the small fish. That is going to cloud your figures. Trying to compare what was going on 20 years ago and what is going on now is a whole different fishery. We need to

basically put that into the mix. I'm not saying it is totally wrong, but there are a lot of changes in what the recreational sector has done, gas prices, the way the people fish, and who is fishing.

Those are the big three; I see that in Jersey. When I used to go out in 2002, maybe one guy on the boat would keep one fish. Now you go and they keep eight fish, but they go back to the dock, and that is what they're doing. There is not the continuously catch and release there was a long time ago, and also gas prices.

Gas prices; people are not spending a lot of money to go out and fish if they can't take something home to eat nowadays. It is a different type of fishery. We need to take that into consideration. Now I don't know if anybody is doing any surveys on that. I would basically look at Southwick and see if they put any information together like that, because they do a lot of studies on recreational fishing and their trends.

But we really needed to look at the trends. We make assumptions, and we make assumptions when we look at models. I know that always gets us in trouble. We're looking at them and things have changed in those models with the way the data is going now is because of what people are doing, then we have to take that into consideration and pay attention to it.

MR. PAUL J. DIODATI: I guess it wasn't clear to me. Is this all we're going to hear today relative to the updated stock assessment? Okay, so we're going to wait for the peer review results; but what you did present – well, you talked a little bit about the new reference points relative to fishing mortality, and I guess you are waiting to hear about that. Could you talk about what direction it might go; where would that benchmark go? Not what the value is but directionally what are you thinking?

DR. DREW: The big change that we made is – well, as you know. the current SSB reference point is sort of a historical or an empirical-based reference point where we used the estimate of the 1995 SSB as our threshold. For a number of reasons, we decided that we were satisfied with the stock in that condition, so the 1995 SSB is our biomass threshold.

Previously in management, the F reference point that we chose to complement that was a model-based MSY reference point, so we used a standard MSY modeling approach to come up with an F value of about 0.3 that was supposed to match up with the historical SSB estimate that we used for our SSB threshold.

The problem we were finding is that the two of them didn't really have a theoretical background to link them. What we've done for this assessment is we've kept the SSB threshold the same, and instead we've done projections using empirical recruitment and what we know about the biology of the stock to project the stock forward and figure out what F value gives you that SSB value that we want, and that is our new F threshold.

Then we have a similar approach for the target, which the target is 125 percent of the 1995 SSB. We chose an F value in the same way, that if you project the stock forward with our empirical estimates of recruitment, the F that gives you that SSB target is our F target. What this does is it results in a lower F value than the current value we have on the record as our management threshold and target.

MR. DIODATI: I have a few more follow-ups. That sounds very logical to have gone that approach, to follow that. It seems that assuming that the peer review agrees with this approach; that the new F target and threshold is going to be lower than what we've been working with. From what I saw, what you already presented for a majority of the adult indices that you demonstrated are in decline. You also characterized what the group believes is recruitment failure that seems to be also going on in this fishery. I thought that is what I heard. I thought I heard you say recruitment failure.

DR. DREW: I wouldn't say failure. I would say I think the recruitment that we've seen in recent years, not counting 2011 – 2011 appears to have been a very strong year; but in the recent couple of years it has been lower than the very

strong recruitment that we saw that really helped the stock recover through the late nineties and early two thousands.

That was a very strong recruitment. What we're seeing now is lower values of recruitment. I wouldn't say it is a failure. It is definitely not near the values that we saw in the eighties when the stock was collapsed and crushed, but it is definitely lower than the peak recruitment that we saw that really helped the stock build up.

MR. DIODATI: But substantially lower for the past eight out of nine years?

DR. DREW: Lower, yes. I couldn't tell you the exact percentage so I don't want to oversell the situations, but definitely lower, noticeably lower than the strongest year classes we've seen.

MR. ROY W. MILLER: I just wanted to make sure that I heard Dr. Duval correctly when she was characterizing her recent fishery; and may I follow up with her with a question? Michelle, you said that there were no commercial or recreational landings thus far this year; did I hear you right?

DR. DUVAL: That is correct, Roy. Our commercial season starts December 1 of every year. We're not on a calendar year, so our 2013 fishing year actually starts December 1, 2012, and then runs through the spring. We had zero commercial landings. We've had for the recreational season, that is a calendar year, so for 2013 we had no recreational landings at all, and this is a winter fishery for us.

I'm talking about the ocean fishery. Of course, we have our internal water fisheries on the Albemarle/Roanoke, and we certainly had landings there, but I was specifically referring to the ocean fishery. We did have some releases that came in on the ocean fishery on the recreational side. I want to say it was something like 1,500 fish that were released, but dismally low.

MR. MILLER: Have you seen any trends in the Albemarle fishery, while we're on the topic?

DR. DUVAL: Certainly, both commercial and recreational landings have been lower the past several years; and again we're waiting for the stock assessment to be reviewed so we can determine what if any management action is required. Certainly, the juvenile abundance index in 2011, I think it was our second highest on record, which it was a great year for a lot of states up and down the coast in terms of the JAI.

MR. MILLER: Thank you. I just wonder, having heard that, how much of a factor climate change has been in the apparent decline in those North Carolina landings. Are those fish not going as far south, in other words, but I guess that is yet to be determined.

CHAIRMAN O'CONNELL: To keep us moving along, I'm going to let Mike move into his presentation, which is kind of a discussion of the next steps pending the peer review, to let the board know what different pathways are available if action is needed following the results.

DISCUSSION OF NEXT STEPS FOR MANAGEMENT PENDING PEER REVIEW RESULTS

MR. MICHAEL WAINE: Just to catch everybody up on how we got to this point as we anticipate the results of the peer review report; back in March of 2011 the board instructed the Plan Development Team to draft an addendum. That addendum contained management options that are aimed to reduce striped bass fishing mortality up to 40 percent.

It included measures that further protect the spawning stock when concentrated and vulnerable. Additionally, some of the background material that went into that document was recent performance of the fishery, status of the stock, the juvenile recruitment; basically all the things that Dr. Drew just took you through based on this most recent assessment; except at that time that was based on the 2009 stock assessment update results.

There was also some information on mycobacteriosis in habitat areas of importance.

The PDT drafted that for the August 2011 meeting. The document explored reductions in an F ranging from 0 to 56 percent using projections of abundance, spawning stock biomass and landings from 2011 through 2017 under lower average recruitment levels.

As a reminder, those projections were based on the results from the 2009 stock assessment update. Included in that document were the proposed commercial management options to achieve those projection scenarios. Those were changes to minimum size limits, reduction to the commercial quota, season closures and some additional spawning stock protection.

The protection for the spawning stock was focused on the jurisdictions of the Hudson River, the Delaware Bay, the Chesapeake Bay and Albemarle Sound/Roanoke River. Also included in the document were similar proposed recreational management options; changes to size limit, bag limit, season closures, modifications to the Chesapeake Bay spring trophy fishery, and spawning stock protection for that fishery as well.

The PDT drafted all those management options into a document and brought it back to the board in August of 2011. At that time we were also going through a 2011 stock assessment update. The board postponed action on that addendum until we got the updated results from that 2011 stock assessment update.

They tasked the PDT to incorporate the new results into the projections, rerun everything, and bring it back to the board for the annual meeting in 2011. At that point, they also reviewed the stock assessment update results from the 2011 assessment and decided to postpone further action on that draft addendum until the results from the benchmark peer-reviewed assessment became available. That is where we stand right now.

As a result, that addendum never actually ended up going out for public comment. I just wanted to paint that picture so we could put ourselves into a position as we anticipate that peer review report for the board to react to those results. As Dr. Drew mentioned, that is available in mid-September.

I've laid out two timelines here for discussion purposes in terms of the board taking action. The first would be initiating a draft addendum at this meeting. Given that timeline, the PDT would update everything based on the anticipated results of this peer-reviewed assessment. We could bring a draft back for public comment in October of 2013. That would be at our annual meeting.

Then we would conduct public hearings through the winter and bring any document that was proposed today back to the board for final action at the February meeting in 2014. The second potential timeline would be to not take action today, but take action at our annual meeting in October.

At that point, the PDT would be instructed to draft the document for the February meeting. The board would approve it for public comment at that point. We would conduct hearings in the spring of 2014 and then take final action at the May meeting. Those are the two potential timelines moving forward.

Before I wrap up, I'll just mention to keep in mind what the implementation schedule would look like based on this hypothetical document that we've discussed timelines for. For example, Dr. Duval noted that North Carolina has a winter fishery that begins in late 2013. It is just something to keep in mind as the board discusses the next steps and is responsive to the benchmark peer review.

CHAIRMAN O'CONNELL: Thanks, Mike. I think it is important for the board to also, as you look at a February or a May action date by the board, states will need a time to implement any actions that would have been approved, depending on regulatory and legislative processes. We're looking for some input from the board as we prepare for the pending peer review.

MR. DIODATI: I guess one change I would make – well, I would probably want to see

modifications to the draft addendum that was prepared almost two years ago, if not two years ago, and to incorporate any new reference point changes or suggestions that might develop from the peer review. That would be one thing.

I would consider modifying that mortality rate reduction from 40 to perhaps something more akin to what the assessment suggests. It might be 30. Based on what I've heard just today, I would probably exempt North Carolina fisheries from any possible action, so that would be the Albemarle/Roanoke fisheries I suppose, from this. They don't seem to be contributing in any way to any possible declines.

Those kinds of things I would at least like to have a discussion at some point. I don't know if it is for today or the next meeting. I can see where we might want to discuss modifying and putting a finer point on the addendum. Personally I think the addendum does need to go through continued development, go through the public process. I felt that way two years ago; I feel even stronger today. I've heard nothing today or since the start of developing of the addendum that supports not taking an action.

CHAIRMAN O'CONNELL: I recognize we're on a tight timeline today. I think what I would like to do is get the board input as to whether or not the board feels like we should be directing staff to initiate an addendum at this meeting – if so, we're going to have to try to provide that guidance to the staff – or if the board wants to wait until results become available in October. We can focus the discussion on that point and then see where we need to go. People that want to speak, just raise your hand for a minute, I'll get you down. I've got Pat next.

MR. AUGUSTINE: I think the report and update that we had from Mike was excellent and very timely. I agree with what Paul's comments were, and I think I would like to be a little stronger, my words. I would like to have the PDT take a hard look at those recommendations that you made two years ago.

You have the inside information as to what the review was from SAW/SARC 57. I agree with you, Mr. Chairman; I think if we take that updated information and have the PDT or technical committee and staff put together the skeleton for what this new amendment should look like, I think it would give us a leg up on where we're going to have to go.

I think anybody who doesn't realize we're going to have to take some corrective action either has their head in the sand or they're not paying attention. I don't want to embarrass anybody, but the fact of the matter is here is another case where we've paid so much attention to striped bass over the last 15 years, we haven't allowed it to crash, we aren't about ready to let it crash.

I think if we got a leg up on the public's input to us saying, hey, you guys are going to let this thing crash. In other words, let's get out in the forefront. I agree with you, let's start an amendment today with the skeleton information that we have and update it and go from there. I would be willing to make that motion later in the meeting, Mr. Chairman.

MR. JAMES J. GILMORE: I agree both with what Paul and what Pat said. I think we're definitely going towards some management. But as a practical argument here, I think if we started an addendum now we'd try to do a full one, and this really goes to Katie and Mike.

It is like I think you are going to have a lot more options, because right now we don't know. We've got 40 percent. Then maybe it is going to go down to 30 percent, but kind of shooting in the dark you are going to have like six, eight options, whatever, for each one of the different pieces of this, and the document is just going to get a lot bigger.

I like Pat's idea; if we could get something of a basic framework or a skeleton of this so we've got a document to build on when we come back; but as much as I'd like to save time. I'm not sure how unwieldy an addendum is going to be if we develop it now; and then we come back in October and we've got a lot of stuff in there that we really don't even need to consider. You tell me; do you think you guys could frame this thing in at least somewhat simplistic and reduce

it down to maybe your best guesses at what might happen? I think that is the only way we're going to save any time. Thanks.

MR. WAINE: Yes, I think there are some things we can do between now and when we meet at the annual meeting, specifically trying to update a lot of the background information, sort of set the stage for the addendum, pull in some of the information from the peer review report once we get that back.

Some of the management measures and what exactly those mean in terms of moving forward, and how those proposed management measures would be implemented; it would be helpful to have more direction from the board before we took those projections and tried to turn them into here are some proposed management measures to get us the fishing mortality reductions that you guys are interested in.

MR. FOTE: It seems like this is a lot of déjà vu. I've gone through this process I guess in the last 20 years. We've gone to striped bass and basically prepared an addendum about four or five times; and then basically because of what the stock assessment says, we didn't do it and put a lot of time and a lot of effort into going on.

I don't have my head buried in the sand; I'm looking at the facts. This stock is not crashing. The stock is not as robust, but understand when we had this stock when it opened up in '92, we had a moratorium for almost 10 years. Even when we opened it up, we opened it up with a limited commercial fishery and a limited recreational.

It was mostly catch and release, and that is why a lot of those big fish go to be bigger and maybe reproducing. We are probably more stable. I remember when we did bluefish. There was a real option to basically put in dramatic measures on bluefish and cut it all the way back down. Then we looked at the 50-year average on bluefish and found out we were above the 50-year average.

What I'm going to be looking at is the long-term average of where we are with striped bass under all the factors that are going on and not doing another knee-jerk reaction as we've done four times. New Jersey has changed its regulation because of knee-jerk reactions twice, and I don't want to do it again.

MR. O'REILLY: I do support the addendum; I just don't support trying to do something right now. The reason I say that is I was part of the PDT in 2011. It was a very awkward situation. The PDT did not really know how to address the reductions in F because of various size limit regimes and other factors.

The PDT at that time looked more at hoping to come to the board with maybe some way of looking at maximum spawning potential. I know it was a very awkward situation, and I think that the technical committee by and large at that time didn't really support any kind of change, any kind of reduction either.

I would recommend that if there is going to be an addendum that ASMFC staff along with the technical committee be able to tell the management board what would be practical to move forward with in an addendum. I think an addendum can be something that can be positive. It doesn't have to be sweeping, but certainly there is some conservation measures that might be good to look at given that things have changed over time. We're focusing a lot on recruitment.

I know in Virginia for 2013, at least through the preliminary stages, we're looking at average to above average recruitment for the year. That is good compared to 2012, which was the lowest of all time in Virginia. Then you go to 2011; it was the highest. Recruitment is a pretty good arbiter of how things might be, and we know there has been bad recruitment. I think overlying this, the poor to average recruitment in Chesapeake Bay over the six years or so do play a role in maybe the need for some conservation measures in an addendum.

MR. JOHN CLARK: I would also like to wait to initiate the draft addendum until the stock assessment has been reviewed and released, so we can have a better chance to study that. To

follow up on what Tom was saying, I feel the same thing that we're seeing in Delaware. The stock has definitely come down but does not seem to be in any imminent danger of crashing.

Having the stock at a smaller but still large size has seemed to have had some positive impacts on some of our other fisheries; in particular weakfish are coming back some in Delaware Bay where they've been pretty much extirpated from the Bay for several years now. I'm not going to blame that all on striped bass, but all I'm saying is that now the striped bass stock has come down to a more manageable level, we are seeing weakfish again.

MR. TERRY STOCKWELL: I am actually happy to report to the board that Maine anglers are seeing the best striper fishing than they have had in the last four or five years; all year classes, slot fish, a lot of small ones. That being said, I am going to follow John and support initiation of a draft addendum at the October meeting, following the receipt of the peer-reviewed benchmark report. I do agree with Paul and Pat and Jim that the PDT should be tasked to take a look at the 2011 addendum, update it, and be prepared to bring back to us a template that we can move forward with in some expeditious manner.

MR. G. RITCHIE WHITE: I think the PDT could look at beyond Paul's suggestion a 30 percent; what it would take to get to the target, both spawning stock biomass and mortality rates, because I am kind of sensing that we're going to fall between a threshold and a target; because if we're below the threshold, we've got to take action. It seems logical that is where this is going to come out. That is what I would like to see is how do we get back to the target?

MR. RUSSELL DIZE: I would like to get my head out of the sand. It is not down there where Pat had said. In Maryland we have got so cotton-picking many striped bass that we're being smothered out in the commercial fishery. We've got two year olds that are like minnows in the marinas and around the boats. We've got so many two years olds that our pound netters can't pound net for them. They are trying to catch croakers and spot and menhaden. They can't do it, because we've got so many two year olds that they fill the pound nets. They've got to cull all these. All this has to go on a culling board. They are a nuisance for us.

I would like to ship some up north and down to North Carolina. Listen, they are eating us out of the bay. I think they are responsible for part of our decline in the crab industry. I also think they are responsible for eating a lot of the other fish up in the bay. But the state opened up the hook- and-line fishery; in two days the quota was caught. That means we have got three and four year olds in there too, or maybe five year olds.

But we've got so many two year olds that it is impossible to count them. If you go home and tell our commercial and our charter fishermen that you are going to reduce it, I think they would revolt, because they can't even fish commercially for striped bass in the Chesapeake Bay. It doesn't even sound reasonable from Maryland that you would cut the production or the catch by 30 percent, because we would like to bring you down there and take some of the fish out of the bay. Two years olds are putting us under.

CHAIRMAN O'CONNELL: That was everybody on the list that asked to speak at this time. Just back to the agenda topic is whether or not the board wants to take any action today. We don't have to. We can be very specific and direct staff to begin drafting addendum. We could have staff just begin developing a skeleton that we can fill in come October, and that should help expedite the process a little bit. Pat.

MR. AUGUSTINE: I think listening to the comments around the table there were some excellent comments and a combination thereof. It just seems to me that with the direction that the board has suggested so far, it looks as though an update of the existing PDT, good interaction with the technical committee, determine the direction we should be going, because you are

going to have to give the information back to the board to give us a chance to make some suggestions.

Along with what Mr. Gilmore said, too many options are going to kill us. Keep the options sweet and short and tight. It is no rush, because as I had said and Tom responded, I don't believe he has his head in the sand or other people around the table who really have an interest in striped bass have their head in the sand.

I just want to make sure if we have some time between now and October to put this together, so we're ahead of the curve. We have control of it and we don't let emotions arise up in the public out there and they drive the process. This is a case where you, Mr. Chairman, can direct this activity to make sure we get it on track in a reasonable time.

I do think if we have enough information background that we bring forward, the assessment that comes back from the peer review, I think our technical committee has a pretty good idea the direction we have to go, but we don't know that yet. I think based on their best ability to sort out where we should go; let them bring us a – call it a white paper or call us a skeleton addendum for our next meeting.

Now if you need it in the form of a formal motion, I will make that, But I'm not sure we need that, because I think all it will take at that point in time is just to say I move that we create addendum, whatever, and be done with it, but in the form of a white paper or in the form of an update of the PDT report to the board; I think that will help us. Unless some new ideas come forward as a result of the peer review, I think we've got a handle on the direction we need to be going.

CHAIRMAN O'CONNELL: Just based upon the feedback that has been discussed today, it seems like the majority of people that spoke thought that we should wait until we get more results, but it would be beneficial for staff to begin working with the TC to update the Public Information Document so we have something to work with in October if we need to act. I would ask that unless somebody believes we should be taking a different route at this time, we will proceed in that manner.

Okay, we'll go ahead and we'll work with Mike and the TC and the advisory panel as needed to put that information together for the October meeting. Our last item under other business; Fish and Wildlife Service wanted to provide an update on the tagging cruise. Bill, did you want to do that or Wilson?

OTHER BUSINESS

DR. WILSON LANEY: Just a quick update; recall that in 2013 we had a Coastal Recreational Fishing License Grant from North Carolina to me and Dr. Roger Rulifson in the amount of $238,000 that allowed us to conduct both the traditional winter 2013. We had the full amount from the Coastal Recreational Fishing License Program that allowed us to conduct the traditional winter trawling for striped bass as well as to conduct charter hook-and-line trips out of Rudy Inlet, Virginia for tagging stripers. We were able to do that.

We had applied originally for a three-year grant that would cover 2014 and 2015 as well. The CRFL program challenged us to find a 50 percent match for the 2014 and 2015, and they gave us an extended period of time to locate a match, and we were unable to meet that challenge. As it stands right now we do have a sufficient match.

We're going to use part of our Atlantic Coastal Fisheries Cooperative Management Act allocation from the commission to match the charterboat component of the tagging program, which is $8,000 for $16,000 total. We don't have the funding that we need to conduct the traditional winter trawl program on a research vessel.

We do have two research vessels that have indicated that they are available and willing to do the work, but we would have to find the funding. If we went with the low bid, that total amount that we would need for that component

of it is somewhere in the neighborhood of about $220,000, I think.

We were hoping to be able to tag using the trawl-caught fish as well as the hook-and-line-caught fish for three years in a row, so that we would be able to have a rigorous study design, and then compare survivability between the two different types of tagging operations. That is my report Mr. Chairman. I will add that Dr. Rulifson and I still have the potential I suppose for finding that total amount of funding through some other source, and we are still looking for potential sources of funding. That is my report.

CHAIRMAN O'CONNELL: Does the board have any questions for Wilson? Michelle.

DR. DUVAL: Wilson, how far out did you have to go this year to find stripers to tag?

DR. LANEY: I presume you want me to address that distribution question, and the answer is that this year we had to go further offshore than we've ever had to go before. We were mostly operating in the vicinity of the Chesapeake Bay Light Tower, for those of you who know where that is, in the neighborhood of 12 to 20 miles offshore, the mouth of Chesapeake Bay.

We did not catch a single striped bass in North Carolina waters this year using the trawler. All of our hook-and-line operations were off the mouth of Chesapeake Bay, because we could not find any reports of any striped bass in North Carolina waters. That continues a trend that we have observed since about 2007, I think, that the fish seem to be further north and further offshore during the winter months. Remember, we're operating in a very narrow spatiotemporal window out there, so we're only out there usually for a couple of weeks.

DR. LOUIS B. DANIEL: No, I'm going to ask you all for money. I've given the money. I did want to let you know that we are committed to this. This is an important coast-wide tagging study. All the states around the table benefit from this study. I hate losing this time series. We tried to do more, but we did the first year and half the second year and committed to half the third year. Two hundred grand is not a lot of money when it is divvied up amongst 15, 16 states.

I would suggest – we will step back and do everything we can to make that money available as the 50 percent match, so don't think that time has run out and we can't still make something happen. I hope we can, but I've sort of foot my foot down on the 50 percent match, so I'm not coming up with anymore money.

I think we've been pretty generous in what we have put together. Think about that and soul search a little bit, because Roger and Wilson could give you a very detailed account of how important that cruise is not just for stripers but for sturgeon and for many other species that we all rely on at ASMFC for age and growth and that type of information. Just keep it in mind.

ADJOURNMENT

CHAIRMAN O'CONNELL: Any other comments before we wrap the meeting up? All right, that is all the agenda items, meeting adjourned.

(Whereupon, the meeting was adjourned at 3:10 o'clock p.m., August 6, 2013.)

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

October 10, 2013

TO: **Atlantic Striped Bass Management Board**

FROM: **Mike Waine, FMP Coordinator**

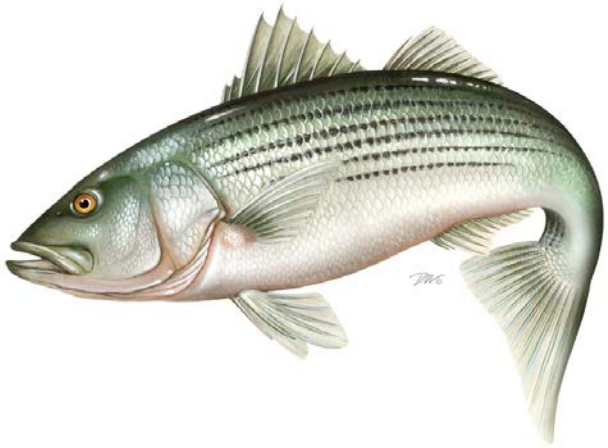
RE: **2013 Atlantic Striped Bass Benchmark Stock Assessment Reports**

Enclosed please find the benchmark stock assessment updated with finalized 2012 landings data and the peer review summary report from the 57th Stock Assessment Review Committee.

Please recall the benchmark assessment was completed using preliminary 2012 landings data (final landings data were not available at the time of the assessment workshop). Following the peer review summary report release in September 2013, the TC updated the assessment with the final 2012 landings data. Therefore, the information in the updated benchmark assessment will have slightly different final numbers then the SAW/SARC summary report (see enclosures).

Please let me know if you have any questions (mwaine@asmfc.org).

Atlantic States Marine Fisheries Commission
Update of the Striped Bass Stock Assessment using Final 2012 Data
October 2013



Prepared by:

Dr. Gary Nelson, MA DMF
ASMFC Striped Bass Technical Committee

Healthy, self-sustaining populations of all Atlantic coast fish species or successful restoration well in progress by the year 2015

Model Description

The striped bass statistical catch-at-age (SCA) model used since 2007 has been generalized to allow, among other things, specification of multiple fleets, different stock-recruitment relationships, and year- and age-specific natural mortality rates. The changes in model structure and additions are based on recommendations of the 2007 benchmark review committee (NEFSC 2008). The 2013 SCA model is used to estimate fishing mortality, abundance, and spawning stock biomass of striped bass during 1982-2012 from total removals-at-age and fisheries-dependent and fisheries-independent survey indices. See the 2013 SARC Document for complete description of model. A summary of the model structure used in this assessment is listed in Table 1.

Data Inputs

Plus Group

As in the 2007 benchmark, an age 13+ plus-group was used for catch and indices data as an attempt to address the increase in scale-ageing bias after ages 12 or so.

Updated Catch Data

Commercial harvest data for some states changed in the final version of datasets and these were updated (Tables 2 and 3). Commercial discard data for 2004-2012 (Table 4) were also updated with the changes in MRIP and commercial harvest data for 2012 and a correction in the hook-and-line discard mortality (from 0.08 to 0.09 following the use of the Diodati and Richards (1997) release mortality estimate). The recreational harvest (Tables 5 and 6) and release (Tables 7 and 8) data were updated with the final 2012 MRIP estimates. Average catch weights-at-age (Table 9) were also updated with the new total weights-at-age and total numbers-at-age from state spreadsheets.

Comparison of the preliminary numbers from the benchmark assessment and the final numbers used in this update, expressed as percent differences (final-prelim)/prelim*100), are shown in Figure 1 for each data type, state and year (where applicable). Changes in estimates ranged from -1.6% (NY) to 18.5% (MD) for MRIP harvest, -1.4% (NY) to 2.8% (MD) for MRIP releases, and 0% (MA, RI, DE, PRFC, NC) to 0.40% (NY) for commercial harvest. Commercial discards rose between 0.6% (2005) and 2.9% (2012) (Figure 1). For 2012, the resulting changes increased total removals by only 2% (3,597,528 versus 3,670,791).

Total removals (recreational and commercial harvest numbers plus number of discards that die due to handling and release and incidental removals) and the proportions of catch-at-age of striped bass fisheries are the primary data used in the model. The removals data were partitioned into three "fleets" in an attempt to account for more realistic patterns in fishing selectivity known to have occurred as management measures changed over time. All selectivity time blocks corresponded to Amendment changes. Removals data were split into *Chesapeake Bay*, *Coast* and the *Commercial Dead Discards*. The latter was a separate fleet because commercial discards were from a multitude of gears that do not necessarily target striped bass and the mixed gear types may have a unique selectivity over time. In addition, the data prior to 1996 could not be separated into regions. The Chesapeake Bay fleet includes commercial and recreational harvest and recreational dead discards

taken in the Bay by MD, VA, and the PRFC. The Coast fleet includes commercial and recreational harvest and recreational dead discards taken in the coastal regions, Delaware Bay and Hudson River by ME, NH, MA, NY, NJ, DE, MD, VA and NC. The observed total removals and catch age compositions were generated from all state reported landings-at-age, recreational dead discards-at-age and incidental removals-at-age. The total removals and age composition by region are given year (Table 10).

Indices of Relative Abundance

States provided age-specific and aggregate indices from fisheries-dependent and fisheries-independent sources that were assumed to reflect trends in striped bass relative abundance. A formal review of age-2+ abundance indices was conducted by ASMFC at a workshop in July of 2004. The 2004 workshop developed a set of evaluation criteria and tasked states with a review of indices. Both the Striped Bass Technical Committee and the Management Board approved of the criteria and of the review. The resulting review led to revisions and elimination of some indices used in previous stock assessments. The following sources were used as tuning indices in the current stock assessment:

MRFSS/MRIP Total Catch Rate Index
Maryland Gillnet Survey
New York Ocean Haul Seine Survey
Northeast Fisheries Science Center Bottom Trawl Survey
Young-of-the-Year Indices from the Delaware River, Hudson River,
and MD and VA portions of the Chesapeake Bay
Age 1 Indices from the Hudson trawl survey and MD seine survey
Connecticut Bottom Trawl Survey
New Jersey Bottom Trawl Survey
Delaware Electrofishing Spawning Stock Survey
Virginia Pound Net Survey

All indices used in the benchmark assessment were used in the update.

Starting Values

Initial starting values for all parameters are given in Table B11 of the SARC document and were selected based on trial-and-error and used in the benchmark assessment. Based on the coast-wide age samples, the starting effective sample sizes for the age proportions in each fleet were set at 50.

Used as starting values, the average effective sample size for each survey with age composition data was calculated in the 2007 benchmark (http://www.nefsc.noaa.gov/publications/crd/crd0803/) by using methods in Pennington and Volstad (1994) and Pennington and others (2002). In essence, effective sample size was estimated by first calculating the length sample variance using the simple random sampling equation and dividing into it the cluster sampling variance of mean length derived through bootstrapping, assuming each seine/trawl haul, gillnet set, or electrofishing run was the sampling unit. The average of the annual effective sample sizes was used as starting values in each survey multinomial error distribution (NJ Trawl = 23; NYOHS = 56; DESSN = 68; MDSSN=68; VAPNET = 68).

Sex Proportions-at-age

Female sex proportions-at-age are used to apportion the numbers-at-age to female numbers-at-age for calculation of female spawning stock biomass. The sex proportions were derived from available state catch datasets. The proportions used were:

Age	1	2	3	4	5	6	7	8	9	10	11	12	13+
Prop	0.53	0.56	0.56	0.52	0.57	0.65	0.73	0.81	0.88	0.92	0.95	0.97	1.00

Female Maturity

The proportions mature-at-age for females were derived from literature values and field samples.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13+
Prop	0.0	0.0	0.0	0.04	0.13	0.45	0.89	0.94	1.00	1.00	1.00	1.00	1.00

Natural Mortality

The age-specific M estimates used in the updated base model are:

Age	1	2	3	4	5	6	$\geq$7
M	1.13	0.68	0.45	0.33	0.25	0.19	0.15

Model Specification

Phases

Model parameters were solved in phases. The parameters solved in each phase were:

1 Yr 1, Age 1 N or Avg N (log)
2 recruitment deviations and fishing mortality
3 stock-recruitment parameters
4 catch selectivity parameters
5 survey selectivity parameters
6 catchability coefficients of survey indices

Catch Selectivity Functions

The same four time blocks for catch selectivity estimations used in the 2013 benchmark were used in the update.

Stock-Recruitment Curve

Based on literature reviews and committee opinion, the Beverton-Holt equation was selected as the appropriate stock recruitment relationship for striped bass.

Data Weighting

Data weighting was accomplished by first running the model with all initial starting values, lambda weights = 1, and index CV weights = 1. The lambda weights for the total removal data were increased to 2 for the Bay, Coast, and Commercial Discards to force the model to better fit the data in these early years (1982-1984). Based on recommendations by the SARC panel, the initial effective sample sizes were first adjusted once by using the Francis multipliers and the model was re-run. After the model was re-run, the index CV weights were adjusted to obtain index RMSE values close 1.0. The estimated RMSE values were used as the CV weights and this allowed the resulting RMSE values to be near 1.0. The model was re-run to make small adjustments in the RMSE values. Since the MRFSS and MDSSN indices have considerable influence on the model results, the CV weights for these indices were then adjusted until the RMSE values were nearly identical to balance the influence of each index.

Results

Resulting contributions to total likelihood are listed in Table 11. The converged total likelihood was 9,746.1 (Table 11). Estimates of fully-recruited fishing mortality for each fleet, total fishing mortality, recruitment, parameters of the selectivity functions for the selectivity periods, catchability coefficients for all surveys, and parameters of the survey selectivity functions are given in Table 12 and are shown graphically in Figures 2-4. Graphs depicting the observed and predicted values and residuals for the catch age composition, survey indices, and survey compositions are given in Appendix A. The model fit the observed total catches (Figure 2) and catch age compositions of all fleets well, except for ages 1 and 13+ for the Coast and Commercial Discard fleets (Appendix A), and the YOY, age 1, CTTrawl, and NEFSC indices reasonably well (Appendix A). The predicted trends matched the observed trends in age composition survey indices (except MDSSN and NYOHS), and predicted the survey age composition reasonably well (MDSSN) to poorly (NJ Trawl) (Appendix A).
Estimates of the catch selectivity patterns for each fleet showed that, although the patterns varied over time with changes in regulation, selectivity was dome-shaped for Chesapeake Bay and Commercial Discard fleets and primarily flat-topped for the Coast over time (Figure 3).

Fishing Mortality

Partial fully-recruited fishing mortality in 2012 for the Bay, Coast and Commercial Discard fleets was 0.058, 0.141, and 0.041, respectively (total fully-recruited F_{2012} =0.200) (Table 12; Figure 4). An average F weighted by N was calculated for comparison to tagging results since the tag releases and recaptures are weighted by abundance as part of the experimental design. The 2012 F weighted by N for ages 7-11 (age 7 to compare with tagged fish $\geq$28") was 0.192 (Table 13; Figure 5). An F weighted by N for ages 3-8, comparable to the direct enumeration estimate for Chesapeake Bay, was equal to 0.099 (Table 13; Figure 5). The maximum total F-at-age in 2012 was 0.200 for ages 10-11 (Table 14). Average fishing mortality on ages 3-8, which are generally targeted in producer areas, was 0.14 (Table 13; Figure 5).

Fishing mortality-at-age in 2011 and 2012 for the three fleets is shown in Figure 5. Fishing mortality-at-age peaked at age 5 in the Chesapeake Bay and Commercial Discards fleets and age 13+ in the

Coast fleet. The highest fishing mortality was attributed to the Coast fleet at ages ≥6 (Table 14; Figure 6).

Population Abundance (January 1)

Striped bass abundance (1+) increased steadily from 1982 through 1997 when it peaked around 246 million fish (Table 15; Figure 7). Total abundance fluctuated without trend through 2004. From 2005-2010, age 1+ abundance declined to about 134 million fish. Total abundance increased to 211 million fish by 2012 (Figure 7). The increase in 2012 was due primarily to the abundant 2011 year class from Chesapeake Bay (Table 15). Total abundance is expected to drop in 2013 as the very small 2012 year-class from Chesapeake Bay recruits to the population (Figure 7). Abundance of striped bass age 8+ increased steadily through 2004 to 11.3 million, but declined to 7.2 million fish through 2010 (Table 15; Figure 7). A small increase in 8+ abundance occurred in 2011 as the 2003 year class became age 8 (Figure 7).

Spawning Stock Biomass and Total Biomass

Weights-at-age used to calculate female spawning stock biomass (SSB) were generated from catch weights-at-age and the Rivard algorithm described in the NEFSC's VPA/ADAPT program. Female SSB grew steadily from 1982 through 2003 when it peaked at about 78 thousand metric tons (Table 16, Figure 8A). Female SSB has declined since then and was estimated at 58.2 thousand metric tons (95% CI: 43,262-73,212) in 2012 (Table 16; Figure 8A). The SSB point estimate in 2012 remained just above the threshold level of 57.6 thousand metric tons (1995 SSB value) and indicates that the striped bass are not overfished. However, given the error associated with the 1995 and 2012 values, there is a probability of 0.46 that the female spawning stock biomass in 2012 is below the threshold. The spawning stock numbers (Figure 8B) declined more rapidly than the spawning stock biomass.

Total biomass (January 1) increased from 18,782 metric tons in 1982 to its peak at 218,221 metric tons in 1999 (Figure 8C) Total biomass declined through 2011, but increased in 2012 due to the strong 2011 year-class (Figure 8C).

Retrospective Analysis

Retrospective analysis plots and percent difference plots between the 2012 and peels of the retrospective analysis are shown in Figure 9. Moderate retrospective bias was evident in the more recent estimates of fully-recruited total F, SSB, and age 8+ abundance of SCA (Figure 9). The retrospective pattern suggests that fishing mortality is likely slightly over-estimated (between 9 and 13% since 2007) and could decrease with the addition of future years of data, while female spawning biomass appears under-estimated and could increase with the addition of future years of data. Similar retrospective trends have been observed in the previous assessment of striped bass using the ADAPT VPA (ASMFC 2005), the 2007 benchmark, and supporting ASAP model presented in the 2013 benchmark assessment document.

Biological Reference Points

Biological reference points for striped bass calculated in the last assessment and currently used as thresholds in management are F_{MSY} (0.34) and an SSB proxy which is equivalent to the 1995 spawning stock biomass. The SSB target was calculated as 125% of the 1995 SSB, and the F target was defined as an exploitation rate of 24% or F=0.3. The estimate for FMSY was derived using the results of the 2008 SCA assessment in which four stock-recruitment models were considered; a Ricker, a log-normal Ricker model, a Shepherd and a log-normal Shepherd model. The TC used a model averaging approach among the four results, producing an estimate of FMSY = 0.34 (range of 0.28-0.40).

For this assessment, the SSB_{Target} and $SSB_{Threshold}$ definitions remained the same, but F reference points were chosen to link the target and threshold F with the target and threshold SSB. Using a stochastic projection drawing recruitment from empirical estimates and a distribution of starting population abundance at age, fishing mortality associated with the SSB target and threshold were determined.

Empirical estimates of recruitment, selectivity, and the starting population came from the SCA model results. Selectivity was calculated as the geometric mean of the 2008-2012 of total F at age, scaled to the highest F at age. Estimates of recruitment were restricted to 1990 and later, when the stock was considered restored but not fully rebuilt. Similarly, spawning stock weights-at-age were calculated as the geometric mean of the 2008-2012 of adjusted Rivard weights-at-age. The median 50-year SSB of 1000 projections was compared to the 1995 SSB value.

This resulted in an SSB_{Target} of 57,626 metric tons metric tons with an associated F_{Target} = 0.180, and an $SSB_{Threshold}$ of 57,626 metric tons with an associated $F_{Threshold}$ = 0.219.

One SARC reviewer suggested using only the 1995-2012 recruitment values since the 1995 SSB value reflects the year when the stock was declared. To explore the impact, the above analyses were repeated using only 1995-2012 recruitment estimates. An F threshold of 0.222 was required to achieve a median SSB of 57,626 metric tons in the 50^{th} year (compared to 0.219), and an F target of 0.182 was required to achieve a median SSB of 72,032 metric tons (compared to 0.180).

The time series of fully-recruited F from the SCA model is compared to the $F_{Threshold}$ and F_{Target} values in Figure 10. The F estimate for 2012 is below the threshold but above the target indicated overfishing is not occurring. However, if error in both the 2012 F and $F_{Threshold}$ estimates is accounted for, the probability of the 2012 F values being above or equal to the $F_{Threshold}$ is 0.31.

Spawning Stock Biomass Projections

Five-year projections of female spawning stock biomass were made by using a population simulation model written in R. The model projection began in year 2012 and abundance-at-age data with associated standard errors, total fishing-at age, Rivard weights, natural mortality, female sex proportions-at-age, and female maturity-at-age from the model input/output for 2012 were used to parameterize the model and calculate SSB using the abundance and spawning stock biomass equation given in the model structure portion of this document. For the years greater than 2012, total fully-

recruited fishing mortality was first specified and multiplied by the average selectivity derived from the average F-at-age values from 2008-2012. This F-at-age vector is used to project the population in the remaining years. For each iteration of the simulation, the abundance-at-age in 2012 is first randomly drawn from a normal distribution parameterized with the 2012 estimates of January-1 abundance–at-age and associated standard errors from the stock assessment model, and spawning stock biomass is calculated. For the remaining years, abundance of age 1 recruits is randomly generated using the using 1990-2012 recruitment estimates. An age 13 plus-group was assumed. Female spawning stock biomass is calculated by using average Rivard weight estimates from 2008-2012, sex proportions-at-age, and female maturity-at-age. Each year's SSB estimate is stored in a file and the whole procedure is repeated for the specified number of iterations.

For each year of the projection, the probability of SSB going below the SSB reference point was calculated using SSBs from all iterations of the simulation and an algorithm used to approximate equation 2 in Shertzer et al. (2008). This equation was used to incorporate the associated error of the projected SSB and the associated error of the SSB reference point (1995 value in SCA model). Several F scenarios were investigated. For years >2012, simulations were performed using the current fully-recruited F, $F_{threshold}$ reference point (=0.219), F_{target} (=0.180), the old $F_{threshold}$ (=0.34), F=0.15, F=0.10.

If the current fully-recruited F (0.200) is maintained during 2013-2017, the probability of being below the SSB reference point increases to 0.86 by 2015 (Figure 11). After 2016, the probability is expected to decline slightly. If the current fully-recruited F increases to $F_{threshold}$ (0.219) and is maintained during 2013-2017, the probability of being below the SSB reference point reaches 0.93 by 2015 and declines thereafter (Figure 11). If the fully-recruited F decreases to the current F_{target} (0.180) and is maintained during 2013-2017, the probability of being below the SSB reference point reaches 0.77 by 2015 and declines thereafter (Figure 11). If the fully-recruited F increases to the old $F_{threshold}$ (0.34) and is maintained during 2013-2017, the probability of being below the SSB reference point reaches 0.98 by 2014 and 1.0 thereafter (Figure 11). If the fully-recruited F decreases to 0.15 and is maintained during 2013-2017, the probability of being below the SSB reference point reaches a maximum of 0.60 by 2013 and declines thereafter (Figure 11). If the fully-recruited F decreases to 0.10 and is maintained during 2013-2017, the probability of being below the SSB reference point reaches is maximum (0.54) in 2013 and declines thereafter (Figure 11).

Comparison of Results from the Updated Assessment with 2012 Final Data and the 2013 Benchmark Assessment

Fully-recruited fishing mortality and female spawning stock biomass estimates from the update and benchmarks assessments are shown in Figure 12. The updated assessment produced higher fully-recruited fishing mortality and lower female spawning stock biomass estimates than the benchmark assessment (Figure 12).

Status of the Stock

In 2012, the Atlantic striped bass stock was not overfished or experiencing overfishing based on the points estimates of fully-recruited fishing mortality and female spawning stock biomass relative to the reference points defined in this assessment. Female spawning stock biomass was estimated at 58.2

thousand metric tons (128 million pounds), above the SSB threshold of 57,626 metric tons, but below the SSB target of 72,023 metric tons. Total fishing mortality was estimated at 0.200, below the F threshold of 0.219 but above the F target of 0.180.

However, because of error associated with these estimates, there is a probability of 0.46 that the 2012 female SSB estimates is below or equal to the SSB threshold, and a probability of 0.31 that the 2012 fully-recruited fishing mortality is above or equal the fishing mortality threshold. If the estimates are adjusted for the average retrospective bias in the last five years (fishing mortality = 12% over-estimate; SSB = 14% under-estimate), the probability of the 2012 female SSB estimates being below or equal to the SSB threshold declines to 0.12, while the probability of the 2012 fully-recruited fishing mortality being above or equal the fishing mortality threshold declines to 0.13.

Literature Cited

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Table 1. Model structure, equation, and data inputs used in this assessment.

Input Data	Symbol	Description/Definition
Catch Weight-at-age (kg)	$w_{y,a}$	Overall average of mean weights-at-age reported for fishery components of states
Rivard Weight-at-age (kg)	$rw_{y,a}$	January-1 weights calculated from catch weights.
SSB Weight-at-age (kg)	$sw_{y,a}$	Adjustment of $rw_{y,a}$ (average of $rw_{y,a}$ and $w_{y,a}$) made to match time of spawning.
Natural Mortality	$M_{y,a}$	Age 1 2 3 4 5 6 ≥7 M 1.13 0.68 0.45 0.33 0.25 0.19 0.15 From regression fit to tag estimates of Z for ages 1-3 from Western Long Island Sound, and tag-based estimates of M (Jiang et al., 2007) for ages 3-6 prior to 1997. M for ages ≥ 7 from longevity method. M assumed constant across years
Female sex proportions-at-age	sr_a	Calculated from scientific and fishery samples
Maturity-at-age	m_a	Calculated from literature and field samples

Table 1 cont.

Population Model	Symbol	Equation
Age-1 numbers	$\hat{N}_{y,1}$	$\hat{N}_{y,1} = \exp\left(\log_e(\hat{\alpha}) + \log_e(SSB_{y-1}) - \log_e\left(1+\frac{SSB_{y-1}}{\hat{\beta}}\right) + \hat{e}_y - 0.5\hat{\sigma}_R^2\right)$ $\hat{\sigma}_R = \sqrt{\frac{\sum_y (\hat{e}_y - \bar{\hat{e}})^2}{n-1}}$ where e_y are independent and identically distributed normal random variables with zero mean and constant variance and are constrained to sum to zero over all years
Abundance-at-Age	$\hat{N}_{y,a}$	First year (ages 2-A in 1970): $\hat{N}_{y,a} = \hat{N}_{y,a-1} \exp^{-\hat{F}_{1982,a-1} - M_{1982,a-1}}$ Rest of years (ages 2-12): $\hat{N}_{y,a} = \hat{N}_{y-1,a-1} \exp^{-\hat{F}_{y-1,a-1} - M_{y-1,a-1}}$
Plus-group abundance-at-age	$\hat{N}_{y,A}$	$\hat{N}_{y,A} = \hat{N}_{y-1,A-1} \exp^{-\hat{F}_{y-1,A-1} - M_{y-1,A-1}} + \hat{N}_{y-1,A} \exp^{-\hat{F}_{y-1,A} - M_{y-1,A}}$
Fishing Mortality	$\hat{F}_{f,y,a}$	$\hat{F}_{f,y,a} = \hat{F}_{f,y} \cdot \hat{s}_{f,a}$ where F_{fy} and s_{fa} are estimated parameters
Total Mortality	$\hat{Z}_{y,a}$	$Z_{y,a} = F_{y,a} + M_{y,a}$
Fleet Selectivity	$\hat{s}_{f,a}$	Fleet 1 (Chespeake Bay): 1982-1984, 1985-1989, 1990-1995, 1996-2012 Fleet 2 (Coast): 1982-1984 Fleet 3 (Commercial Dead Discards): 1985-1989,1990-1995,1996-2002,2003-2012 $\hat{s}_a = \frac{1}{1-\hat{\gamma}} \cdot \left(\frac{1-\hat{\gamma}}{\hat{\gamma}}\right)^{\hat{\gamma}} \frac{\exp^{\hat{\alpha}\hat{\gamma}(\hat{\beta}-a)}}{1+\exp^{\hat{\alpha}(\hat{\beta}-a)}}$ Fleet 2 (Coast): 1985-1989, 1990-1996, 1997-2012 $\hat{s}_a = \exp^{(-\exp^{-\hat{\beta}(a-\hat{\alpha})})}$ Fleet 3 (Commercial Dead Discards): 1982-1984 $\hat{s}_a = \alpha \exp^{\beta a}$
Predicted Catch-At-Age	$\hat{C}_{f,y,a}$	$\hat{C}_{f,y,a} = \frac{\hat{F}_{f,y,a}}{\hat{F}_{f,y,a} + M_{y,a}} \cdot (1 - \exp^{-\hat{F}_{y,a} - M_{y,a}}) \cdot \hat{N}_{y,a}$

Table 1 cont.

Population Model	Symbol	Equation
Predicted Total Catch	$\hat{C}_{y,a}$	$\hat{C}_{f,y} = \sum_a \hat{C}_{f,y,a}$
Predicted Proportions of Catch-At-Age	$\hat{P}_{f,y,a}$	$\hat{P}_{f,y,a} = \frac{\hat{C}_{f,y,a}}{\sum_a \hat{C}_{f,y,a}}$
Predicted Aggregated Indices of Relative Abundance	$\hat{I}_{t,y,\sum a}$	$\hat{I}_{t,y,\Sigma a} = \hat{q}_t \cdot \sum_a \hat{N}_{y,a} \cdot \exp^{-p_t \cdot Z_{y,a}}$
Predicted Age-Specific Indices of Relative Abundance	$\hat{I}_{t,y,a}$	$\hat{I}_{t,y,a} = \hat{q}_t \cdot \hat{s}_{t,a} \cdot \hat{N}_{y,a} \cdot \exp^{-p_t \cdot \hat{Z}_{y,a}}$
Predicted Total Indices of Relative Abundance with Age Composition Data	$\hat{I}_{t,y}$	$\hat{I}_{t,y} = \hat{q}_t \sum_a \hat{s}_{t,a} \cdot \hat{N}_{y,a} \cdot \exp^{-p_t \cdot \hat{Z}_{y,a}}$
Predicted Age Composition of Survey	$\hat{U}_{t,y,a}$	$\hat{U}_{t,y,a} = \frac{\hat{I}_{t,y,a}}{\sum_a \hat{I}_{t,y,a}}$
Female Spawning Stock Biomass (metric tons)	SSB_y	$SSB_y = \sum_{a=1}^{A} N_{y,a} \cdot sr_a \cdot m_a \cdot sw_{y,a} / 1000$
January-1 Biomass (metric tons)	B_y	$B_y = \sum_{a=1}^{A} N_{y,a} \cdot rw_{y,a} / 1000$

Table 1 cont.

Likelihood	Symbol	Equation
Concentrated Lognormal Likelihood for Fleet Catch and Indices of Relative Abundance	$-L_l$	$-L_l = 0.5 * \sum_i n_i * \ln\left(\frac{\sum_i RSS_i}{\sum_i n_i}\right)$ where $RSS_f = \lambda_f \sum_y \left(\frac{\ln\left(C_{f,y}+1e^{-5}\right)-\ln\left(\hat{C}_{f,y}+1e^{-5}\right)}{CV_{f,y}}\right)^2$ $RSS_t = \lambda_t \sum_y \left(\frac{\ln\left(I_{t,y}+1e^{-5}\right)-\ln\left(\hat{I}_{t,y}+1e^{-5}\right)}{\delta_t \cdot CV_{t,y}}\right)^2$ $CV_{f,y}$ and $CV_{t,y}$ are the annual coefficient of variation for the observed total catch and index in year y, δ_t is the CV weight for index t, and λ_t and λ_f are relative weights
Multinomial fleet catch (f) and index (t) age compositions	$-L_f$ or $-L_t$	$-L_f = \lambda_f \sum_y -n_{f,y} \sum_a P_{f,y,a} \cdot \ln\left(\hat{P}_{f,y,a}+1e^{-7}\right)$ $-L_t = \lambda_t \sum_y -n_{t,y} \sum_a U_{t,y,a} \cdot \ln\left(\hat{U}_{t,y,a}+1e^{-7}\right)$ where λ_f and λ_t are a user-defined weighting factors and n_y are the effective sample sizes
Effective sample size	$\hat{\bar{n}}$	The multiplier from equation 1.8 of Francis (2011) was used to adjust the starting values
Constraints Added To Total Likelihood	P_{n1}, P_{rdev}, P_{fadd}	$P_{n1} = \lambda_{n1}(\hat{N}_{y,1} - N^e_{y,1})^2$ - forces $N_{1,1}$ to follow S-R curve $P_{rdev} = \lambda_R \sum_y \log_e(\hat{\sigma}_R) + \frac{\hat{e}_y^2}{2\hat{\sigma}_R^2}$ - for bias correction to constrain deviations $P_{f_{add}} = \begin{cases} \text{phase} < 3, & 10 \cdot \sum_y (F_{f,y} - 0.15)^2 \\ \text{phase} \geq 3, & 0.000001 \cdot \sum_y (F_{f,y} - 0.15)^2 \end{cases}$ - avoid small F values at start

Table 1 cont.

Diagnostics	Symbol	Equation
Standardized residuals (lognormal – catch and surveys)	$r_{f,y,a}$ or $r_{t,y,a}$	$r_{t,y} = \frac{\log I_{t,y} - \log \hat{I}_{t,y}}{\sqrt{\log_e((\delta_t CV_{t,y})^2 + 1)}}$ $r_{f,y} = \frac{\log C_{f,y} - \log \hat{C}_{f,y}}{\sqrt{\log_e(CV_{f,y}^2 + 1)}}$
Standardized residuals (age compositions – catch and surveys)	$ra_{f,y,a}$ or $ra_{t,y,a}$	$ra_{f,y,a} = \frac{P_{f,y,a} - \hat{P}_{f,y,a}}{\sqrt{\frac{\hat{P}_{f,y,a}(1-\hat{P}_{f,y,a})}{\hat{n}_f}}}$ $ra_{t,y,a} = \frac{P_{t,y,a} - \hat{P}_{t,y,a}}{\sqrt{\frac{\hat{P}_{t,y,a}(1-\hat{P}_{t,y,a})}{\hat{n}_t}}}$
Root mean square error	*RMSE*	Total catch $RMSE_f = \sqrt{\frac{\sum_y r_{f,y}^2}{n_f}}$ Index $RMSE_t = \sqrt{\frac{\sum_y r_{t,y}^2}{n_t}}$

Table 2. Commercial harvest (numbers) by state and year.

Year	ME	NH	MA*	RI	CT	NY	NJ	DE	MD	PRFC	VA	NC	Total
1982			26,183	52,896	207	74,935		12,794	189,089	54,421	14,905	3,200	428,630
1983			9,528	48,173	83	66,334		5,806	147,079	63,171	15,962	1,405	357,541
1984			5,838	8,878	192	70,472		12,832	392,696	372,924	6,507	532	870,871
1985	90		7,601	7,173	350	52,048		1,359		82,550	23,450		174,621
1986			3,797	2,668						10,965	251		17,681
1987			3,284	23						9,884	361		13,552
1988			3,388							19,334	10,588		33,310
1989			7,402										7,402
1990			5,927	784		11,784		698	534	38,884	56,222	803	115,636
1991			9,901	3,596		15,426		3,091	31,880	44,521	44,970	413	153,798
1992			11,532	9,095		20,150		2,703	119,286	23,291	42,912	1,745	230,714
1993			13,099	6,294		11,181		4,273	211,089	24,451	39,059	3,414	312,860
1994			11,066	4,512		15,212		4,886	208,914	25,196	32,382	5,275	307,443
1995			44,965	19,722		43,704		5,565	280,051	29,308	88,274	23,325	534,914
1996			38,354	18,570		39,707		20,660	415,272	46,309	184,495	3,151	766,518
1997			44,841	7,061		37,852		33,223	706,847	87,643	165,583	25,562	1,108,612
1998			43,315	8,835		45,149		31,386	790,154	93,299	204,911	16,040	1,233,089
1999			40,838	11,559		49,795		34,841	650,022	90,575	205,143	21,040	1,103,812
2000			40,256	9,418		54,894		25,188	627,777	91,471	202,227	6,480	1,057,712
2001			40,248	10,917		58,296		34,373	549,896	87,809	148,346	22,936	952,820
2002			48,926	11,653		47,142		30,440	296,635	80,300	127,211	15,784	658,091
2003			61,262	15,497		68,354		31,531	439,482	83,091	161,777	13,823	874,817
2004			66,556	15,867		70,367		28,406	461,064	91,888	147,998	31,014	913,160
2005			65,332	14,949		70,560		26,336	569,964	80,615	119,244	26,573	973,572
2006			75,062	15,429		73,528		30,212	655,951	92,288	109,396	2,799	1,054,664
2007			57,634	13,934		78,287		31,090	598,495	86,695	140,602	16,621	1,023,358
2008			65,330	16,616		73,263		31,866	594,655	81,720	134,603	12,903	1,010,955
2009			63,875	20,725		82,574		21,590	618,076	89,693	138,303	8,675	1,043,512
2010			65,277	17,256		81,896		19,830	584,554	90,258	159,197	12,670	1,030,938
2011			63,309	14,344		87,349		20,517	490,969	96,126	148,063	10,814	931,490
2012			66,394	14,953		66,897		15,738	472,517	90,616	111,891	323	839,329

* Includes fish taken for personal consumption

Table 3. Total commercial harvest (numbers) by age and year.

	Age															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+	Total
1982	0	45,129	200,221	117,158	22,927	5,035	3,328	2,861	1,871	4,407	5,837	7,639	2,509	2,810	6,898	428,630
1983	0	54,348	120,639	120,999	38,278	7,416	1,954	677	607	1,690	1,314	2,375	2,656	1,856	2,733	357,541
1984	0	478,268	270,140	55,598	30,580	21,688	6,441	1,744	1,020	771	146	279	1,096	1,042	2,058	870,871
1985	0	53,699	45,492	7,545	9,448	19,248	21,569	6,581	3,692	1,514	466	607	493	894	3,373	174,621
1986	0	639	6,020	3,207	180	703	1,425	1,199	546	182	105	220	288	963	2,004	17,681
1987	0	0	3,087	4,265	1,618	252	1,104	1,075	448	233	95	273	302	235	565	13,552
1988	0	0	2,086	3,961	15,491	6,469	2,803	539	541	218	266	108	250	41	537	33,310
1989	0	0	0	0	0	139	1,111	959	1,007	631	475	164	343	444	2,129	7,402
1990	0	650	12,551	48,024	29,596	15,122	3,111	2,357	1,147	519	272	130	428	322	1,407	115,636
1991	0	2,082	22,430	44,723	41,048	21,614	8,546	4,412	4,816	1,163	269	125	80	553	1,937	153,798
1992	0	640	32,277	58,009	46,661	41,581	22,186	11,514	8,746	6,314	1,062	464	169	346	745	230,714
1993	0	1,848	21,073	93,868	87,447	42,112	32,485	13,829	8,396	6,420	3,955	763	184	76	404	312,860
1994	0	1,179	22,873	71,614	101,512	48,269	28,530	14,886	8,902	5,323	2,513	1,250	198	68	326	307,443
1995	0	6,726	35,190	114,519	134,709	98,471	38,918	34,191	37,324	21,827	8,364	3,166	997	363	149	534,914
1996	0	557	50,102	127,825	179,031	161,361	120,693	51,995	29,907	18,864	11,663	9,674	2,264	1,134	1,449	766,518
1997	0	1,843	37,754	342,867	213,454	206,836	102,034	76,149	54,989	30,373	17,813	13,813	4,873	3,125	2,688	1,108,612
1998	0	6,124	54,375	267,791	411,067	184,209	94,726	75,915	63,592	31,809	19,948	12,110	5,149	2,574	3,700	1,233,089
1999	0	7,591	94,342	211,645	264,460	221,773	92,992	66,837	63,357	35,916	20,939	14,180	4,611	2,549	2,621	1,103,812
2000	0	244	51,876	203,457	284,772	194,336	121,949	72,841	51,768	37,496	19,263	11,391	4,041	1,850	2,430	1,057,712
2001	0	165	86,190	189,602	241,867	140,555	89,963	95,580	34,026	31,547	22,172	12,853	5,027	2,582	692	952,820
2002	0	184	39,914	133,965	130,689	107,219	68,875	45,032	56,146	28,715	20,386	12,252	7,430	3,341	3,942	658,091
2003	0	3,932	59,027	156,836	171,626	132,005	96,662	76,612	70,049	59,722	20,916	15,944	6,647	2,366	2,472	874,817
2004	1,221	18,069	83,780	173,546	123,717	102,815	94,480	97,849	73,246	57,207	43,534	22,876	13,844	3,906	3,068	913,160
2005	0	145	43,488	239,748	252,020	102,076	57,072	56,939	75,306	50,440	41,629	25,937	19,435	4,598	4,738	973,572
2006	0	81	90,820	192,639	335,889	150,133	48,304	43,705	46,313	61,550	39,664	23,017	13,656	5,447	3,448	1,054,664
2007	0	0	4,711	305,597	207,826	190,053	78,099	51,494	64,579	51,397	32,964	20,498	9,282	3,006	3,853	1,023,358
2008	0	0	12,506	233,419	311,903	125,702	92,605	60,928	42,177	41,351	35,246	29,726	15,626	5,848	3,920	1,010,955
2009	0	69	19,745	190,560	356,448	191,280	68,995	69,342	41,636	31,813	27,531	18,630	16,438	6,490	4,534	1,043,512
2010	0	7,178	46,448	219,450	247,340	177,935	133,809	58,962	45,183	30,091	21,540	17,394	14,386	5,165	6,055	1,030,938
2011	0	788	49,592	127,860	199,887	198,523	118,074	93,069	45,488	42,628	15,586	12,507	10,349	9,153	7,987	931,490
2012	0	8,532	58,497	87,861	250,673	139,183	99,949	53,740	59,019	22,634	25,562	13,779	7,732	6,480	5,688	839,329

Table 4. Commercial discards (numbers) by age and year.

	Age															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+	Total
1982	0	31,645	3,644	11,456	5,623	1,291	2,397	1,014	369	92	85	0	0	7	0	57,624
1983	0	24,067	1,453	2,878	7,761	2,311	610	610	262	174	0	0	0	0	0	40,127
1984	0	33,575	1,611	5,812	9,734	11,272	2,815	117	586	66	0	52	0	0	0	65,639
1985	0	7,728	30,472	5,939	10,891	3,395	2,742	1,045	261	131	131	0	0	0	0	62,734
1986	0	5,841	20,758	100,067	27,989	13,315	4,295	1,415	346	0	0	0	0	0	0	174,024
1987	0	4,206	14,382	28,597	51,389	16,940	6,520	1,319	1,011	395	111	86	111	0	0	125,066
1988	0	6,142	22,593	36,616	70,959	71,694	23,232	9,116	3,110	1,653	218	195	24	0	0	245,552
1989	0	13,854	50,240	49,029	83,396	82,757	33,479	15,502	6,342	705	1,409	1,409	663	41	0	338,827
1990	0	14,526	68,713	80,935	111,888	115,702	71,600	36,256	5,948	1,539	1,401	1,503	0	0	0	510,011
1991	79	12,632	37,009	64,210	77,335	56,894	36,912	24,857	6,610	4,071	6,542	16	0	0	0	327,167
1992	117	3,698	34,218	36,746	44,412	34,688	14,798	11,179	3,398	2,356	991	0	0	0	0	186,601
1993	0	7,449	50,160	79,011	95,116	63,487	20,941	15,351	9,270	4,606	1,651	536	260	0	0	347,839
1994	0	31,770	47,169	45,081	88,122	84,570	39,229	12,524	6,223	3,674	712	415	30	0	0	359,518
1995	0	72,822	75,520	53,551	94,158	121,592	61,447	19,083	7,569	4,269	2,290	2,346	807	0	0	515,454
1996	0	27,133	114,085	76,336	61,884	58,787	30,835	14,916	6,148	3,989	159	502	50	0	0	394,824
1997	476	7,108	64,352	61,871	30,602	20,951	14,002	6,592	1,963	4,309	2,658	801	1,060	0	0	216,745
1998	0	13,233	53,899	98,510	83,288	29,197	12,970	12,591	7,860	4,372	3,891	2,419	3,311	124	367	326,032
1999	984	58,076	49,894	43,744	55,740	14,477	5,213	3,704	1,980	1,304	648	612	240	3	0	236,619
2000	196	178,457	189,933	157,291	62,699	33,918	26,938	7,831	4,111	3,876	801	863	41	17	25	666,997
2001	0	2,638	58,079	77,958	88,808	29,410	18,877	11,613	9,664	6,371	4,778	1,957	737	10	0	310,900
2002	1,700	20,888	42,641	21,409	28,791	23,720	12,381	6,854	5,645	2,255	1,522	149	173	33	43	168,201
2003	1,512	6,227	28,061	54,464	56,728	19,866	30,850	18,633	16,410	13,572	8,164	3,207	2,894	165	1,222	261,974
2004	2,943	52,811	80,744	76,790	62,580	48,683	52,231	41,378	23,549	9,829	10,381	2,365	446	899	14	465,642
2005	432	11,513	103,930	245,644	169,860	68,808	54,397	43,911	43,609	23,102	16,147	8,477	5,238	2,009	1,466	798,544
2006	0	555	25,769	28,836	36,995	27,669	15,055	16,698	12,693	13,187	7,392	4,430	5,245	0	0	194,524
2007	288	6,384	18,385	89,872	98,205	140,521	78,873	48,659	42,564	30,519	22,267	19,933	11,810	0	0	608,279
2008	0	109	2,928	45,076	71,474	58,005	44,675	21,699	13,857	13,043	12,619	14,253	10,978	0	0	308,715
2009	0	1,661	80,748	166,818	123,878	91,220	30,653	38,426	20,517	16,384	15,706	7,675	18,258	0	0	611,944
2010	0	1,379	16,212	76,208	64,148	46,221	19,637	9,510	6,534	4,079	3,116	1,792	6,007	0	0	254,841
2011	0	3,760	59,534	107,156	127,696	82,263	58,450	57,352	41,289	34,924	16,356	12,334	9,925	9,513	13,869	634,421
2012	0	8,790	48,850	118,242	201,781	142,385	118,204	52,233	43,181	18,375	22,095	17,022	2,871	10,337	14,211	818,579

Table 5. Recreational harvest (numbers) by state and year (includes wave 1 estimated harvest for Virginia).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total
1982	929		83,933	1,757	50,081	21,278	58,294	0	984	0	0	217,256
1983	7,212	4,576	39,316	1,990	42,826	43,731	127,912	135	31,746	0	0	299,444
1984	0	0	3,481	1,230	5,678	57,089	13,625	16,571	16,789	0	0	114,463
1985	11,862	0	66,019	670	15,350	23,107	13,145	0	2,965	404	0	133,522
1986	0	0	29,434	3,291	1,760	27,477	36,999	0	14,077	1,585	0	114,623
1987	0	90	10,807	2,399	522	14,191	9,279	0	4,025	2,442	0	43,755
1988	0	647	21,050	5,226	2,672	20,230	12,141	0	133	24,259	367	86,725
1989	738	0	13,044	4,303	5,777	12,388	1,312	0	0	0	0	37,562
1990	2,912	617	20,515	4,677	6,082	24,799	44,878	2,009	736	56,017	0	163,242
1991	3,265	274	20,799	17,193	4,907	54,502	38,300	2,741	77,873	42,224	391	262,469
1992	6,357	2,213	57,084	14,945	9,154	45,162	41,426	2,400	99,354	21,118	967	300,180
1993	612	1,540	58,511	17,826	19,253	78,560	64,935	4,055	104,682	78,481	264	428,719
1994	3,771	3,023	74,538	5,915	16,929	87,225	34,877	4,140	199,378	127,945	7,426	565,167
1995	2,189	3,902	73,806	29,997	38,261	155,821	254,055	15,361	355,237	149,103	11,450	1,089,182
1996	1,893	6,461	68,300	60,074	62,840	225,428	127,952	22,867	337,415	244,746	17,136	1,175,112
1997	35,259	13,546	199,373	62,162	64,639	236,902	67,800	19,706	334,068	518,483	96,189	1,648,127
1998	38,094	5,929	207,952	44,890	64,215	166,868	88,973	18,758	391,824	383,786	45,773	1,457,062
1999	21,102	4,641	126,755	56,320	55,805	195,261	237,010	8,772	263,191	411,873	65,658	1,446,388
2000	62,186	4,262	181,295	95,496	53,191	270,798	402,302	39,543	506,462	389,126	20,452	2,025,113
2001	59,947	15,291	288,032	80,125	54,165	189,714	560,208	41,195	382,557	355,020	58,873	2,085,127
2002	71,907	12,857	308,749	78,190	51,060	202,075	416,455	29,149	282,429	411,248	109,052	1,973,171
2003	57,765	24,878	407,100	115,471	95,983	313,761	391,842	29,522	525,191	455,812	127,727	2,545,052
2004	48,816	8,386	445,745	83,990	102,844	263,096	424,208	25,429	368,682	548,768	230,783	2,550,747
2005	83,617	24,940	340,743	110,490	141,290	376,894	411,532	20,438	533,929	293,161	104,904	2,441,938
2006	75,347	13,521	314,987	75,811	115,214	367,835	509,606	20,159	669,140	547,482	79,023	2,788,125
2007	53,694	6,348	315,409	101,400	118,549	474,062	289,656	8,465	765,169	353,372	37,376	2,523,500
2008	59,152	5,308	377,959	51,191	108,166	685,589	309,411	26,934	415,403	401,155	25,750	2,466,018
2009	62,153	8,587	344,401	71,427	60,876	356,311	283,024	19,539	501,845	326,867	5,650	2,040,680
2010	17,396	5,948	341,045	70,108	92,806	538,374	320,413	16,244	457,898	102,405	23,778	1,986,415
2011	18,105	32,704	255,507	88,635	63,288	674,844	393,194	18,023	445,171	146,603	94,182	2,230,256
2012	11,624	14,498	377,931	61,537	64,573	424,522	168,629	25,399	262,143	134,758	0	1,545,614

Table 6. Recreational harvest (numbers) by age and year.

st-a-tage	Age															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1982	0	5,721	36,125	81,725	24,916	10,963	16,943	11,960	8,970	5,980	4,983	5,980	997	997	997	217,257
1983	4,617	25,001	50,976	62,840	95,870	27,371	15,035	3,338	1,799	1,799	2,699	2,699	1,799	1,799	1,799	299,443
1984	2,021	22,316	24,474	15,610	16,528	15,288	8,034	2,548	0	849	849	0	849	2,548	2,548	114,463
1985	225	3,305	13,315	22,732	36,208	19,572	18,593	9,786	1,957	1,957	0	0	0	0	5,872	133,522
1986	11,002	5,426	9,354	12,136	12,339	13,473	12,285	18,427	7,020	4,387	2,632	877	877	877	3,510	114,623
1987	1,083	1,370	3,822	2,596	4,838	3,756	3,756	2,817	3,756	1,878	939	1,878	2,817	1,878	6,573	43,756
1988	1,023	8,195	5,116	5,120	6,135	11,214	10,191	12,225	9,169	3,056	3,056	3,056	2,037	3,056	4,075	86,725
1989	0	0	3,130	2,087	4,174	6,260	7,304	4,174	2,087	2,087	1,043	0	1,043	1,043	3,130	37,562
1990	627	7,933	17,317	39,534	22,708	22,980	16,657	15,810	7,680	3,009	1,797	899	1,797	1,797	2,696	163,242
1991	1,368	21,382	38,339	61,798	27,957	13,322	24,432	26,848	23,268	9,293	4,159	937	937	1,405	7,025	262,470
1992	1,881	15,923	61,295	52,925	54,507	20,325	13,805	23,488	23,613	18,849	3,854	1,943	971	2,428	4,371	300,179
1993	2,209	18,044	53,461	93,539	68,083	49,704	18,614	20,458	36,054	35,685	19,855	4,461	2,012	503	6,037	428,719
1994	2,112	43,976	138,180	95,461	91,957	47,419	29,827	23,833	34,809	29,999	13,650	8,815	855	427	3,846	565,167
1995	562	134,922	222,570	183,276	105,211	164,461	64,387	81,839	59,042	34,224	24,276	6,888	4,634	1,144	1,745	1,089,181
1996	531	129,149	257,038	214,669	109,367	116,156	137,033	80,275	58,041	27,210	18,534	19,437	5,627	1,535	512	1,175,113
1997	1,837	2,837	74,549	240,321	185,350	213,594	217,940	290,961	183,150	120,586	58,005	32,037	14,960	7,718	4,280	1,648,125
1998	0	20,368	133,541	229,441	168,884	164,613	134,977	153,529	163,905	96,099	87,690	41,837	31,341	14,855	15,983	1,457,063
1999	0	2,307	39,471	141,735	166,527	282,809	200,750	168,942	155,988	108,584	87,820	42,054	29,505	13,081	6,813	1,446,388
2000	0	503	37,950	255,084	402,268	367,123	423,409	201,142	120,257	97,670	53,095	28,375	17,434	10,132	10,671	2,025,112
2001	1,036	559	60,048	169,642	340,240	403,155	379,607	314,763	150,791	92,207	80,417	44,978	26,295	13,149	8,239	2,085,127
2002	0	1,530	33,823	141,000	266,095	405,275	334,964	249,670	237,566	107,817	86,338	46,611	33,558	12,795	16,128	1,973,171
2003	0	36,600	76,642	198,625	295,548	362,028	463,663	336,910	275,724	218,321	123,058	72,670	46,796	25,286	13,182	2,545,052
2004	427	214	94,601	207,895	211,670	268,011	301,427	435,274	331,997	265,634	210,003	103,959	54,859	39,501	25,272	2,550,745
2005	0	322	40,333	245,135	337,585	282,138	285,659	240,402	308,962	233,801	232,352	100,482	67,791	32,149	34,826	2,441,938
2006	0	8,326	112,441	209,402	372,824	335,684	245,484	289,948	249,576	341,499	248,790	158,204	107,653	41,432	66,863	2,788,125
2007	0	73	25,068	333,424	269,399	403,913	267,964	239,743	269,469	267,806	182,806	133,849	62,176	35,214	32,598	2,523,500
2008	0	246	7,036	74,691	340,359	211,584	473,211	359,388	200,562	243,217	197,085	156,271	103,591	36,841	61,936	2,466,018
2009	0	970	15,868	103,386	228,968	429,381	221,964	309,080	169,576	122,503	132,590	111,295	104,868	38,709	51,521	2,040,680
2010	0	8,973	25,576	141,402	156,928	288,769	487,688	201,524	215,001	155,490	81,649	79,440	58,948	37,431	47,595	1,986,415
2011	0	8,101	33,913	89,551	176,608	330,321	360,990	542,248	186,305	174,692	84,284	63,411	60,207	63,773	55,850	2,230,256
2012	880	5,750	37,455	51,034	138,448	166,043	230,082	267,495	275,475	91,442	91,694	60,174	36,369	35,751	57,521	1,545,614

Table 7. Recreational dead releases (numbers) by state and year (using 0.09 release mortality).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total
1982	62	0	580	230	57,887	1,107	7,888	0	2,734	0	0	70,487
1983	0	0	3,062	490	0	132	10,603	0	19,214	1,080	0	34,580
1984	170	0	8,856	7,662	2,806	3,642	4,764	0	9,369	790	0	38,058
1985	7,304	8	1,112	3,651	2,425	5,179	497	63	13,239	234	0	33,713
1986	394	0	39,807	181	944	11,146	0	0	35,106	678	0	88,256
1987	1,630	39	8,429	5,746	7,059	22,859	5,103	1,529	10,656	685	0	63,734
1988	408	603	18,867	2,101	2,298	8,335	43,768	221	11,903	507	0	89,009
1989	1,443	434	17,376	3,421	11,283	32,914	23,936	433	10,284	6,549	0	108,073
1990	1,129	1,397	30,556	6,076	8,054	23,859	22,895	1,297	37,808	15,754	0	148,823
1991	6,074	590	40,386	2,788	27,133	68,100	14,958	3,450	93,241	18,752	23	275,494
1992	2,806	2,485	70,183	10,837	26,303	71,923	37,216	3,324	67,496	10,431	61	303,066
1993	33,576	1,348	75,021	9,089	24,419	62,470	27,743	8,059	140,116	9,034	137	391,011
1994	32,733	3,915	189,226	12,509	44,097	101,944	51,124	9,359	250,685	17,732	450	713,776
1995	45,518	25,694	295,279	32,069	45,641	108,863	62,540	10,383	216,115	33,385	1,460	876,948
1996	146,403	26,354	294,277	28,290	94,645	129,248	69,855	8,943	229,071	68,392	10,500	1,105,980
1997	127,618	25,137	487,598	54,607	65,044	91,700	66,306	11,707	361,799	110,909	12,227	1,414,651
1998	62,224	21,897	646,592	55,208	92,357	79,616	43,949	16,651	237,751	71,673	15,633	1,343,553
1999	58,483	13,116	411,859	32,411	63,362	110,577	103,741	9,513	214,885	84,668	23,710	1,126,325
2000	84,833	18,865	664,383	48,736	83,373	123,576	79,676	13,665	292,026	91,984	11,676	1,512,793
2001	78,347	14,790	486,981	33,973	99,694	74,185	86,909	14,641	260,105	55,885	4,496	1,210,005
2002	125,298	21,420	514,709	47,736	62,728	52,934	64,359	10,319	263,573	63,606	5,694	1,232,375
2003	76,204	23,415	392,554	40,384	75,873	97,543	83,330	15,211	418,752	87,350	4,405	1,315,020
2004	62,406	20,320	448,117	47,334	74,405	243,832	135,242	14,009	313,167	155,960	20,007	1,534,800
2005	268,668	51,537	358,981	57,048	158,547	127,097	109,700	22,594	347,000	116,619	9,309	1,627,101
2006	360,028	41,455	702,880	75,146	88,803	155,015	170,126	22,289	334,021	148,951	2,184	2,100,897
2007	100,356	23,163	479,832	61,007	88,617	150,995	161,036	22,382	275,844	85,424	1,245	1,449,902
2008	41,850	6,951	328,447	37,474	279,430	121,175	117,851	23,461	120,486	47,894	970	1,125,989
2009	23,716	5,170	205,434	35,882	104,515	96,612	72,046	13,103	128,100	32,309	487	717,373
2010	17,437	4,665	150,429	16,480	60,348	96,180	62,131	5,854	135,778	12,092	1,833	563,227
2011	12,825	8,882	87,587	19,287	55,113	135,547	79,561	9,908	101,476	13,822	9,913	533,923
2012	19,277	5,780	89,056	22,237	23,843	52,744	36,549	9,896	198,587	9,156	145	467,270

Table 8. Recreational dead releases (numbers) by age and year.

	Age														
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1982	2,203	26,433	18,723	12,115	5,507	2,203	2,203	1,101	0	0	0	0	0	0	0
1983	1,153	18,443	11,527	2,305	1,153	0	0	0	0	0	0	0	0	0	0
1984	4,613	14,993	11,533	4,613	1,153	1,153	0	0	0	0	0	0	0	0	0
1985	1,204	10,836	16,856	3,612	1,204	0	0	0	0	0	0	0	0	0	0
1986	2,234	13,406	35,749	21,226	8,937	3,351	1,117	2,234	0	0	0	0	0	0	0
1987	1,138	5,691	19,348	18,210	10,243	4,552	2,276	1,138	1,138	0	0	0	0	0	0
1988	1,156	18,495	17,339	18,495	16,183	9,248	4,624	2,312	1,156	0	0	0	0	0	0
1989	1,114	25,625	30,082	17,826	20,055	7,799	3,342	1,114	1,114	0	0	0	0	0	0
1990	3,382	40,588	39,461	25,931	10,147	11,275	9,020	5,637	2,255	1,127	0	0	0	0	0
1991	0	56,686	71,424	56,686	21,541	11,337	20,407	19,273	11,337	4,535	2,267	0	0	0	0
1992	1,127	36,052	104,777	61,965	45,066	14,646	10,140	13,520	9,013	5,633	1,127	0	0	0	0
1993	2,015	64,083	92,190	92,190	57,338	39,349	14,615	8,994	8,994	6,746	3,373	1,124	0	0	0
1994	5,629	95,695	206,027	120,464	123,841	65,298	37,152	20,265	19,139	12,384	4,503	3,377	0	0	0
1995	4,550	280,942	187,674	141,040	73,932	92,131	30,710	34,122	17,061	6,824	6,824	1,137	0	0	0
1996	523	74,207	397,331	237,531	184,811	117,545	67,642	18,029	5,979	654	1,652	77	0	0	0
1997	41,946	241,354	248,485	378,306	180,913	112,747	73,915	69,136	33,748	21,040	7,060	4,225	1,364	306	106
1998	15,640	168,148	313,615	292,810	260,185	130,762	70,364	45,509	22,978	10,590	7,780	2,385	1,642	785	359
1999	2,830	34,857	280,195	252,317	179,524	210,450	77,416	37,074	22,135	14,195	9,208	3,415	1,244	676	790
2000	36,627	161,331	160,505	424,773	256,963	211,257	157,541	58,495	17,816	12,115	7,178	3,966	2,298	1,098	830
2001	48,231	140,656	156,770	170,708	236,480	156,842	129,616	108,404	31,428	9,872	10,156	5,552	3,203	850	1,236
2002	22,723	225,755	192,562	179,559	136,437	213,849	110,951	72,533	42,377	12,326	10,814	5,600	3,851	2,209	830
2003	950	295,633	335,248	168,906	146,578	85,458	108,307	72,217	40,777	34,257	12,480	6,617	5,954	913	727
2004	71,171	119,239	600,408	306,543	125,022	104,379	67,587	65,250	30,875	16,012	14,024	7,379	3,427	2,658	733
2005	21,321	484,439	253,499	406,041	221,051	75,313	48,982	37,607	34,575	18,354	13,451	6,402	3,203	1,743	1,050
2006	34,400	212,388	953,539	235,964	313,891	173,093	48,895	37,392	27,426	30,541	16,625	9,338	4,058	1,881	1,452
2007	9,182	122,212	218,914	309,915	126,062	161,052	100,212	90,585	95,908	77,293	52,531	37,942	24,048	15,272	8,713
2008	18,323	78,987	187,667	204,472	355,236	95,227	77,349	39,419	20,916	16,653	14,205	10,456	4,286	1,435	1,359
2009	15,986	82,905	96,331	122,987	109,557	161,686	34,648	39,057	17,297	10,042	9,272	7,094	6,198	2,060	2,150
2010	1,653	57,745	125,938	79,677	83,941	68,881	69,651	18,731	18,196	10,842	6,122	7,592	5,411	4,815	4,012
2011	36,803	63,312	103,487	109,801	38,884	76,011	39,600	34,050	9,666	8,356	4,214	3,264	2,735	1,977	1,761
2012	61,548	106,620	100,952	44,062	41,962	27,394	29,141	22,132	16,123	4,874	4,501	2,702	1,343	2,173	1,743

Table 9. Average catch weight (kilograms)-at-age by year.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.13	0.64	1.09	1.54	2.42	3.75	4.83	5.79	6.2	8.68	10.8	11.2	14.05
1983	0.2	0.55	0.94	1.37	2.37	3.29	3.77	5.36	6.01	8.1	9.57	10.39	11.11
1984	0.24	0.6	1.69	1.62	2.67	3.39	5.07	5.65	6.76	7.76	8.41	12.65	12.38
1985	0.06	0.61	1.07	1.66	2.19	3.59	4.91	5.46	6.77	7.45	9	10.69	13.91
1986	0.14	0.57	1.27	2.4	2.44	3.12	3.95	5.05	5.44	6.09	7.75	9.16	12.78
1987	0.2	0.77	1.41	2.11	2.5	2.91	3.61	4.74	5.52	6.49	7.77	9.78	13.15
1988	0.31	0.91	1.1	1.98	3.12	4.02	4.38	4.7	5.24	5.62	8.58	10.4	13.27
1989	0.16	0.83	1.22	2.23	3.06	4.53	5.37	6.23	6.04	8.68	8.94	9.74	13.36
1990	0.08	0.89	1.14	2.05	2.35	3.83	4.91	5.96	5.7	5.97	7.44	9.08	12.6
1991	0.21	0.92	1.29	2.17	2.62	3.17	4.81	5.64	6.46	6.24	9.46	8.3	14.22
1992	0.1	0.69	1.31	1.93	2.81	3.67	4.9	5.79	6.96	8.15	9.77	12.44	13.97
1993	0.07	0.76	1.31	1.99	2.77	3.58	4.8	6.11	7.03	8.01	9.53	10.76	14.55
1994	0.24	1.05	1.69	2.21	2.85	3.5	4.94	6.2	6.8	7.53	9.73	10.69	12.73
1995	0.28	0.7	1.35	2.18	2.77	3.65	5.38	6.16	7.27	8.86	7.57	9.73	16.66
1996	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.2	9.31	10.1	13.7
1997	0.13	0.62	1.18	2.46	2.81	3.64	4.51	5.07	6.73	9.17	9.94	10.24	14.78
1998	0.39	0.77	1.2	1.62	2.25	2.95	4.69	5.66	6.82	7.03	7.76	9.87	11.87
1999	0.62	0.9	1.11	1.44	1.91	2.51	3.36	5.03	6.56	7.85	8.69	9.76	11.98
2000	0.37	0.55	1.1	1.45	1.96	2.79	3.89	5.09	7.11	7.37	9.7	10.7	13.55
2001	0.16	0.38	1.12	1.75	2.21	3.25	4.12	5.02	6.36	7.79	8.65	8.29	10.87
2002	0.12	0.31	1.06	1.51	2.18	3.17	4.19	5.48	6.03	7.56	9.09	9.75	11.52
2003	0.1	0.6	1	1.4	2.2	3.2	4.1	5.2	6.1	7.2	8.5	9.4	11
2004	0.23	0.33	0.84	1.40	2.43	3.11	4.14	5.17	6.07	7.12	8.18	9.03	10.71
2005	0.13	0.50	1.14	1.64	2.22	3.23	4.18	5.64	6.38	7.21	8.51	10.00	12.19
2006	0.18	0.38	0.81	1.35	1.96	2.80	3.84	5.35	6.70	7.41	8.58	9.40	12.05
2007	0.10	0.46	0.94	1.30	2.10	3.07	4.31	5.32	6.89	7.84	9.39	10.12	12.77
2008	0.21	0.45	1.04	1.43	2.14	3.47	5.05	5.51	6.69	8.26	9.19	9.82	12.00
2009	0.26	0.62	1.03	1.41	1.92	3.29	4.49	5.74	6.87	7.73	8.81	9.47	12.24
2010	0.16	0.70	1.11	1.41	1.99	3.34	4.27	5.21	6.27	7.65	8.97	9.15	11.59
2011	0.20	0.52	1.04	1.55	2.00	3.08	4.10	5.13	6.41	7.54	8.20	9.98	13.08
2012	0.27	0.7	1.31	2.27	3.11	3.61	4.34	5.37	6.22	7.74	8.8	9.66	12.51

Table 10. Total removals and associated coefficients of variation and age proportions of total removals of striped bass split into Chesapeake Bay, Coast, and Commercial Discard fleet, 1982-2012.

	Chesapeake Bay		Age Proportions												
Year	Total	CV	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	262,133	0.857	0.00507	0.12678	0.59014	0.23839	0.03160	0.00498	0.00099	0.00089	0.00012	0.00000	0.00029	0.00047	0.00029
1983	277,824	0.224	0.01104	0.28325	0.36483	0.28873	0.03398	0.00918	0.00351	0.00307	0.00086	0.00028	0.00016	0.00032	0.00078
1984	798,853	0.444	0.00557	0.61276	0.33834	0.03751	0.00495	0.00013	0.00068	0.00005	0.00001	0.00000	0.00000	0.00000	0.00000
1985	122,842	0.447	0.01132	0.52144	0.40241	0.04234	0.01142	0.00471	0.00483	0.00153	0.00000	0.00000	0.00000	0.00000	0.00000
1986	56,504	0.516	0.09360	0.28059	0.46742	0.10997	0.01729	0.00595	0.01951	0.00567	0.00000	0.00000	0.00000	0.00000	0.00000
1987	23,170	0.489	0.05059	0.17128	0.40184	0.24355	0.07494	0.00375	0.02876	0.02530	0.00000	0.00000	0.00000	0.00000	0.00000
1988	42,211	0.887	0.02643	0.20139	0.10296	0.10244	0.36728	0.14152	0.05660	0.00138	0.00000	0.00000	0.00000	0.00000	0.00000
1989	16,791	0.285	0.06463	0.56728	0.15406	0.10122	0.07011	0.02801	0.01070	0.00400	0.00000	0.00000	0.00000	0.00000	0.00000
1990	205,740	0.333	0.01873	0.14393	0.18579	0.32698	0.17722	0.10363	0.02839	0.00924	0.00457	0.00152	0.00000	0.00000	0.00000
1991	352,428	0.171	0.00255	0.15667	0.24267	0.25941	0.15361	0.07895	0.05201	0.02952	0.01372	0.00641	0.00448	0.00000	0.00000
1992	383,546	0.156	0.00530	0.09234	0.22350	0.24898	0.18261	0.12646	0.06779	0.03110	0.01392	0.00612	0.00188	0.00000	0.00000
1993	597,071	0.152	0.00278	0.11137	0.16410	0.27782	0.20806	0.11027	0.06903	0.02844	0.01566	0.00797	0.00363	0.00087	0.00000
1994	859,681	0.158	0.00841	0.08882	0.17138	0.19982	0.23514	0.13061	0.08229	0.04048	0.02364	0.01201	0.00506	0.00235	0.00000
1995	1,133,791	0.132	0.00447	0.14701	0.20492	0.22479	0.16855	0.14799	0.04925	0.03082	0.01229	0.00383	0.00414	0.00097	0.00099
1996	1,465,451	0.137	0.00036	0.09842	0.26089	0.18188	0.16817	0.14229	0.08644	0.03241	0.01535	0.00720	0.00462	0.00121	0.00076
1997	1,998,211	0.117	0.02075	0.04500	0.07404	0.32221	0.18116	0.15894	0.08528	0.05664	0.02819	0.01457	0.00648	0.00427	0.00247
1998	1,934,786	0.099	0.00169	0.03597	0.14993	0.25242	0.27003	0.12710	0.06030	0.03604	0.02901	0.01880	0.00978	0.00517	0.00377
1999	1,726,756	0.107	0.00123	0.01763	0.15538	0.22930	0.22668	0.19522	0.07263	0.03593	0.02879	0.01361	0.01137	0.00630	0.00593
2000	2,019,358	0.092	0.01360	0.05297	0.06707	0.24036	0.27401	0.16615	0.09269	0.04241	0.01809	0.01515	0.00751	0.00515	0.00486
2001	1,695,685	0.089	0.02650	0.05998	0.11749	0.19551	0.23594	0.13129	0.08764	0.06882	0.02137	0.01887	0.01455	0.01317	0.00888
2002	1,311,055	0.096	0.01116	0.10412	0.10416	0.19271	0.18460	0.15229	0.10087	0.04483	0.05433	0.01364	0.01389	0.00794	0.01547
2003	2,052,319	0.075	0.00000	0.10428	0.13637	0.17148	0.14837	0.12365	0.09679	0.06315	0.05577	0.05495	0.01998	0.01202	0.01319
2004	1,825,612	0.076	0.03768	0.04394	0.20312	0.20733	0.11058	0.09403	0.08510	0.06536	0.04986	0.03511	0.03521	0.01488	0.01780
2005	1,963,065	0.088	0.00404	0.11522	0.07071	0.24342	0.21513	0.08748	0.05656	0.03891	0.05310	0.03768	0.03703	0.02214	0.01857
2006	2,329,278	0.072	0.01351	0.05082	0.17163	0.17673	0.24904	0.11652	0.04082	0.03479	0.03336	0.04266	0.02650	0.01715	0.02646
2007	2,134,342	0.100	0.00347	0.03161	0.03894	0.34255	0.18042	0.15994	0.05946	0.03628	0.03861	0.03262	0.03410	0.01809	0.02391
2008	1,548,345	0.081	0.00549	0.02349	0.02065	0.20074	0.33928	0.09984	0.08117	0.05211	0.03130	0.03331	0.03126	0.04252	0.03883
2009	1,702,422	0.082	0.00831	0.01123	0.04313	0.18089	0.31257	0.16230	0.06459	0.05332	0.03420	0.02459	0.02821	0.02540	0.05127
2010	1,482,203	0.111	0.00081	0.03521	0.06430	0.25782	0.24658	0.17408	0.09437	0.04192	0.03002	0.01570	0.00713	0.01028	0.02178
2011	1,378,058	0.088	0.02015	0.02148	0.08227	0.15313	0.23472	0.20793	0.11087	0.06843	0.02710	0.02681	0.01204	0.00919	0.02588
2012	1,198,075	0.108	0.05011	0.05624	0.11305	0.10887	0.25845	0.14595	0.09375	0.03454	0.04980	0.01686	0.02784	0.00949	0.03504

Table 10 cont.

Coast			Age Proportions												
Year	Total	CV	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	454,241	0.366	0.00192	0.09698	0.22097	0.32694	0.09921	0.03720	0.04890	0.03454	0.02380	0.02287	0.02365	0.02971	0.03331
1983	413,741	0.699	0.00653	0.04616	0.19767	0.25603	0.30420	0.07791	0.03870	0.00765	0.00524	0.00825	0.00959	0.01205	0.03003
1984	224,539	0.450	0.00973	0.11611	0.15973	0.20421	0.19731	0.16935	0.06206	0.01893	0.00451	0.00722	0.00443	0.00124	0.04517
1985	219,014	0.679	0.00017	0.01728	0.11977	0.13099	0.20756	0.17460	0.18067	0.07387	0.02579	0.01585	0.00213	0.00277	0.04854
1986	164,055	0.324	0.04844	0.02205	0.15063	0.18503	0.12483	0.10479	0.08366	0.13130	0.04612	0.02785	0.01669	0.00669	0.05193
1987	97,873	0.265	0.01071	0.03159	0.17315	0.19850	0.15288	0.08658	0.06610	0.04540	0.05458	0.02157	0.01056	0.02198	0.12638
1988	166,833	0.326	0.00637	0.10903	0.12105	0.13938	0.13371	0.12561	0.09128	0.09001	0.06513	0.01963	0.01991	0.01897	0.05992
1989	136,245	0.276	0.00021	0.11817	0.22478	0.13368	0.16919	0.10076	0.08498	0.04536	0.03088	0.01995	0.01114	0.00120	0.05969
1990	221,962	0.126	0.00071	0.08812	0.14014	0.20822	0.11709	0.12640	0.10339	0.09868	0.04569	0.01956	0.00932	0.00463	0.03806
1991	339,335	0.144	0.00138	0.07349	0.13753	0.21154	0.10729	0.05437	0.10331	0.11826	0.10193	0.03752	0.01508	0.00313	0.03518
1992	450,413	0.106	0.00216	0.03819	0.25005	0.17186	0.16916	0.06228	0.04469	0.08125	0.08000	0.06316	0.01181	0.00534	0.02005
1993	535,519	0.119	0.00479	0.03264	0.12837	0.21235	0.16552	0.12198	0.04575	0.04911	0.08234	0.08233	0.04671	0.01088	0.01721
1994	726,704	0.074	0.00071	0.08875	0.30239	0.15930	0.15848	0.06702	0.03408	0.03328	0.05852	0.05144	0.02245	0.01571	0.00787
1995	1,367,251	0.099	0.00003	0.18718	0.15586	0.13456	0.08978	0.13697	0.05718	0.08427	0.07277	0.04281	0.02543	0.00738	0.00578
1996	1,582,160	0.067	0.00033	0.03773	0.20362	0.19814	0.14332	0.11791	0.12558	0.06498	0.04515	0.02287	0.01586	0.01732	0.00721
1997	2,173,177	0.055	0.00106	0.07183	0.09794	0.14617	0.10018	0.09920	0.10283	0.14866	0.09919	0.06575	0.03218	0.01912	0.01587
1998	2,098,919	0.064	0.00589	0.05958	0.10075	0.14372	0.15136	0.11133	0.08738	0.09777	0.09259	0.04866	0.04597	0.02207	0.03292
1999	1,953,346	0.062	0.00039	0.00743	0.07537	0.10786	0.11237	0.19360	0.12586	0.10795	0.09818	0.06923	0.05035	0.02498	0.02644
2000	2,584,015	0.064	0.00356	0.02137	0.04529	0.15533	0.15168	0.16933	0.19966	0.09557	0.05935	0.04518	0.02493	0.01290	0.01586
2001	2,554,609	0.045	0.00170	0.01553	0.04076	0.07805	0.16409	0.18713	0.17640	0.15741	0.07048	0.03981	0.03448	0.01607	0.01810
2002	2,553,899	0.052	0.00317	0.03562	0.05083	0.07920	0.11422	0.20629	0.14982	0.12079	0.10372	0.05129	0.03890	0.02117	0.02498
2003	2,682,570	0.047	0.00035	0.04553	0.07122	0.06428	0.11528	0.12142	0.17520	0.13276	0.10143	0.07438	0.04304	0.02630	0.02881
2004	3,173,119	0.063	0.00127	0.01806	0.12858	0.09754	0.08148	0.09566	0.09711	0.15098	0.10876	0.08659	0.06406	0.03374	0.03617
2005	3,079,601	0.055	0.00434	0.08402	0.06446	0.13414	0.12610	0.09345	0.09115	0.08397	0.10216	0.07424	0.06973	0.02901	0.04321
2006	3,614,394	0.051	0.00081	0.02834	0.20945	0.06263	0.12243	0.10721	0.06851	0.08024	0.06795	0.09247	0.06733	0.04167	0.05098
2007	2,862,392	0.052	0.00062	0.01915	0.05785	0.07610	0.07623	0.14451	0.11158	0.10634	0.12142	0.11419	0.06831	0.05369	0.05001
2008	3,054,618	0.059	0.00321	0.01403	0.05737	0.06605	0.15785	0.09098	0.16941	0.12409	0.07045	0.08173	0.06487	0.04276	0.05720
2009	2,099,071	0.055	0.00088	0.03088	0.02788	0.05193	0.07758	0.24108	0.10273	0.15564	0.08113	0.05836	0.05782	0.04468	0.06941
2010	2,098,391	0.058	0.00022	0.01035	0.04893	0.02783	0.05848	0.13228	0.26271	0.10345	0.11146	0.08251	0.04706	0.04250	0.07222
2011	2,317,609	0.054	0.00390	0.01838	0.03177	0.05013	0.03966	0.13735	0.15787	0.24813	0.08807	0.08143	0.03775	0.02870	0.07686
2012	1,654,138	0.074	0.00144	0.03236	0.03716	0.03175	0.07341	0.09537	0.14923	0.18257	0.17589	0.05970	0.05345	0.03947	0.06821

Table 10 cont.

	Commercial Discards		Age Proportions												
Year	Total	CV	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	57,624	0.350	0.00000	0.54917	0.06325	0.19881	0.09759	0.02240	0.04160	0.01760	0.00640	0.00160	0.00148	0.00000	0.00012
1983	40,127	0.350	0.00000	0.59977	0.03620	0.07172	0.19342	0.05759	0.01521	0.01521	0.00652	0.00435	0.00000	0.00000	0.00000
1984	65,639	0.350	0.00000	0.51151	0.02455	0.08854	0.14829	0.17173	0.04288	0.00179	0.00893	0.00100	0.00000	0.00079	0.00000
1985	62,734	0.350	0.00000	0.12319	0.48574	0.09467	0.17361	0.05411	0.04371	0.01665	0.00416	0.00208	0.00208	0.00000	0.00000
1986	174,024	0.350	0.00000	0.03356	0.11928	0.57502	0.16084	0.07651	0.02468	0.00813	0.00199	0.00000	0.00000	0.00000	0.00000
1987	125,066	0.350	0.00000	0.03363	0.11499	0.22866	0.41089	0.13545	0.05213	0.01055	0.00808	0.00315	0.00089	0.00069	0.00089
1988	245,552	0.350	0.00000	0.02501	0.09201	0.14912	0.28898	0.29197	0.09461	0.03713	0.01267	0.00673	0.00089	0.00079	0.00010
1989	338,827	0.350	0.00000	0.04089	0.14828	0.14470	0.24613	0.24425	0.09881	0.04575	0.01872	0.00208	0.00416	0.00416	0.00208
1990	510,011	0.350	0.00000	0.02848	0.13473	0.15869	0.21938	0.22686	0.14039	0.07109	0.01166	0.00302	0.00275	0.00295	0.00000
1991	327,167	0.350	0.00024	0.03861	0.11312	0.19626	0.23638	0.17390	0.11282	0.07598	0.02020	0.01244	0.02000	0.00005	0.00000
1992	186,601	0.350	0.00063	0.01982	0.18337	0.19692	0.23801	0.18589	0.07930	0.05991	0.01821	0.01263	0.00531	0.00000	0.00000
1993	347,839	0.350	0.00000	0.02142	0.14421	0.22715	0.27345	0.18252	0.06020	0.04413	0.02665	0.01324	0.00475	0.00154	0.00075
1994	359,518	0.350	0.00000	0.08837	0.13120	0.12539	0.24511	0.23523	0.10911	0.03484	0.01731	0.01022	0.00198	0.00115	0.00008
1995	515,454	0.350	0.00000	0.14128	0.14651	0.10389	0.18267	0.23589	0.11921	0.03702	0.01468	0.00828	0.00444	0.00455	0.00156
1996	394,824	0.350	0.00000	0.06872	0.28895	0.19334	0.15674	0.14889	0.07810	0.03778	0.01557	0.01010	0.00040	0.00127	0.00013
1997	216,745	0.350	0.00220	0.03279	0.29690	0.28546	0.14119	0.09666	0.06460	0.03041	0.00906	0.01988	0.01226	0.00370	0.00489
1998	326,032	0.350	0.00000	0.04059	0.16532	0.30215	0.25546	0.08955	0.03978	0.03862	0.02411	0.01341	0.01193	0.00742	0.01166
1999	236,619	0.350	0.00416	0.24544	0.21086	0.18487	0.23557	0.06118	0.02203	0.01565	0.00837	0.00551	0.00274	0.00259	0.00103
2000	666,997	0.350	0.00029	0.26755	0.28476	0.23582	0.09400	0.05085	0.04039	0.01174	0.00616	0.00581	0.00120	0.00129	0.00012
2001	310,900	0.350	0.00000	0.00849	0.18681	0.25075	0.28565	0.09460	0.06072	0.03735	0.03108	0.02049	0.01537	0.00629	0.00240
2002	168,201	0.350	0.01011	0.12418	0.25351	0.12728	0.17117	0.14102	0.07361	0.04075	0.03356	0.01340	0.00905	0.00089	0.00148
2003	261,974	0.350	0.00577	0.02377	0.10711	0.20790	0.21654	0.07583	0.11776	0.07112	0.06264	0.05181	0.03116	0.01224	0.01634
2004	465,642	0.350	0.00632	0.11341	0.17340	0.16491	0.13439	0.10455	0.11217	0.08886	0.05057	0.02111	0.02229	0.00508	0.00292
2005	798,544	0.350	0.00054	0.01442	0.13015	0.30761	0.21271	0.08617	0.06812	0.05499	0.05461	0.02893	0.02022	0.01062	0.01091
2006	194,524	0.350	0.00000	0.00285	0.13247	0.14824	0.19018	0.14224	0.07739	0.08584	0.06525	0.06779	0.03800	0.02277	0.02696
2007	608,279	0.350	0.00047	0.01050	0.03022	0.14775	0.16145	0.23101	0.12967	0.08000	0.06997	0.05017	0.03661	0.03277	0.01941
2008	308,715	0.350	0.00000	0.00035	0.00948	0.14601	0.23152	0.18789	0.14471	0.07029	0.04489	0.04225	0.04088	0.04617	0.03556
2009	611,944	0.350	0.00000	0.00271	0.13195	0.27260	0.20243	0.14907	0.05009	0.06279	0.03353	0.02677	0.02567	0.01254	0.02984
2010	254,841	0.350	0.00000	0.00541	0.06361	0.29904	0.25172	0.18137	0.07706	0.03732	0.02564	0.01601	0.01223	0.00703	0.02357
2011	634,421	0.350	0.00000	0.00593	0.09384	0.16890	0.20128	0.12967	0.09213	0.09040	0.06508	0.05505	0.02578	0.01944	0.05250
2012	818,579	0.350	0.00000	0.01074	0.05968	0.14445	0.24650	0.17394	0.14440	0.06381	0.05275	0.02245	0.02699	0.02079	0.03350

Table 11. Likelihood components with respective contributions from base model run.

Likelihood Components

Concentrated Log-likelihood	Weight	RSS
Fleet 1 Total Catch:	2	19.72
Fleet 2 Total Catch:	2	0.54
Fleet 3 Total Catch:	2	0.09
Aggregate Abundance Indices		
NYYOY	1	37.37
NJYOY	1	25.39
MD YOY	1	39.06
VA YOY	1	27.89
NY Age 1	1	24.89
MD Age 1	1	31.72
MRFSS	1	23.94
CTTRL	1	26.20
NEFSC	1	17.04
Age Comp Abundance Indices		
NYOHS	1	25.57
NJ Trawl	1	22.32
MDSSN	1	23.57
DESSN	1	17.20
VAPNET	1	21.69
Total RSS		384.19
No. of Obs		481
Conc. Likel.		-54.05
Age Composition Data Likelihood		
Fleet 1 Age Comp:	1	1769.45
Fleet 2 Age Comp:	1	3129.18
Fleet 3 Age Comp:	1	1523.00
NYOHS	1	540.41
NJ Trawl	1	226.29
MDSSN	1	1096.18
DESSN	1	1101.92
VAPNET	1	449.36
log_R constraint	1	0.26
Recr Devs	1	12.87
Total Likelihood		9746.11
AIC		19888.20

Table 12. Parameter estimates and associated standard deviations of base model configuration.

	Bay			Coast			Commercial Discards			Total					
Year	Full F	SD	CV	Full F	SD	CV	Full F	SD	CV	Full F	SD	CV	Recruitment	SD	CV
1982	0.831	0.128	0.15	0.164	0.003	0.02	0.011	0.001	0.11	0.888	0.126	0.14	18,727,000	2,246,190	0.120
1983	0.071	0.048	0.68	0.123	0.004	0.03	0.007	0.006	0.82	0.159	0.052	0.33	45,215,100	4,268,940	0.094
1984	0.145	0.003	0.02	0.063	0.004	0.06	0.009	0.015	1.74	0.170	0.050	0.30	39,555,500	3,885,090	0.098
1985	0.009	0.015	1.67	0.104	0.003	0.03	0.017	0.002	0.12	0.108	0.052	0.48	39,172,100	3,756,450	0.096
1986	0.004	0.052	14.33	0.061	0.007	0.11	0.032	0.005	0.16	0.067	0.021	0.31	32,081,700	3,277,090	0.102
1987	0.001	0.002	1.40	0.028	0.005	0.19	0.017	0.019	1.13	0.032	0.008	0.26	42,415,300	3,937,520	0.093
1988	0.002	0.050	20.65	0.039	0.004	0.09	0.030	0.004	0.12	0.047	0.009	0.19	55,745,800	4,746,850	0.085
1989	0.001	0.021	25.71	0.026	0.006	0.22	0.039	0.006	0.15	0.048	0.010	0.22	63,712,900	5,222,560	0.082
1990	0.015	0.003	0.17	0.017	0.006	0.34	0.057	0.020	0.35	0.086	0.015	0.18	83,514,400	6,320,380	0.076
1991	0.022	0.003	0.12	0.023	0.006	0.29	0.032	0.006	0.19	0.073	0.010	0.13	69,257,200	5,679,860	0.082
1992	0.021	0.051	2.46	0.026	0.008	0.30	0.016	0.007	0.44	0.057	0.006	0.11	69,427,100	5,825,090	0.084
1993	0.029	0.005	0.18	0.027	0.006	0.23	0.025	0.026	1.02	0.076	0.008	0.11	91,525,900	7,037,110	0.077
1994	0.039	0.001	0.03	0.034	0.006	0.18	0.023	0.002	0.07	0.089	0.009	0.10	180,532,000	10,755,400	0.060
1995	0.047	0.021	0.45	0.057	0.003	0.05	0.031	0.007	0.24	0.123	0.012	0.09	115,494,000	8,239,010	0.071
1996	0.056	0.009	0.17	0.056	0.007	0.12	0.010	0.022	2.22	0.114	0.009	0.08	124,097,000	8,635,660	0.070
1997	0.065	0.000	0.01	0.152	0.016	0.11	0.005	0.005	0.97	0.186	0.019	0.10	150,834,000	9,577,810	0.063
1998	0.059	0.009	0.15	0.137	0.001	0.01	0.008	0.005	0.69	0.169	0.017	0.10	99,090,300	7,372,100	0.074
1999	0.051	0.005	0.09	0.119	0.005	0.04	0.005	0.026	4.88	0.145	0.015	0.10	99,259,400	7,245,520	0.073
2000	0.059	0.001	0.02	0.150	0.015	0.10	0.016	0.003	0.17	0.184	0.018	0.10	78,733,800	6,357,190	0.081
2001	0.051	0.012	0.24	0.146	0.002	0.01	0.008	0.007	0.85	0.173	0.017	0.10	113,744,000	7,987,150	0.070
2002	0.042	0.008	0.19	0.145	0.005	0.03	0.004	0.019	4.16	0.166	0.016	0.10	133,633,000	8,990,880	0.067
2003	0.068	0.000	0.00	0.154	0.013	0.08	0.009	0.006	0.66	0.193	0.018	0.09	75,862,200	6,494,110	0.086
2004	0.061	0.007	0.12	0.188	0.001	0.01	0.016	0.007	0.48	0.228	0.022	0.10	157,460,000	10,622,100	0.067
2005	0.066	0.010	0.15	0.190	0.005	0.03	0.027	0.020	0.75	0.240	0.024	0.10	85,542,800	7,358,240	0.086
2006	0.080	0.004	0.04	0.233	0.016	0.07	0.007	0.003	0.40	0.275	0.029	0.10	81,113,200	7,342,620	0.091
2007	0.074	0.002	0.03	0.193	0.004	0.02	0.021	0.007	0.35	0.243	0.027	0.11	58,453,200	6,212,400	0.106
2008	0.057	0.015	0.27	0.214	0.004	0.02	0.011	0.024	2.13	0.249	0.029	0.12	80,225,900	8,274,700	0.103
2009	0.069	0.003	0.05	0.154	0.015	0.10	0.024	0.007	0.30	0.205	0.023	0.11	56,047,700	7,134,000	0.127
2010	0.066	0.003	0.05	0.161	0.002	0.01	0.011	0.007	0.64	0.200	0.024	0.12	76,222,600	10,190,400	0.134
2011	0.065	0.009	0.13	0.188	0.004	0.02	0.030	0.020	0.65	0.241	0.030	0.13	106,913,000	13,238,500	0.124
2012	0.059	0.003	0.05	0.141	0.015	0.10	0.041	0.010	0.25	0.200	0.027	0.13	140,382,000	23,899,800	0.170

Table 12 cont.

Catch Selectivtiy Parameters

Bay				Coast				Commercial Discards			
	Estimate	SD	CV		Estimate	SD	CV		Estimate	SD	CV
1982-1984				1982-1984				1982-1984			
α	-5.649	0.457	0.08	α	-2.4840	0.3488	0.14	α	0.0164	0.0078	0.48
β	2.2655	0.0659	0.03	β	3.3610	0.2593	0.08	β	1.2446	0.1901	0.15
ϒ	0.9196	0.0221	0.02	ϒ	0.9936	0.0230	0.02				
1985-1989				1985-1989				1985-1989			
α	-3.8292	0.4960	0.13	α	5.26E+00	6.53E-01	0.12	α	-2.1327	0.2379	0.11
β	2.0072	0.1294	0.06	β	4.22E-01	6.48E-02	0.15	β	4.0912	0.3809	0.09
ϒ	0.9533	0.0232	0.02					ϒ	0.8831	0.0649	0.07
1990-1995				1990-1995				1990-1995			
α	-2.2902	0.2378	0.10	α	3.12E+00	1.85E-01	0.06	α	-1.9033	0.1544	0.08
β	3.4543	0.2537	0.07	β	9.05E-01	1.13E-01	0.13	β	4.6668	0.3601	0.08
ϒ	0.8928	0.0386	0.04					ϒ	0.8180	0.0614	0.08
1996-2012				1996-2012				1996-2002			
α	-1.9169	0.1279	0.07	α	5.27E+00	2.70E-01	0.05	α	-2.7415	0.4946	0.18
β	3.7534	0.1554	0.04	β	4.36E-01	3.25E-02	0.07	β	2.8138	0.2741	0.10
ϒ	0.9447	0.0179	0.02					ϒ	0.9564	0.0277	0.03
								2003-2012			
								α	-2.4583	0.3314	0.13
								β	3.6391	0.2015	0.06
								ϒ	0.9800	0.0168	0.02

Survey Selectivity Parameters			
NYOHS	Estimate	SD	CV
α	-5.69	0.09	0.02
β	2.29	0.04	0.02
ϒ	0.96	0.01	0.01
NJ Trawl			
α	3.12	0.67	0.22
β	0.52	0.14	0.28
DE SSN			
α	3.25	0.17	0.05
β	0.83	0.11	0.14
MDSSN			
s_2	0.14	0.02	0.15
VAPNET			
α	-3.16	0.41	0.13
β	3.15	0.13	0.04
ϒ	0.99	0.01	0.01

Catchability Coefficients			
Survey	Estimate	SD	CV
NY YOY	1.42E-07	1.64E-08	0.12
NJ YOY	1.27E-08	9.87E-10	0.08
MD YOY	4.52E-08	3.79E-09	0.08
VA YOY	1.10E-07	8.90E-09	0.08
NY Age 1	4.52E-08	4.19E-09	0.09
MD Age 1	9.93E-09	9.81E-10	0.10
MRFSS	2.58E-08	1.61E-09	0.06
CTTRL	3.60E-08	2.73E-09	0.08
NEFSC	1.03E-08	1.08E-09	0.11
NYOHS	1.61E-07	1.43E-08	0.09
NJTRL	1.00E-07	1.27E-08	0.13
MDSSN	1.28E-07	1.65E-08	0.12
DESSN	8.06E-08	9.72E-09	0.12
VAPNET	5.51E-07	6.42E-08	0.12

Table 13. Average total fishing mortality for various age ranges and weighting schemes.

Year	Maximum F-at-Age	Unweighted Avg. 3-8	Unweighted Avg. 8-11	N-weighted Avg. 3-8	N-weighted Avg. 7-11
1982	0.888	0.508	0.216	0.763	0.248
1983	0.159	0.142	0.128	0.135	0.132
1984	0.170	0.125	0.077	0.153	0.086
1985	0.108	0.061	0.099	0.031	0.089
1986	0.067	0.049	0.067	0.029	0.065
1987	0.032	0.024	0.032	0.016	0.031
1988	0.047	0.038	0.046	0.030	0.047
1989	0.048	0.037	0.038	0.029	0.042
1990	0.086	0.061	0.042	0.047	0.058
1991	0.073	0.054	0.041	0.043	0.050
1992	0.057	0.045	0.038	0.035	0.042
1993	0.076	0.058	0.046	0.050	0.052
1994	0.089	0.069	0.055	0.061	0.063
1995	0.123	0.098	0.083	0.081	0.094
1996	0.114	0.095	0.099	0.066	0.105
1997	0.186	0.118	0.180	0.079	0.172
1998	0.169	0.109	0.164	0.077	0.158
1999	0.145	0.093	0.141	0.064	0.134
2000	0.184	0.120	0.179	0.095	0.168
2001	0.173	0.107	0.166	0.086	0.156
2002	0.166	0.096	0.157	0.077	0.147
2003	0.193	0.124	0.188	0.092	0.180
2004	0.228	0.138	0.218	0.093	0.208
2005	0.240	0.151	0.232	0.114	0.223
2006	0.275	0.165	0.263	0.104	0.252
2007	0.243	0.154	0.236	0.113	0.225
2008	0.249	0.143	0.235	0.108	0.217
2009	0.205	0.137	0.201	0.115	0.195
2010	0.200	0.127	0.194	0.096	0.183
2011	0.241	0.153	0.233	0.123	0.223
2012	0.200	0.137	0.197	0.099	0.192

Table 14. Total fishing mortality-at-age and fishing mortality-at-age by fleet.

Total Fishing Mortality

Age

Year	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.003	0.250	0.888	0.687	0.515	0.391	0.309	0.257	0.223	0.200	0.185	0.174	0.170
1983	0.001	0.026	0.113	0.158	0.159	0.148	0.140	0.134	0.129	0.125	0.123	0.120	0.118
1984	0.001	0.046	0.170	0.156	0.131	0.110	0.095	0.085	0.079	0.074	0.071	0.069	0.067
1985	0.001	0.008	0.020	0.039	0.059	0.072	0.083	0.092	0.098	0.102	0.105	0.107	0.108
1986	0.000	0.004	0.014	0.036	0.055	0.061	0.063	0.065	0.067	0.067	0.067	0.067	0.067
1987	0.000	0.002	0.007	0.018	0.028	0.030	0.031	0.031	0.032	0.032	0.032	0.031	0.031
1988	0.000	0.003	0.010	0.029	0.045	0.047	0.047	0.047	0.047	0.046	0.045	0.045	0.044
1989	0.000	0.002	0.009	0.031	0.048	0.047	0.044	0.041	0.039	0.037	0.035	0.034	0.032
1990	0.000	0.004	0.019	0.053	0.086	0.085	0.069	0.055	0.045	0.037	0.032	0.028	0.025
1991	0.000	0.004	0.021	0.052	0.073	0.071	0.060	0.050	0.043	0.038	0.034	0.031	0.029
1992	0.000	0.004	0.019	0.044	0.057	0.056	0.049	0.044	0.039	0.036	0.033	0.032	0.030
1993	0.000	0.005	0.024	0.058	0.076	0.073	0.063	0.055	0.048	0.043	0.039	0.036	0.034
1994	0.001	0.006	0.031	0.072	0.089	0.085	0.074	0.065	0.057	0.052	0.048	0.044	0.042
1995	0.001	0.008	0.042	0.097	0.123	0.120	0.107	0.095	0.086	0.079	0.073	0.069	0.066
1996	0.001	0.008	0.040	0.087	0.112	0.114	0.111	0.106	0.101	0.097	0.093	0.089	0.086
1997	0.001	0.006	0.031	0.082	0.121	0.144	0.160	0.172	0.179	0.183	0.185	0.186	0.185
1998	0.001	0.006	0.030	0.077	0.112	0.132	0.147	0.157	0.164	0.167	0.169	0.169	0.168
1999	0.001	0.005	0.025	0.065	0.096	0.113	0.125	0.134	0.140	0.144	0.145	0.145	0.144
2000	0.001	0.007	0.037	0.087	0.123	0.144	0.160	0.171	0.178	0.182	0.184	0.184	0.183
2001	0.001	0.006	0.029	0.073	0.108	0.129	0.145	0.157	0.165	0.170	0.172	0.173	0.173
2002	0.001	0.005	0.024	0.062	0.095	0.117	0.134	0.147	0.156	0.161	0.164	0.166	0.166
2003	0.001	0.006	0.030	0.086	0.129	0.152	0.168	0.180	0.187	0.192	0.193	0.193	0.192
2004	0.001	0.006	0.032	0.091	0.139	0.168	0.190	0.206	0.217	0.223	0.226	0.228	0.227
2005	0.001	0.007	0.035	0.104	0.156	0.184	0.205	0.221	0.231	0.237	0.239	0.240	0.239
2006	0.001	0.008	0.038	0.108	0.165	0.201	0.228	0.248	0.261	0.269	0.274	0.275	0.275
2007	0.001	0.007	0.037	0.107	0.160	0.189	0.210	0.225	0.235	0.240	0.243	0.243	0.242
2008	0.001	0.007	0.032	0.090	0.141	0.174	0.200	0.219	0.233	0.241	0.246	0.248	0.249
2009	0.001	0.006	0.033	0.099	0.145	0.168	0.183	0.194	0.201	0.204	0.205	0.205	0.203
2010	0.001	0.006	0.030	0.087	0.131	0.155	0.173	0.185	0.193	0.198	0.200	0.200	0.199
2011	0.001	0.007	0.036	0.106	0.158	0.187	0.207	0.222	0.232	0.238	0.240	0.241	0.240
2012	0.001	0.006	0.033	0.101	0.147	0.168	0.182	0.191	0.197	0.200	0.200	0.199	0.197

Chesapeake Bay

Age

Year	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.0016	0.2426	0.8307	0.5356	0.3400	0.2158	0.1370	0.0870	0.0552	0.0350	0.0222	0.0141	0.0122
1983	0.0001	0.0206	0.0706	0.0455	0.0289	0.0183	0.0116	0.0074	0.0047	0.0030	0.0019	0.0012	0.0010
1984	0.0003	0.0423	0.1448	0.0933	0.0593	0.0376	0.0239	0.0152	0.0096	0.0061	0.0039	0.0025	0.0021
1985	0.0003	0.0053	0.0088	0.0075	0.0063	0.0053	0.0044	0.0037	0.0031	0.0026	0.0022	0.0018	0.0015
1986	0.0001	0.0022	0.0036	0.0031	0.0026	0.0022	0.0018	0.0015	0.0013	0.0011	0.0009	0.0007	0.0006
1987	0.0000	0.0009	0.0014	0.0012	0.0010	0.0009	0.0007	0.0006	0.0005	0.0004	0.0004	0.0003	0.0003
1988	0.0001	0.0015	0.0024	0.0021	0.0017	0.0014	0.0012	0.0010	0.0008	0.0007	0.0006	0.0005	0.0004
1989	0.0000	0.0005	0.0008	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002	0.0002	0.0002	0.0001
1990	0.0002	0.0011	0.0066	0.0153	0.0150	0.0120	0.0094	0.0074	0.0058	0.0045	0.0035	0.0028	0.0022
1991	0.0002	0.0016	0.0096	0.0223	0.0218	0.0175	0.0138	0.0108	0.0084	0.0066	0.0052	0.0040	0.0032
1992	0.0002	0.0015	0.0089	0.0208	0.0203	0.0163	0.0128	0.0100	0.0078	0.0061	0.0048	0.0038	0.0029
1993	0.0003	0.0021	0.0124	0.0290	0.0284	0.0228	0.0179	0.0140	0.0109	0.0086	0.0067	0.0052	0.0041
1994	0.0004	0.0028	0.0167	0.0390	0.0382	0.0306	0.0240	0.0188	0.0147	0.0115	0.0090	0.0070	0.0055
1995	0.0005	0.0034	0.0201	0.0467	0.0457	0.0367	0.0288	0.0225	0.0176	0.0138	0.0108	0.0084	0.0066
1996	0.0005	0.0028	0.0144	0.0417	0.0558	0.0540	0.0492	0.0443	0.0398	0.0358	0.0322	0.0290	0.0261
1997	0.0006	0.0033	0.0168	0.0487	0.0652	0.0631	0.0574	0.0517	0.0465	0.0419	0.0377	0.0339	0.0305
1998	0.0005	0.0030	0.0153	0.0444	0.0594	0.0575	0.0523	0.0471	0.0424	0.0381	0.0343	0.0309	0.0277
1999	0.0004	0.0026	0.0131	0.0380	0.0508	0.0492	0.0448	0.0403	0.0363	0.0326	0.0293	0.0264	0.0237
2000	0.0005	0.0030	0.0151	0.0438	0.0585	0.0567	0.0516	0.0465	0.0418	0.0376	0.0338	0.0304	0.0274
2001	0.0004	0.0026	0.0133	0.0384	0.0514	0.0498	0.0453	0.0408	0.0367	0.0330	0.0297	0.0267	0.0240
2002	0.0004	0.0021	0.0107	0.0312	0.0417	0.0404	0.0368	0.0331	0.0298	0.0268	0.0241	0.0217	0.0195
2003	0.0006	0.0034	0.0176	0.0511	0.0684	0.0662	0.0602	0.0543	0.0488	0.0439	0.0395	0.0355	0.0319
2004	0.0005	0.0031	0.0156	0.0454	0.0606	0.0588	0.0534	0.0482	0.0433	0.0390	0.0350	0.0315	0.0283
2005	0.0006	0.0033	0.0169	0.0490	0.0655	0.0635	0.0577	0.0520	0.0468	0.0421	0.0378	0.0340	0.0306
2006	0.0007	0.0040	0.0207	0.0600	0.0802	0.0777	0.0707	0.0637	0.0573	0.0515	0.0463	0.0417	0.0375
2007	0.0006	0.0037	0.0191	0.0554	0.0741	0.0718	0.0653	0.0588	0.0529	0.0476	0.0428	0.0385	0.0346
2008	0.0005	0.0029	0.0147	0.0428	0.0572	0.0554	0.0504	0.0454	0.0409	0.0368	0.0331	0.0297	0.0267
2009	0.0006	0.0035	0.0179	0.0519	0.0694	0.0672	0.0612	0.0551	0.0496	0.0446	0.0401	0.0361	0.0324
2010	0.0006	0.0033	0.0170	0.0493	0.0660	0.0639	0.0581	0.0524	0.0471	0.0424	0.0381	0.0343	0.0308
2011	0.0006	0.0033	0.0168	0.0489	0.0654	0.0633	0.0576	0.0519	0.0467	0.0420	0.0378	0.0340	0.0305
2012	0.0005	0.0030	0.0151	0.0438	0.0586	0.0567	0.0516	0.0465	0.0418	0.0376	0.0338	0.0304	0.0274

Table 14 cont.

Coast

Age

Year	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.0005	0.0058	0.0500	0.1411	0.1644	0.1644	0.1620	0.1594	0.1569	0.1545	0.1520	0.1496	0.1473
1983	0.0004	0.0043	0.0374	0.1056	0.1231	0.1231	0.1213	0.1194	0.1175	0.1156	0.1138	0.1120	0.1103
1984	0.0002	0.0022	0.0192	0.0542	0.0632	0.0632	0.0623	0.0613	0.0603	0.0594	0.0585	0.0575	0.0566
1985	0.0003	0.0020	0.0080	0.0196	0.0353	0.0518	0.0667	0.0787	0.0877	0.0942	0.0987	0.1017	0.1038
1986	0.0002	0.0012	0.0047	0.0116	0.0209	0.0307	0.0395	0.0466	0.0519	0.0557	0.0584	0.0602	0.0614
1987	0.0001	0.0006	0.0022	0.0053	0.0096	0.0141	0.0182	0.0214	0.0239	0.0257	0.0269	0.0277	0.0283
1988	0.0001	0.0008	0.0030	0.0074	0.0133	0.0195	0.0252	0.0297	0.0331	0.0355	0.0372	0.0384	0.0391
1989	0.0001	0.0005	0.0020	0.0050	0.0089	0.0131	0.0168	0.0199	0.0221	0.0238	0.0249	0.0257	0.0262
1990	0.0000	0.0011	0.0056	0.0110	0.0144	0.0160	0.0167	0.0170	0.0172	0.0172	0.0172	0.0172	0.0173
1991	0.0000	0.0014	0.0074	0.0144	0.0188	0.0210	0.0219	0.0223	0.0225	0.0226	0.0226	0.0226	0.0226
1992	0.0000	0.0016	0.0084	0.0163	0.0214	0.0239	0.0249	0.0254	0.0256	0.0257	0.0257	0.0257	0.0257
1993	0.0000	0.0017	0.0090	0.0174	0.0228	0.0255	0.0266	0.0271	0.0273	0.0274	0.0274	0.0274	0.0274
1994	0.0000	0.0022	0.0112	0.0217	0.0285	0.0317	0.0332	0.0338	0.0340	0.0341	0.0342	0.0342	0.0342
1995	0.0001	0.0036	0.0186	0.0361	0.0473	0.0527	0.0551	0.0561	0.0565	0.0567	0.0567	0.0568	0.0568
1996	0.0001	0.0035	0.0183	0.0356	0.0467	0.0520	0.0544	0.0554	0.0558	0.0559	0.0560	0.0560	0.0560
1997	0.0003	0.0025	0.0107	0.0277	0.0512	0.0763	0.0986	0.1164	0.1296	0.1390	0.1454	0.1496	0.1525
1998	0.0002	0.0022	0.0096	0.0250	0.0462	0.0687	0.0889	0.1049	0.1168	0.1252	0.1310	0.1348	0.1374
1999	0.0002	0.0019	0.0083	0.0216	0.0399	0.0594	0.0768	0.0907	0.1010	0.1082	0.1132	0.1165	0.1187
2000	0.0003	0.0024	0.0105	0.0272	0.0504	0.0750	0.0970	0.1145	0.1275	0.1367	0.1429	0.1472	0.1499
2001	0.0002	0.0024	0.0103	0.0265	0.0491	0.0731	0.0945	0.1116	0.1242	0.1331	0.1393	0.1434	0.1461
2002	0.0002	0.0023	0.0102	0.0263	0.0487	0.0725	0.0938	0.1107	0.1233	0.1322	0.1383	0.1423	0.1450
2003	0.0003	0.0025	0.0108	0.0280	0.0518	0.0771	0.0997	0.1177	0.1311	0.1405	0.1470	0.1513	0.1542
2004	0.0003	0.0030	0.0132	0.0342	0.0632	0.0941	0.1217	0.1437	0.1600	0.1715	0.1794	0.1847	0.1882
2005	0.0003	0.0031	0.0133	0.0345	0.0638	0.0949	0.1228	0.1450	0.1614	0.1730	0.1810	0.1863	0.1899
2006	0.0004	0.0038	0.0164	0.0423	0.0783	0.1166	0.1507	0.1780	0.1982	0.2124	0.2222	0.2288	0.2331
2007	0.0003	0.0031	0.0135	0.0350	0.0648	0.0964	0.1247	0.1473	0.1640	0.1758	0.1838	0.1893	0.1928
2008	0.0004	0.0035	0.0150	0.0389	0.0719	0.1071	0.1385	0.1635	0.1821	0.1951	0.2041	0.2101	0.2141
2009	0.0003	0.0025	0.0108	0.0279	0.0517	0.0769	0.0994	0.1174	0.1307	0.1401	0.1465	0.1509	0.1537
2010	0.0003	0.0026	0.0113	0.0292	0.0540	0.0803	0.1039	0.1226	0.1366	0.1464	0.1531	0.1576	0.1606
2011	0.0003	0.0030	0.0132	0.0342	0.0633	0.0942	0.1218	0.1438	0.1601	0.1716	0.1795	0.1848	0.1883
2012	0.0002	0.0023	0.0099	0.0257	0.0474	0.0706	0.0913	0.1078	0.1201	0.1287	0.1346	0.1386	0.1412

Commercial Discards

Age

Year	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.0006	0.0021	0.0072	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105
1983	0.0004	0.0014	0.0047	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068
1984	0.0005	0.0017	0.0060	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087	0.0087
1985	0.0001	0.0005	0.0029	0.0115	0.0174	0.0152	0.0121	0.0094	0.0073	0.0057	0.0045	0.0035	0.0027
1986	0.0001	0.0009	0.0054	0.0213	0.0321	0.0281	0.0222	0.0174	0.0135	0.0105	0.0082	0.0064	0.0050
1987	0.0001	0.0005	0.0029	0.0114	0.0172	0.0151	0.0119	0.0093	0.0073	0.0057	0.0044	0.0034	0.0027
1988	0.0001	0.0008	0.0050	0.0199	0.0300	0.0263	0.0208	0.0162	0.0127	0.0099	0.0077	0.0060	0.0047
1989	0.0002	0.0011	0.0065	0.0255	0.0385	0.0338	0.0267	0.0209	0.0163	0.0127	0.0099	0.0077	0.0060
1990	0.0003	0.0015	0.0070	0.0269	0.0567	0.0569	0.0429	0.0307	0.0217	0.0154	0.0109	0.0077	0.0054
1991	0.0002	0.0009	0.0040	0.0152	0.0321	0.0322	0.0243	0.0173	0.0123	0.0087	0.0061	0.0043	0.0031
1992	0.0001	0.0004	0.0019	0.0074	0.0155	0.0156	0.0117	0.0084	0.0059	0.0042	0.0030	0.0021	0.0015
1993	0.0001	0.0007	0.0031	0.0118	0.0249	0.0250	0.0188	0.0135	0.0095	0.0067	0.0048	0.0034	0.0024
1994	0.0001	0.0006	0.0028	0.0108	0.0227	0.0228	0.0172	0.0123	0.0087	0.0062	0.0044	0.0031	0.0022
1995	0.0002	0.0008	0.0038	0.0145	0.0305	0.0306	0.0230	0.0165	0.0117	0.0082	0.0058	0.0041	0.0029
1996	0.0001	0.0013	0.0073	0.0100	0.0092	0.0082	0.0073	0.0064	0.0057	0.0051	0.0045	0.0040	0.0035
1997	0.0001	0.0007	0.0038	0.0052	0.0048	0.0042	0.0038	0.0033	0.0030	0.0026	0.0023	0.0021	0.0018
1998	0.0001	0.0010	0.0055	0.0076	0.0070	0.0062	0.0055	0.0049	0.0043	0.0038	0.0034	0.0030	0.0027
1999	0.0001	0.0007	0.0038	0.0053	0.0048	0.0043	0.0038	0.0034	0.0030	0.0027	0.0024	0.0021	0.0019
2000	0.0002	0.0020	0.0113	0.0155	0.0143	0.0127	0.0113	0.0100	0.0089	0.0079	0.0070	0.0062	0.0055
2001	0.0001	0.0010	0.0057	0.0078	0.0072	0.0064	0.0057	0.0051	0.0045	0.0040	0.0035	0.0031	0.0028
2002	0.0001	0.0006	0.0033	0.0045	0.0041	0.0037	0.0033	0.0029	0.0026	0.0023	0.0020	0.0018	0.0016
2003	0.0000	0.0002	0.0017	0.0068	0.0088	0.0086	0.0082	0.0078	0.0075	0.0071	0.0068	0.0064	0.0061
2004	0.0000	0.0003	0.0031	0.0120	0.0155	0.0153	0.0146	0.0139	0.0132	0.0126	0.0120	0.0114	0.0109
2005	0.0001	0.0006	0.0052	0.0204	0.0265	0.0261	0.0249	0.0237	0.0226	0.0215	0.0204	0.0195	0.0185
2006	0.0000	0.0001	0.0013	0.0053	0.0068	0.0067	0.0064	0.0061	0.0058	0.0055	0.0053	0.0050	0.0048
2007	0.0000	0.0004	0.0041	0.0162	0.0210	0.0206	0.0197	0.0187	0.0178	0.0170	0.0162	0.0154	0.0147
2008	0.0000	0.0002	0.0022	0.0087	0.0114	0.0112	0.0107	0.0101	0.0097	0.0092	0.0088	0.0083	0.0079
2009	0.0001	0.0005	0.0048	0.0188	0.0244	0.0240	0.0229	0.0218	0.0208	0.0198	0.0188	0.0179	0.0171
2010	0.0000	0.0002	0.0022	0.0087	0.0113	0.0111	0.0106	0.0101	0.0096	0.0091	0.0087	0.0083	0.0079
2011	0.0001	0.0006	0.0059	0.0230	0.0299	0.0294	0.0280	0.0267	0.0254	0.0242	0.0230	0.0219	0.0209
2012	0.0001	0.0009	0.0081	0.0317	0.0411	0.0404	0.0386	0.0368	0.0350	0.0333	0.0317	0.0302	0.0287

Table 15. Estimates of population abundance by age.

	Age														
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	8+
1982	18,727,000	5,687,350	4,130,530	2,369,680	572,248	188,329	161,441	106,960	80,605	89,500	70,204	135,764	67,896	32,387,507	550,929
1983	45,215,100	6,032,860	2,243,010	1,083,820	856,932	266,310	105,374	101,969	71,204	55,530	63,070	50,232	147,468	56,292,879	489,473
1984	39,555,500	14,592,800	2,977,090	1,277,790	665,350	569,384	189,892	78,869	76,791	53,869	42,160	48,024	151,128	60,278,647	450,841
1985	39,172,100	12,765,300	7,059,080	1,601,570	785,724	454,470	422,014	148,649	62,341	61,094	43,049	33,799	160,179	62,769,368	509,110
1986	32,081,700	12,646,400	6,416,790	4,413,310	1,107,780	576,904	349,611	334,252	116,724	48,643	47,463	33,351	149,896	58,322,824	730,329
1987	42,415,300	10,359,300	6,379,640	4,035,860	3,060,900	816,170	448,884	282,402	269,475	93,985	39,142	38,187	147,492	68,386,736	870,682
1988	55,745,800	13,699,000	5,238,270	4,041,480	2,849,780	2,318,350	654,948	374,631	235,562	224,712	78,367	32,641	154,899	85,648,440	1,100,812
1989	63,712,900	18,002,400	6,919,060	3,305,400	2,821,600	2,121,770	1,828,690	537,762	307,671	193,526	184,703	64,452	154,419	100,154,353	1,442,533
1990	83,514,400	20,576,200	9,101,570	4,371,080	2,303,400	2,094,450	1,673,490	1,506,290	444,237	254,768	160,571	153,511	182,327	126,336,294	2,701,704
1991	69,257,200	26,964,700	10,385,500	5,693,130	2,979,640	1,645,950	1,590,990	1,344,240	1,227,000	365,663	211,297	133,902	281,601	122,080,813	3,563,703
1992	69,427,100	22,362,900	13,607,500	6,485,030	3,885,820	2,157,770	1,268,240	1,289,700	1,100,100	1,011,450	303,045	175,806	347,223	123,421,684	4,227,324
1993	91,525,900	22,420,100	11,289,400	8,511,380	4,459,460	2,857,990	1,687,680	1,038,910	1,062,510	910,344	839,804	252,255	436,612	147,292,345	4,540,435
1994	180,532,000	29,552,500	11,307,400	7,024,470	5,772,880	3,218,630	2,196,650	1,363,510	846,768	871,880	750,828	695,287	572,714	244,705,517	5,100,987
1995	115,494,000	58,286,000	14,888,300	6,991,890	4,701,460	4,111,730	2,444,420	1,755,150	1,099,900	688,151	712,571	616,259	1,045,240	212,835,071	5,917,271
1996	124,097,000	37,282,800	29,299,600	9,099,480	4,560,640	3,236,340	3,015,880	1,890,600	1,373,680	868,881	547,476	569,942	1,336,840	217,179,159	6,587,419
1997	150,834,000	40,062,100	18,744,800	17,950,100	5,994,820	3,176,740	2,387,420	2,323,580	1,463,480	1,068,420	678,839	429,493	1,504,980	246,618,772	7,468,792
1998	99,090,300	48,682,500	20,166,700	11,584,200	11,893,500	4,136,050	2,275,600	1,751,420	1,684,730	1,053,040	765,463	485,437	1,383,880	204,952,820	7,123,970
1999	99,259,400	31,983,600	24,511,700	12,473,000	7,711,660	8,277,250	2,996,180	1,691,450	1,288,540	1,231,300	766,810	556,576	1,360,060	194,107,526	6,894,736
2000	78,733,800	32,042,300	16,120,400	15,239,500	8,404,530	5,458,770	6,114,350	2,275,010	1,272,790	963,939	918,104	570,969	1,427,660	169,542,122	7,428,472
2001	113,744,000	25,410,700	16,114,400	9,905,980	10,048,000	5,786,850	3,907,300	4,485,400	1,650,400	916,721	691,522	657,580	1,432,450	194,751,303	9,834,073
2002	133,633,000	36,715,400	12,797,200	9,978,960	6,621,460	7,026,360	4,205,190	2,907,750	3,298,310	1,203,960	665,580	500,899	1,513,150	221,067,219	10,089,649
2003	75,862,200	43,140,300	18,507,700	7,964,720	6,742,710	4,691,530	5,171,060	3,166,190	2,161,150	2,429,670	881,944	486,044	1,468,330	172,673,548	10,593,328
2004	157,460,000	24,485,200	21,722,500	11,450,500	5,254,830	4,616,020	3,332,830	3,761,840	2,276,620	1,542,290	1,726,720	625,716	1,387,590	239,642,656	11,320,776
2005	85,542,800	50,821,400	12,325,400	13,416,300	7,512,310	3,559,960	3,226,600	2,372,940	2,635,850	1,578,050	1,062,100	1,185,120	1,380,390	186,619,220	10,214,450
2006	81,113,200	27,607,700	25,569,600	7,585,610	8,693,590	5,006,520	2,448,080	2,261,570	1,637,990	1,801,200	1,072,090	719,628	1,738,090	167,254,868	9,230,568
2007	58,453,200	26,174,000	13,876,000	15,690,400	4,897,360	5,738,830	3,386,480	1,677,830	1,519,400	1,085,690	1,184,090	701,748	1,606,210	135,991,238	7,774,968
2008	80,225,900	18,863,700	13,164,100	8,528,620	10,139,900	3,250,660	3,929,290	2,363,480	1,153,390	1,034,180	734,833	799,458	1,558,840	145,746,351	7,644,181
2009	56,047,700	25,893,300	9,494,120	8,129,490	5,601,350	6,861,820	2,259,640	2,770,220	1,634,070	786,738	699,436	494,588	1,583,060	122,255,532	7,968,112
2010	76,222,600	18,089,200	13,033,300	5,854,510	5,295,650	3,771,810	4,796,530	1,618,900	1,963,340	1,150,330	551,946	490,205	1,458,840	134,297,161	7,233,561
2011	106,913,000	24,601,600	9,108,160	8,060,930	3,857,590	3,617,210	2,670,530	3,474,120	1,157,990	1,392,930	812,359	388,992	1,374,150	167,429,561	8,600,541
2012	140,382,000	34,504,700	12,377,300	5,602,720	5,211,940	2,563,970	2,481,550	1,868,070	2,394,080	790,189	945,197	549,864	1,193,860	210,865,440	7,741,260

Table 16. Estimate of female spawning stock biomass-at-age by year.

	Age														
Year	1	2	3	4	5	6	7	8	9	10	11	12	13+	Total	SD
1982	0	0	0	57	83	186	455	433	383	651	680	1,367	893	5,188	1,208
1983	0	0	0	26	122	220	242	381	351	364	526	481	1,541	4,252	1,020
1984	0	0	0	33	101	480	529	289	407	341	315	519	1,769	4,784	1,089
1985	0	0	0	50	108	413	1,158	572	335	385	334	311	2,098	5,763	1,201
1986	0	0	0	161	167	450	828	1,207	529	265	327	279	1,811	6,023	1,138
1987	0	0	0	140	515	623	963	924	1,215	509	258	324	1,840	7,311	1,223
1988	0	0	0	137	548	2,263	1,594	1,189	1,003	1,096	564	290	1,948	10,631	1,421
1989	0	0	0	115	526	2,394	5,623	2,214	1,456	1,292	1,325	560	1,957	17,461	1,939
1990	0	0	0	146	361	2,066	4,945	6,303	2,159	1,331	1,119	1,278	2,181	21,889	2,190
1991	0	0	0	195	497	1,321	4,443	5,280	6,478	1,946	1,605	995	3,800	26,561	2,554
1992	0	0	0	210	694	1,989	3,429	5,143	6,060	6,786	2,385	1,879	4,603	33,179	3,027
1993	0	0	0	283	764	2,626	4,654	4,329	5,931	6,138	6,931	2,437	6,025	40,120	3,438
1994	0	0	0	252	1,017	2,894	6,145	5,709	4,668	5,621	6,262	6,638	6,910	46,116	3,699
1995	0	0	0	264	830	3,829	7,225	7,344	6,381	4,957	4,835	5,497	16,463	57,626	4,501
1996	0	0	0	341	901	3,515	10,245	8,989	8,382	6,535	4,510	4,901	17,282	65,601	4,857
1997	0	0	0	718	1,082	3,039	6,556	8,891	8,214	8,091	5,874	3,892	20,782	67,140	5,061
1998	0	0	0	321	1,846	3,268	6,104	6,681	8,790	6,305	5,506	4,357	15,373	58,551	4,473
1999	0	0	0	318	955	5,491	5,950	5,977	6,728	8,054	5,632	4,667	15,284	59,058	4,606
2000	0	0	0	382	1,028	3,751	12,972	7,435	6,828	5,933	7,498	5,257	18,077	69,161	5,329
2001	0	0	0	286	1,349	4,495	8,899	15,069	8,178	6,008	5,107	5,144	14,565	69,101	5,166
2002	0	0	0	259	924	5,527	10,088	10,595	15,665	7,510	5,177	4,304	16,316	76,365	5,744
2003	0	0	0	192	909	3,691	12,088	11,102	10,549	14,375	6,456	4,102	15,079	78,544	5,910
2004	0	0	0	272	749	3,557	7,849	13,029	10,896	9,046	12,092	5,022	13,825	76,338	5,992
2005	0	0	0	344	998	2,888	7,588	8,781	13,058	9,319	7,631	10,158	15,636	76,401	6,520
2006	0	0	0	181	1,094	3,562	5,441	8,041	8,577	10,958	7,748	5,926	19,391	70,918	6,587
2007	0	0	0	334	618	4,246	7,934	5,829	8,039	6,995	9,247	6,140	19,054	68,438	6,896
2008	0	0	0	203	1,289	2,686	10,620	8,682	5,962	6,978	5,725	6,991	17,365	66,502	6,907
2009	0	0	0	196	672	5,477	5,775	10,945	8,720	5,032	5,371	4,204	18,070	64,462	7,059
2010	0	0	0	141	651	2,967	11,662	5,781	9,892	7,354	4,227	4,020	15,774	62,469	7,032
2011	0	0	0	212	475	2,693	6,300	12,064	5,767	8,575	5,779	3,407	16,701	61,972	7,530
2012	0	0	0	193	916	2,157	6,002	6,666	11,653	5,008	7,092	4,614	13,936	58,238	7,640

Figure 1. Comparison of removal estimates used in the benchmark assessment and updated assessment, expressed as percent differences ((final-prelim)/prelim*100), by state and year (where applicable).

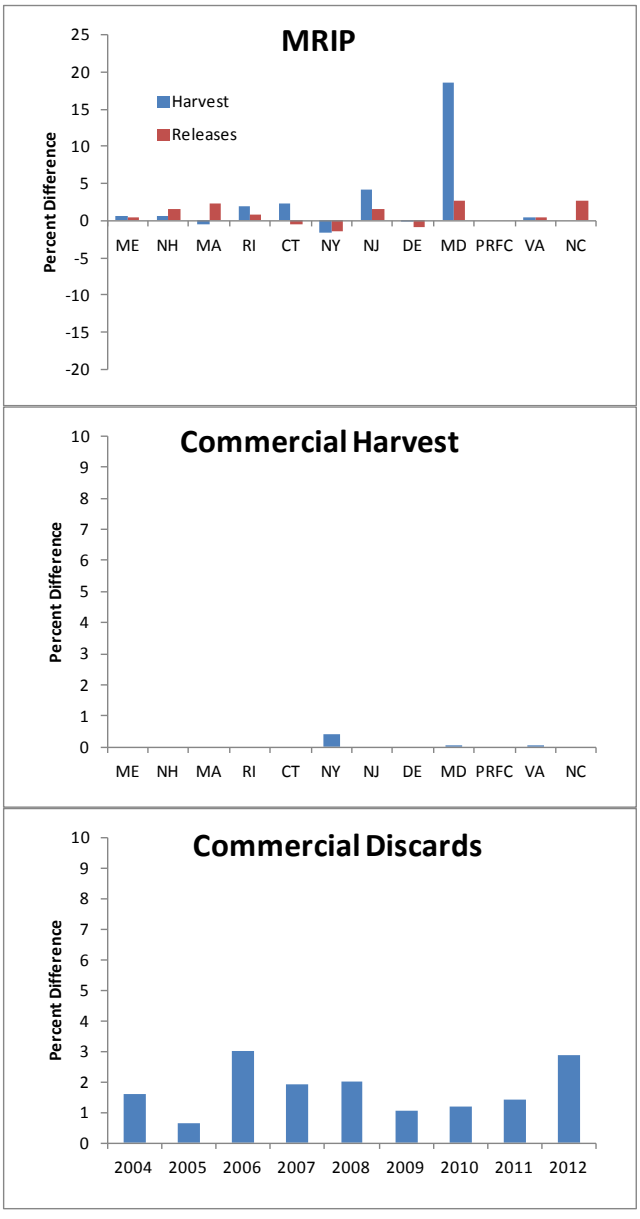


Figure 2. Observed and predicted total catch and standardized residuals by fleet.

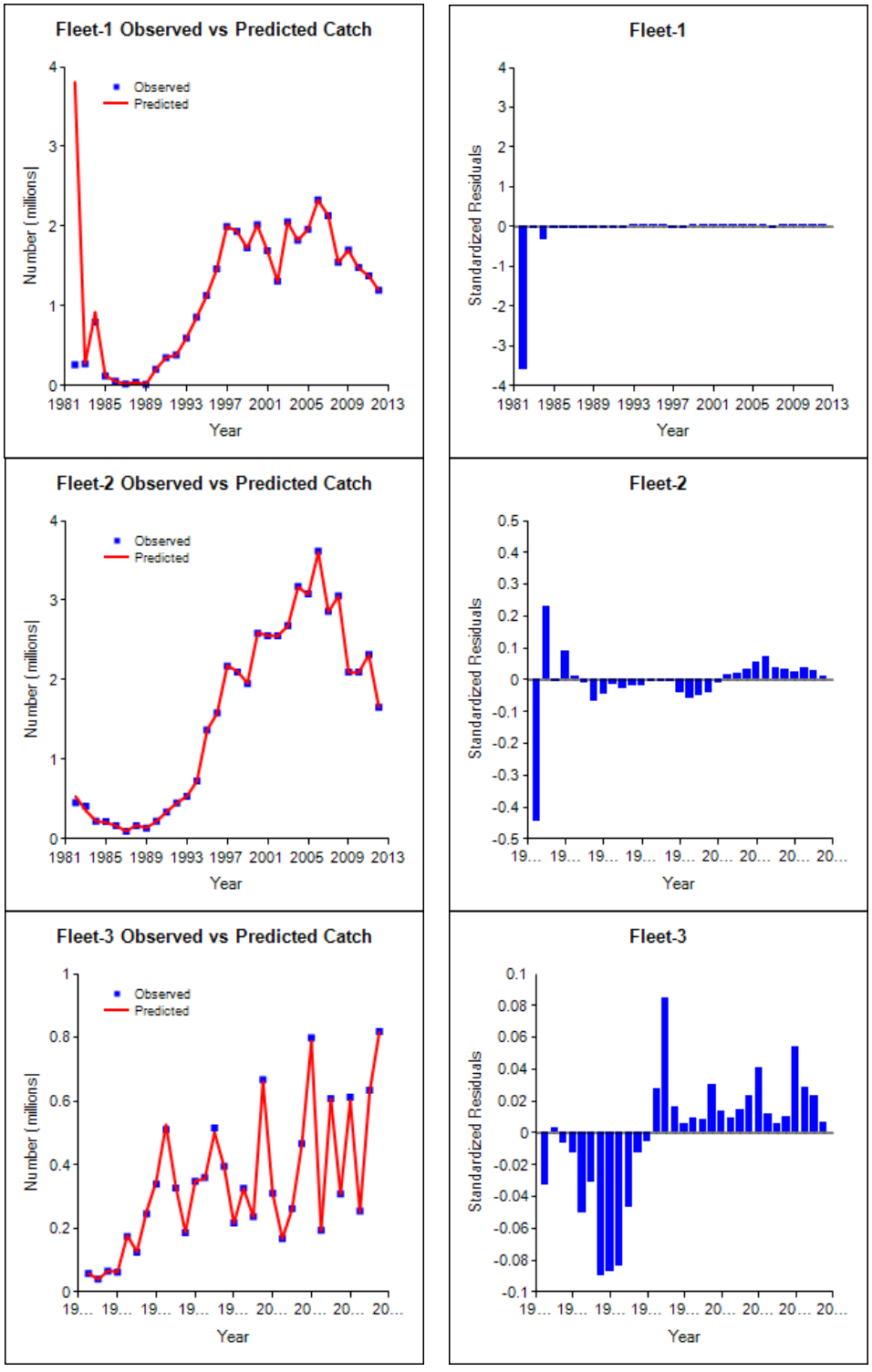


Figure 3. Catch selectivity patterns by fleet (Fleet 1 = Bay, Fleet 2 = Coast, Fleet 3 = Commercial Discards).

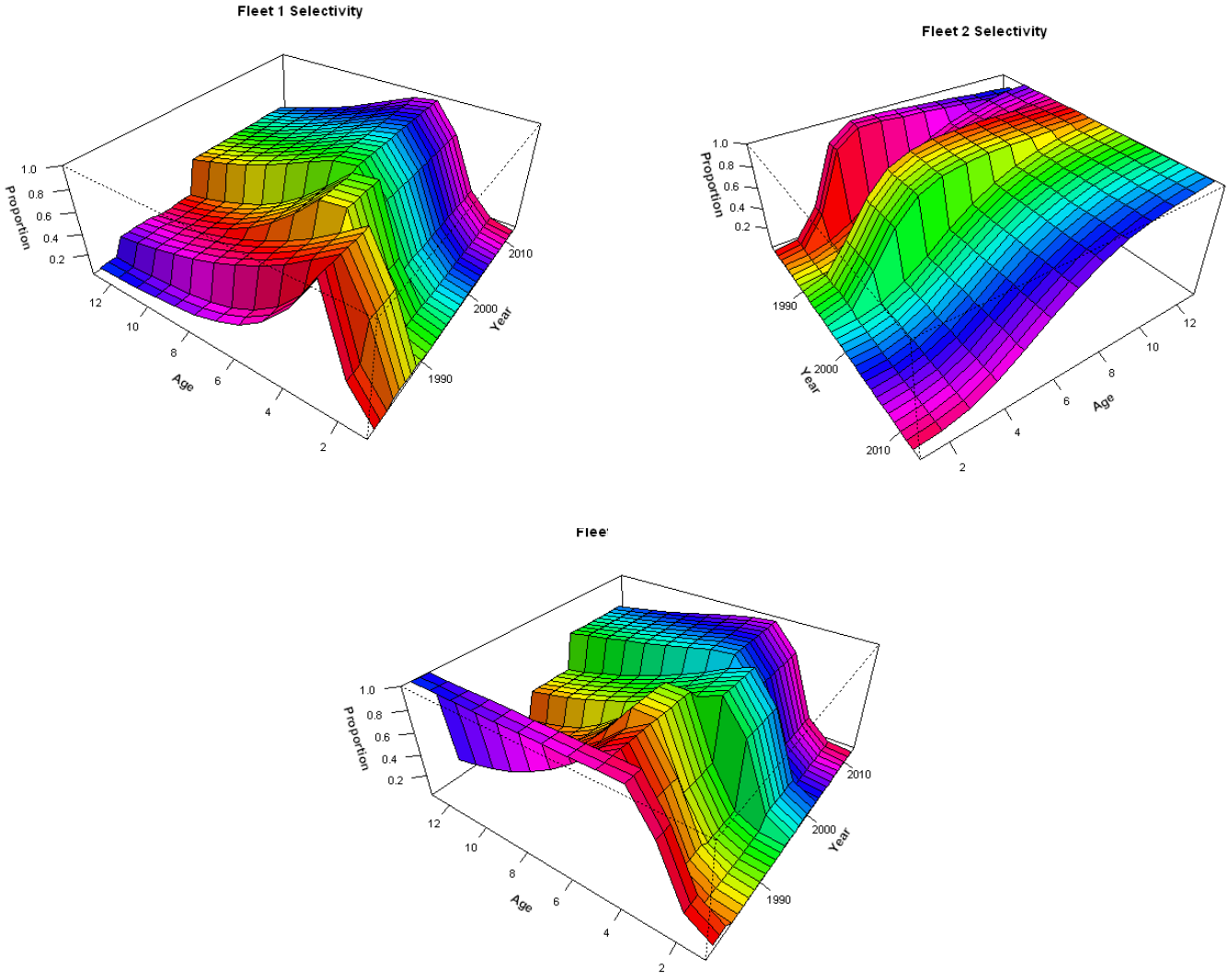


Figure 4. Estimates of total and fleet-specific fully-recruited fishing mortality (±1 SD) and recruitment (±1 SD) from the SCA base model run.

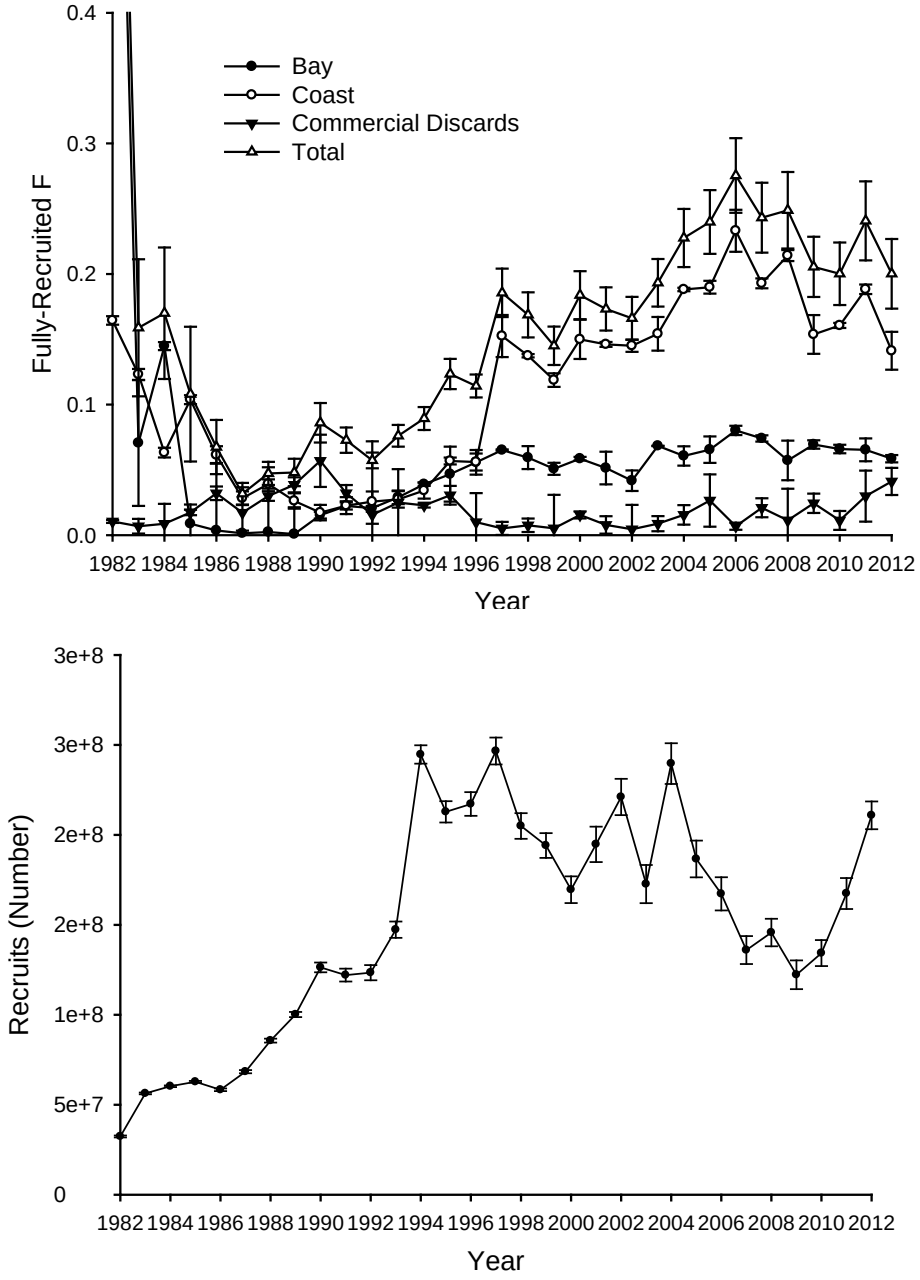


Figure 5. Comparison of average fishing mortality estimates from the SCA model.

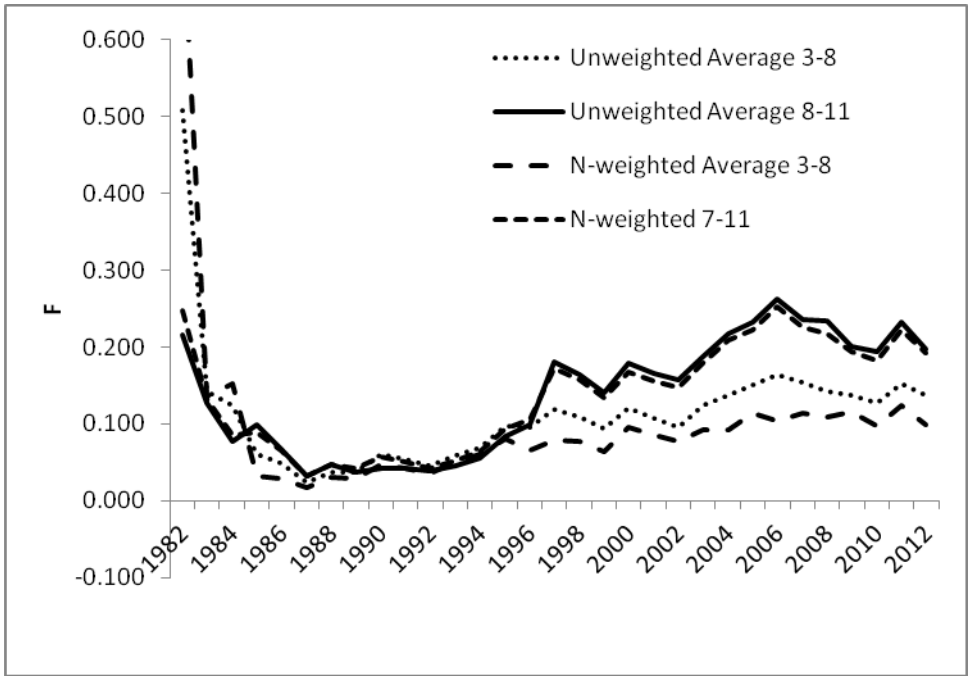


Figure 6. Comparison of fishing mortality-at-age in 2011 and 2012 from the SCA model partitioned into fleets.

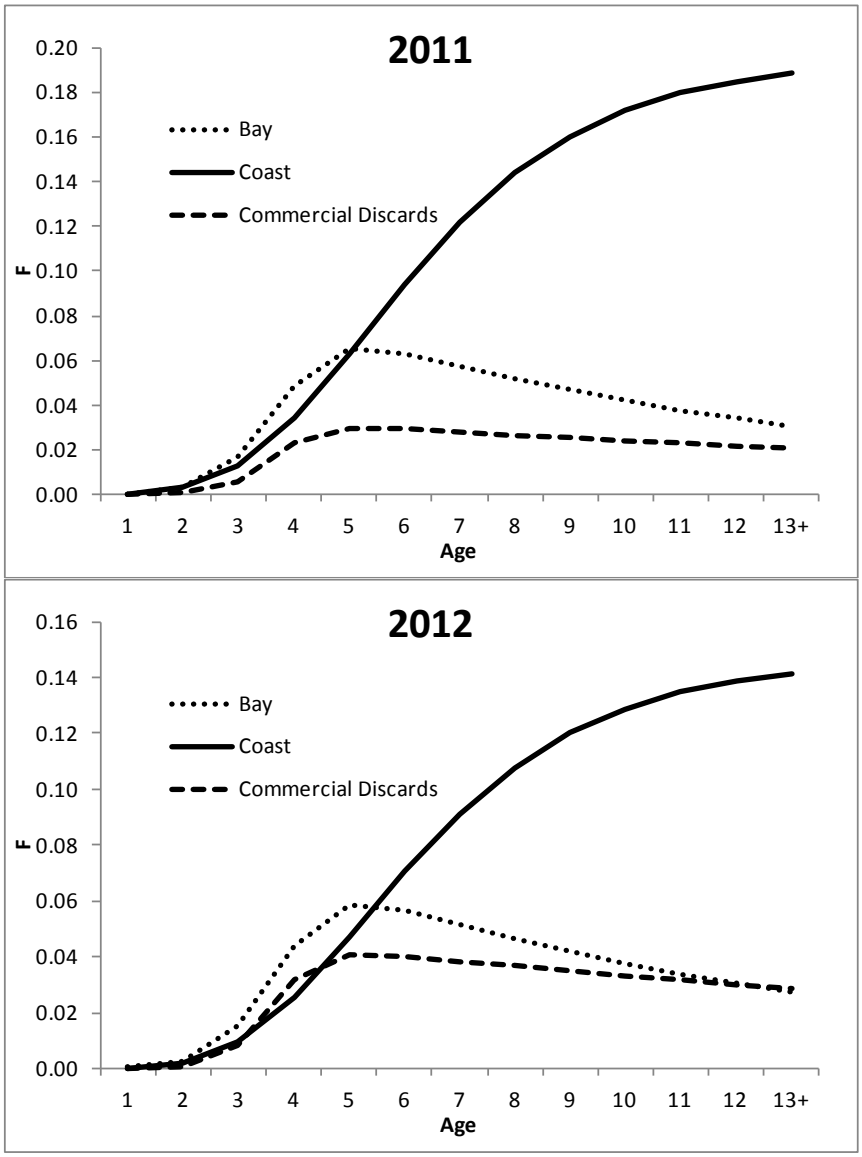


Figure 7. Estimates of January-1 total (age 1+) and 8+ abundance for 1982-2013. January-1 abundance for age 1 in 2013 was estimated from the 2012 observed values of the YOY indices and SCA model catchability coefficients, while older ages were projected from January-1 abundances and fishing and natural mortalities-at-age for 2012.

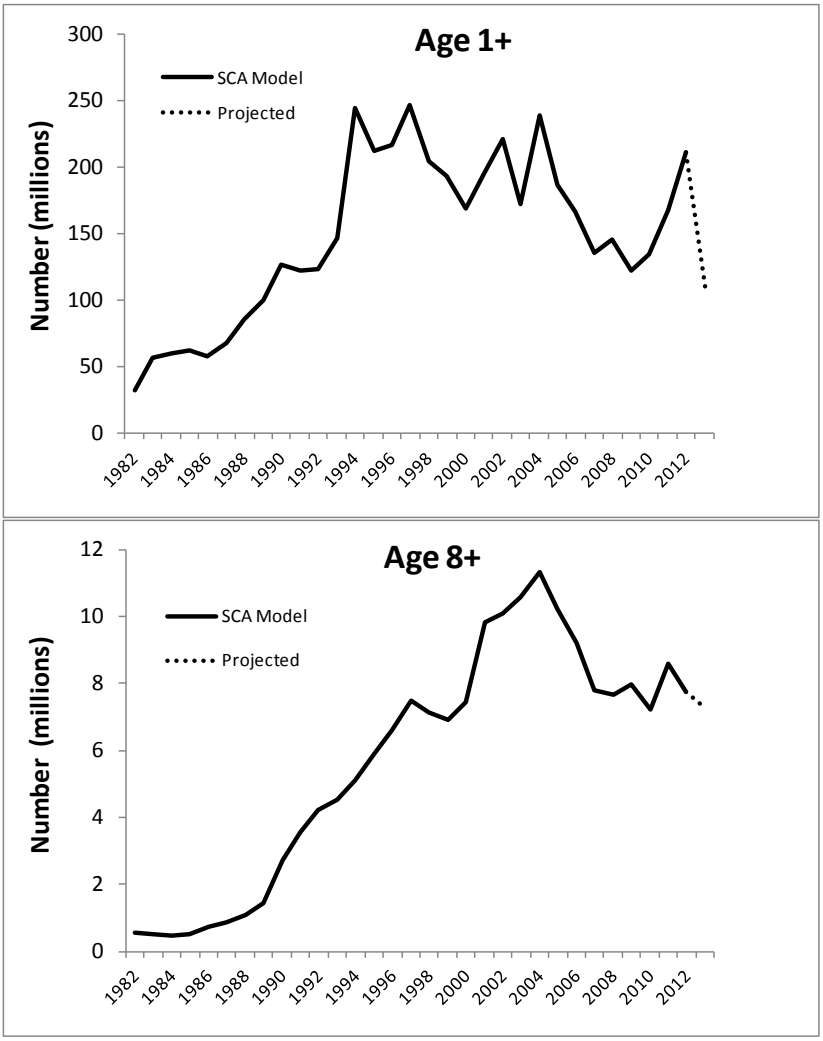


Figure 8. Estimates of A) female spawning stock biomass by year (solid line), B) female spawning stock numbers, and C) total January-1 biomass. Dotted lines equal 95% confidence intervals. Dashed line is the female SSB threshold (1995 value). Solid grey line is the SSB target (125% of threshold).

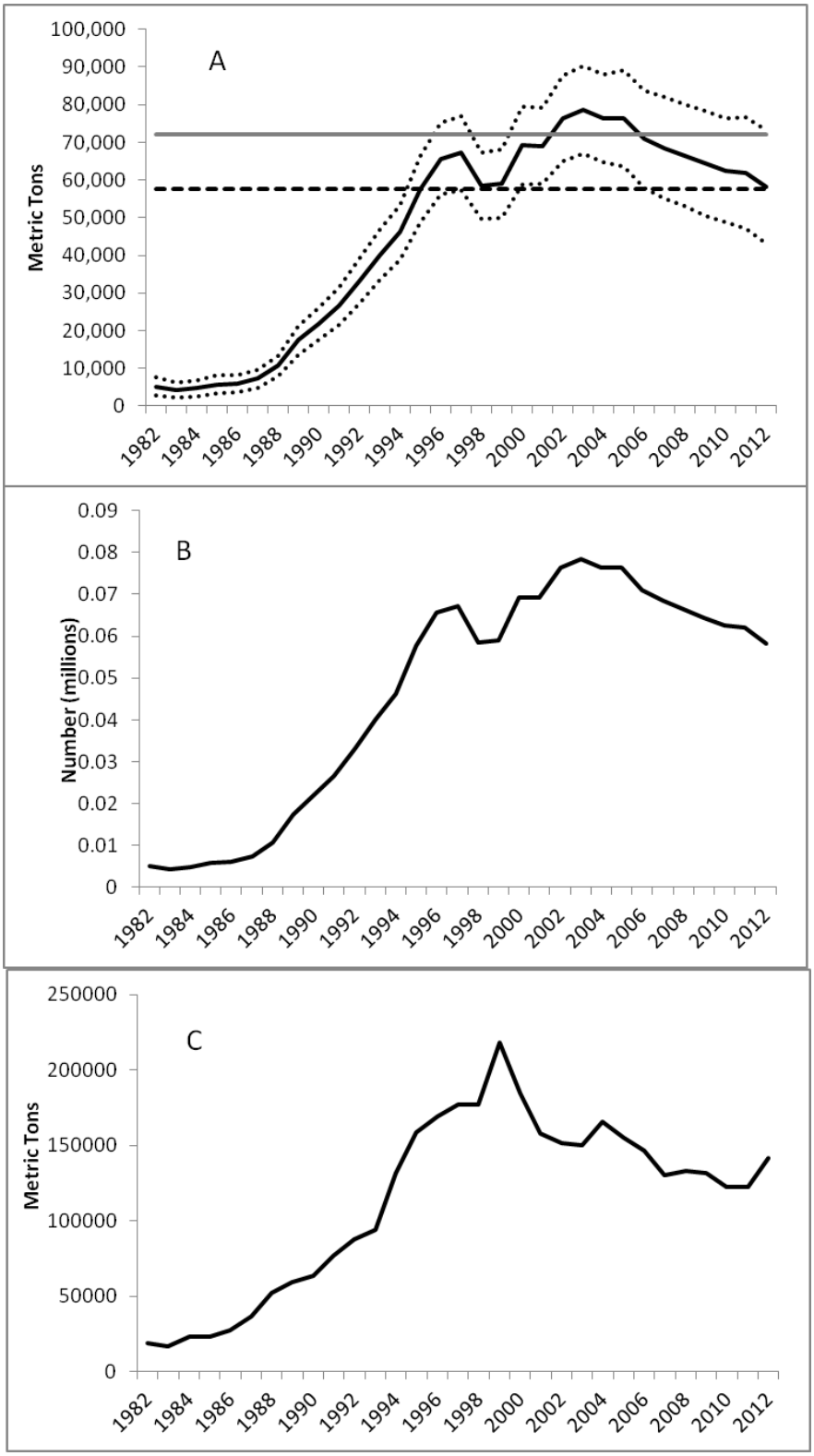


Figure 9. Retrospective analysis of fully-recruited F, female spawning stock biomass , 8+ abundance and Age 1 recruits.

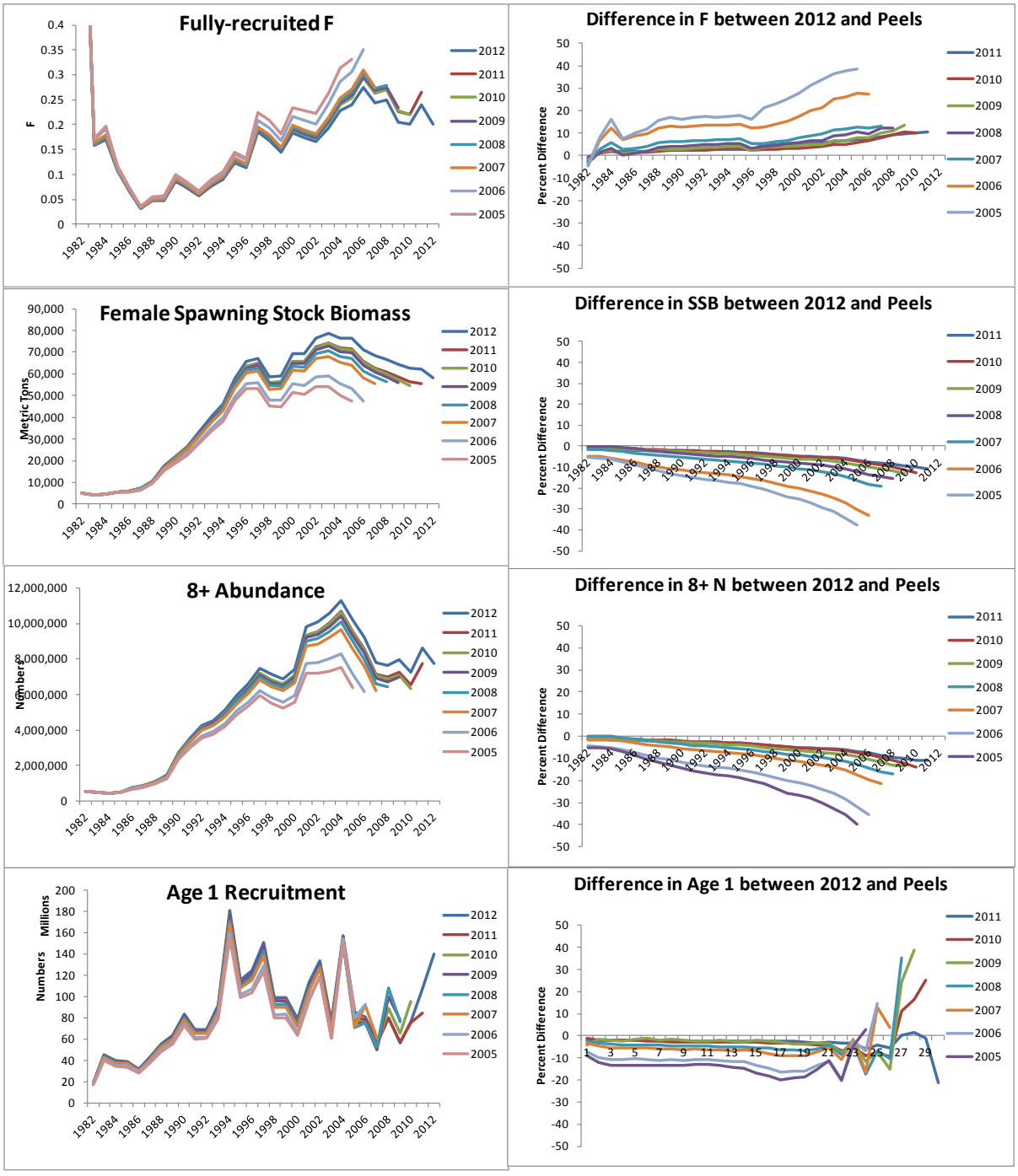


Figure 10. Comparison of fully-recruited F time series and the $F_{threshold}$ and F_{target} reference points.

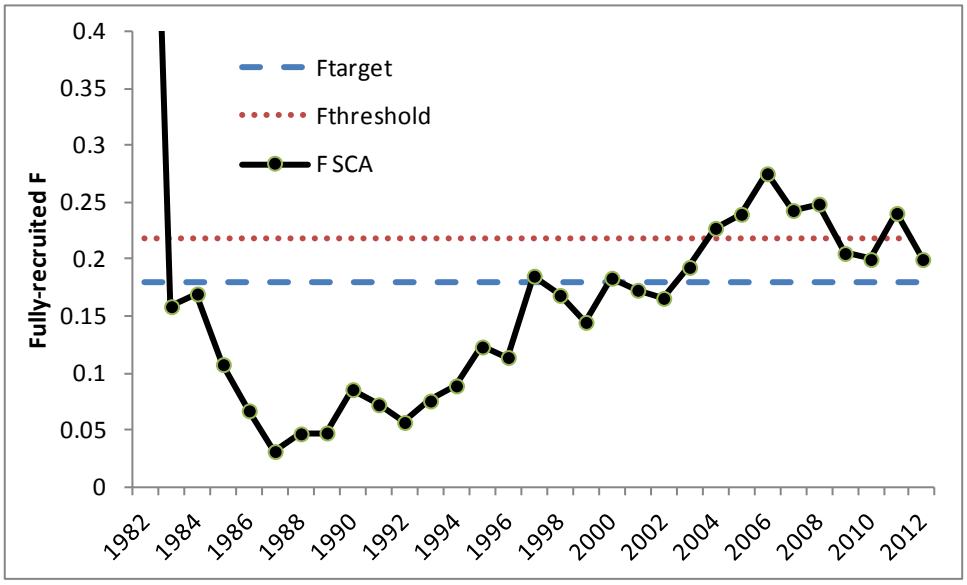


Figure 11. Results of the female spawning stock biomass projections using parameter estimates from the 2012 base SCA model and randomly drawing recruitment values from the 1990-2012 time series of recruitment estimates. Gray lines are the 1000 SSB projections and red line is the median of the 1000 SSB projections.

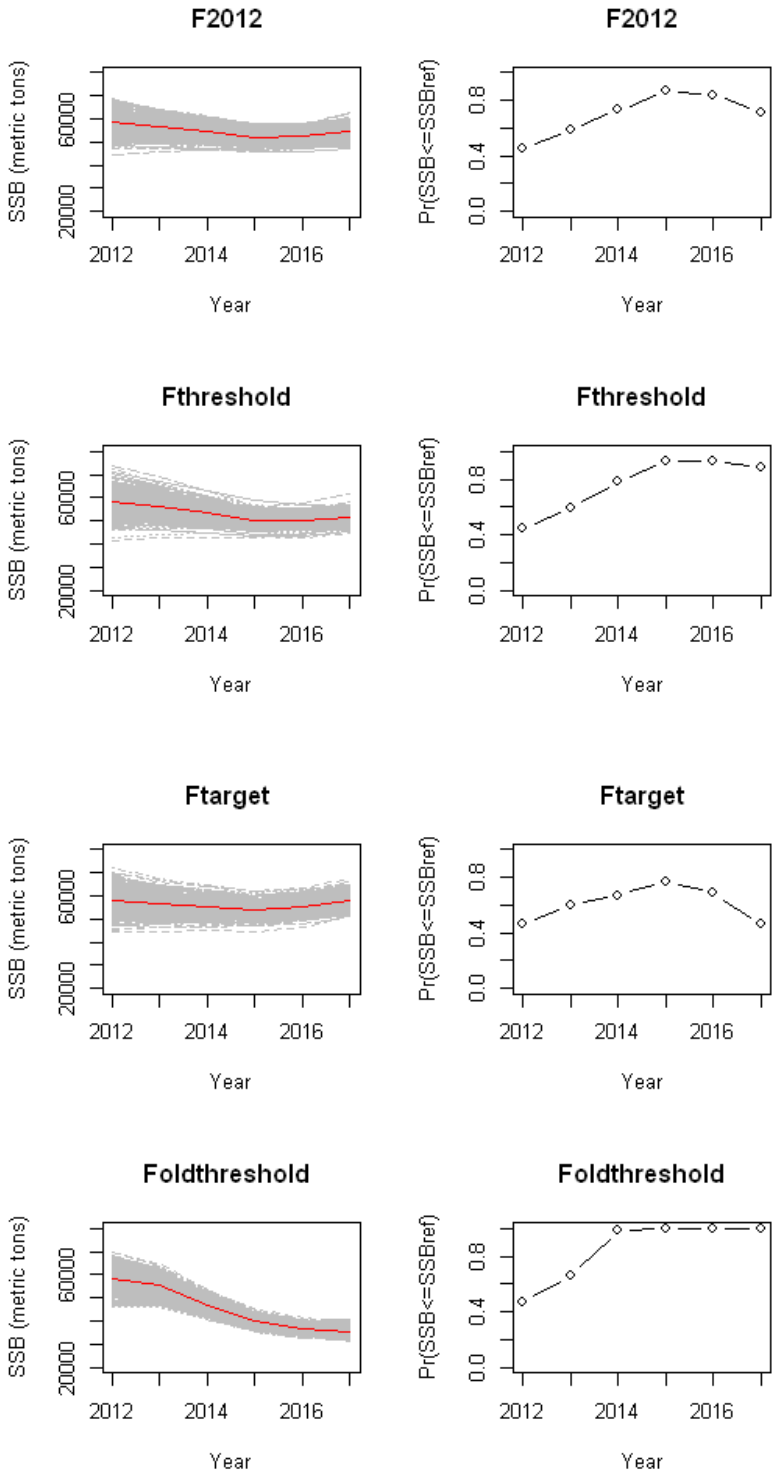


Table 11 cont.

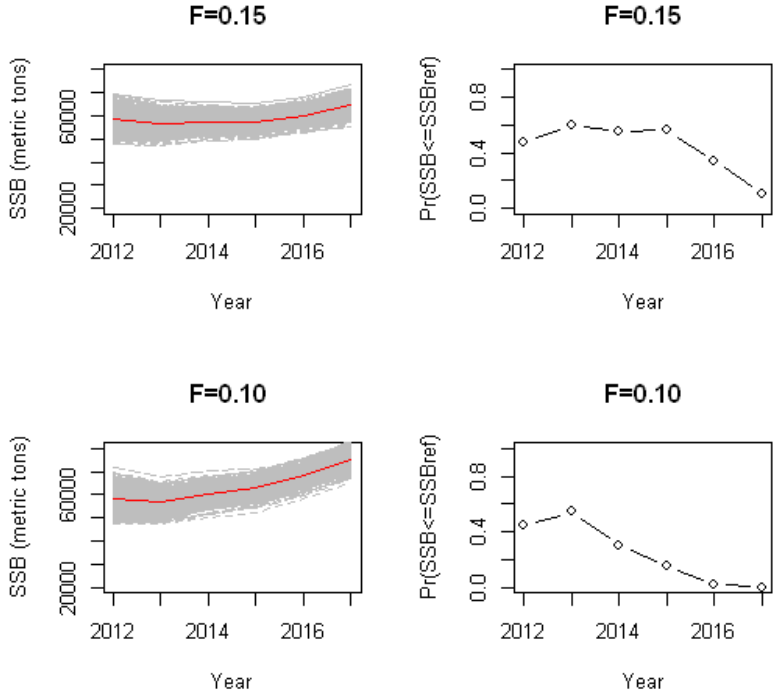
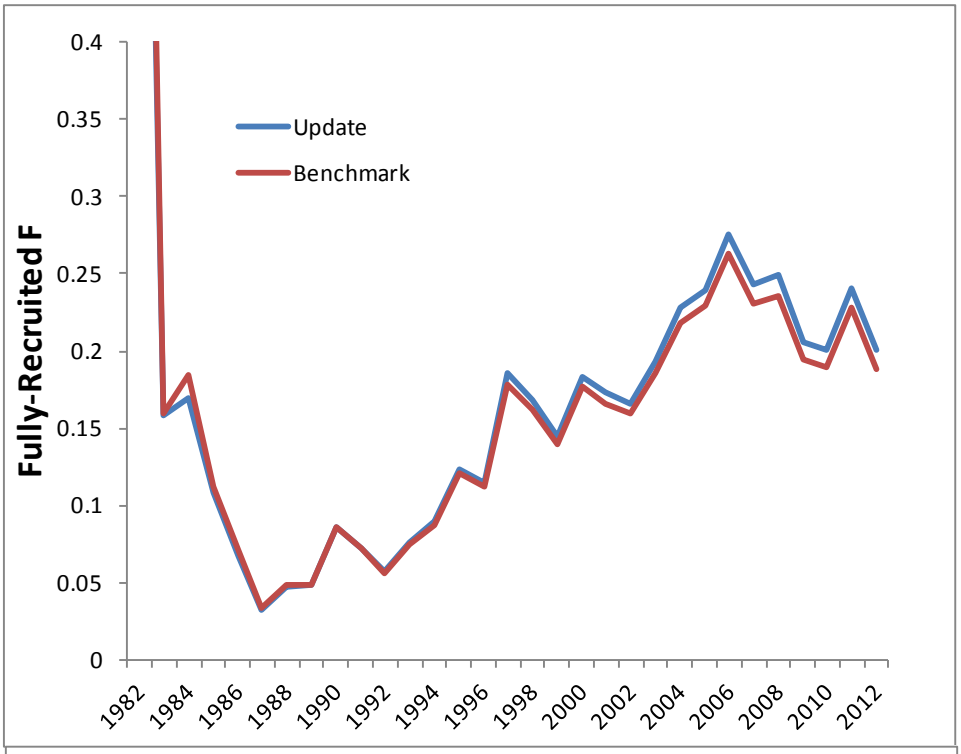
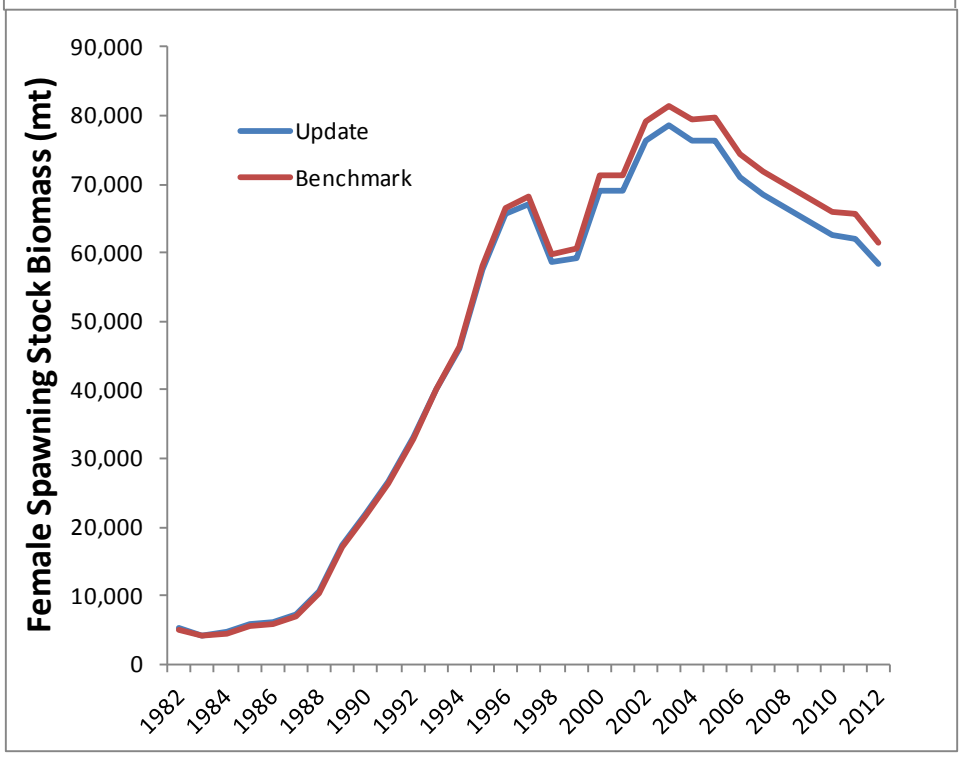


Table 12. Comparison of fully-recruited fishing mortality and female spawning stock biomass estimates between the updated and benchmark assessments.





Appendix A. Plots of SCA model output.

Figure 1. Plots of observed and predicted catch proportions-at-age by year for each fleet.

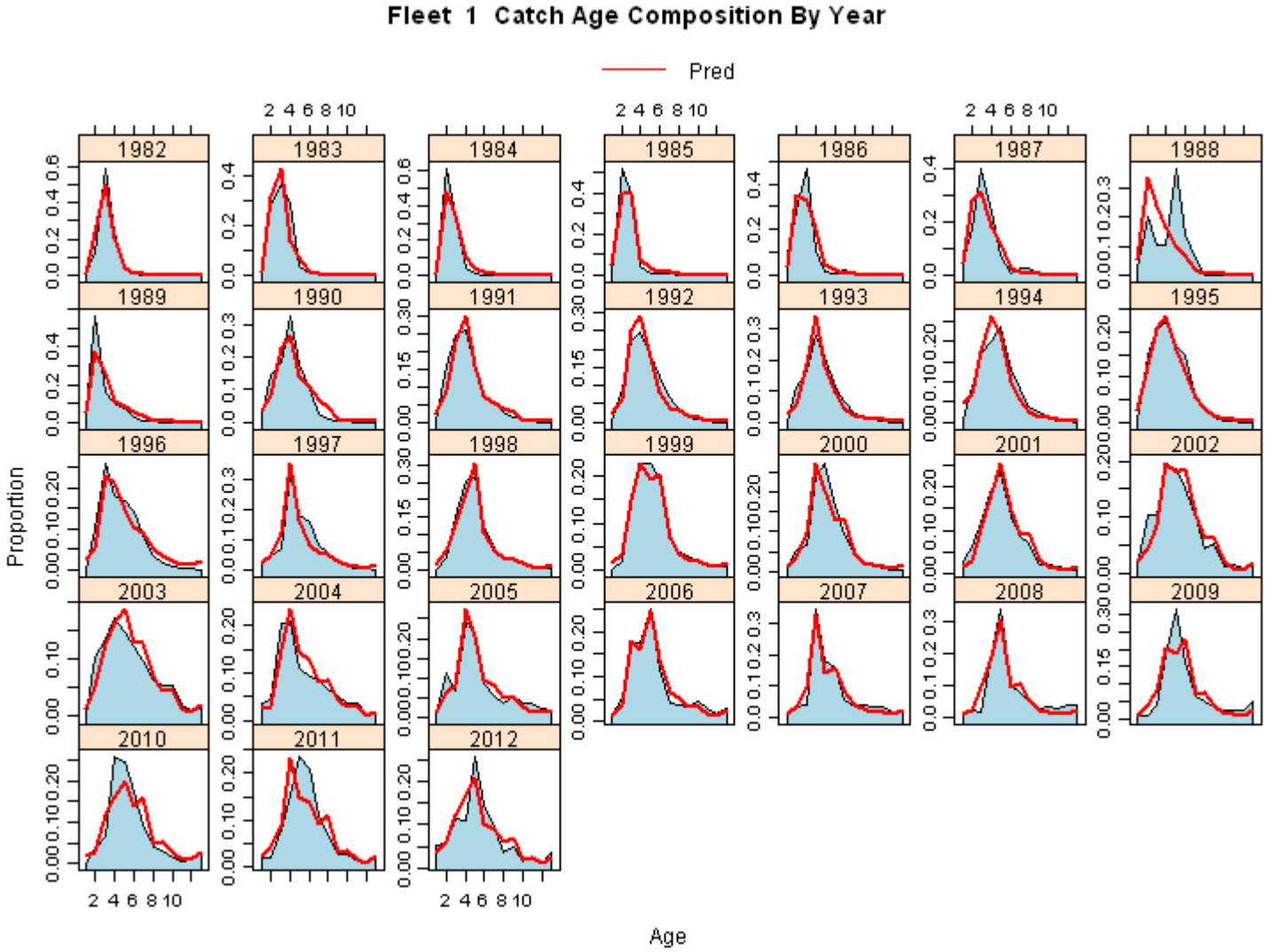


Figure 1 cont.

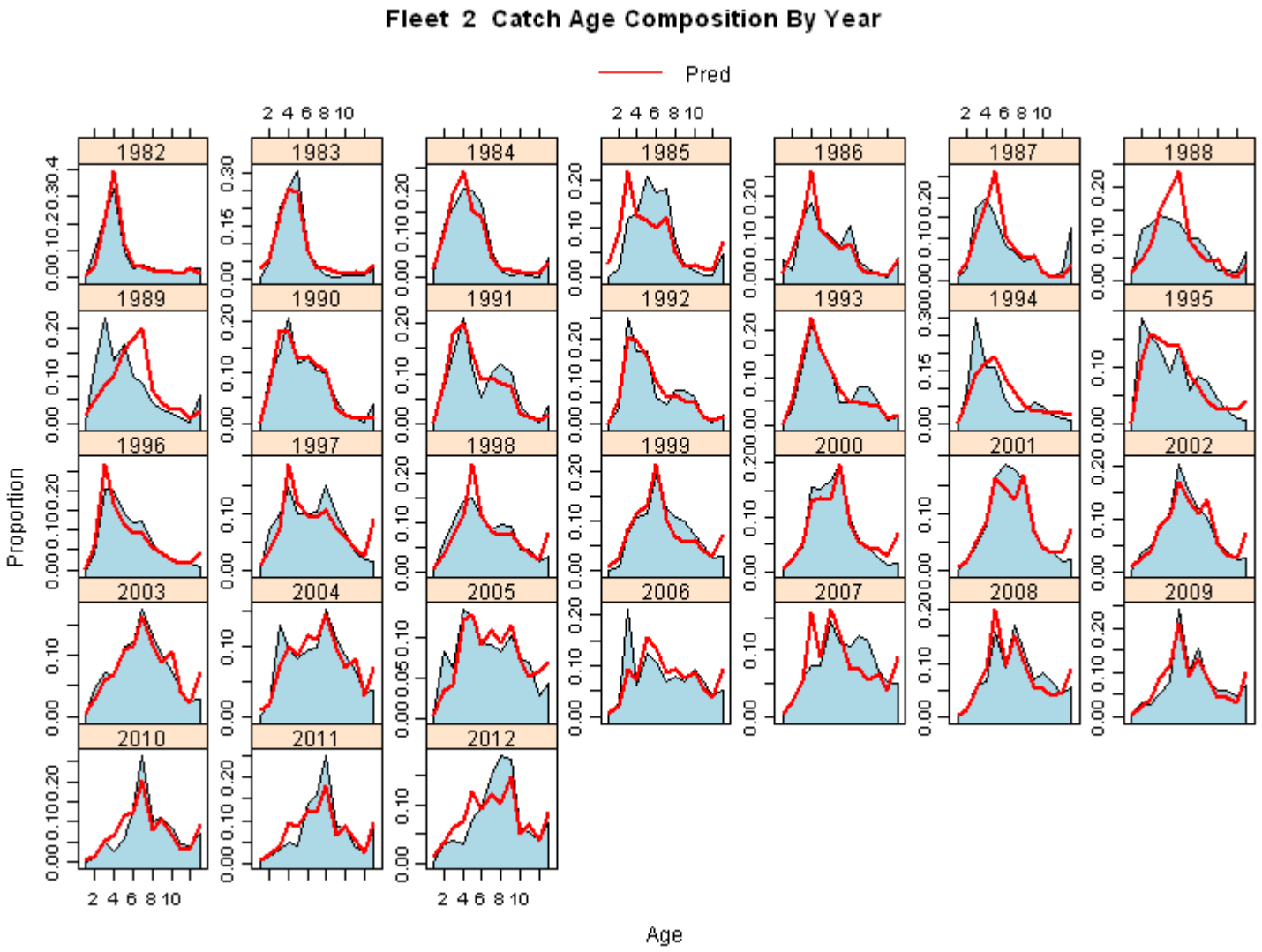


Figure 1 cont.

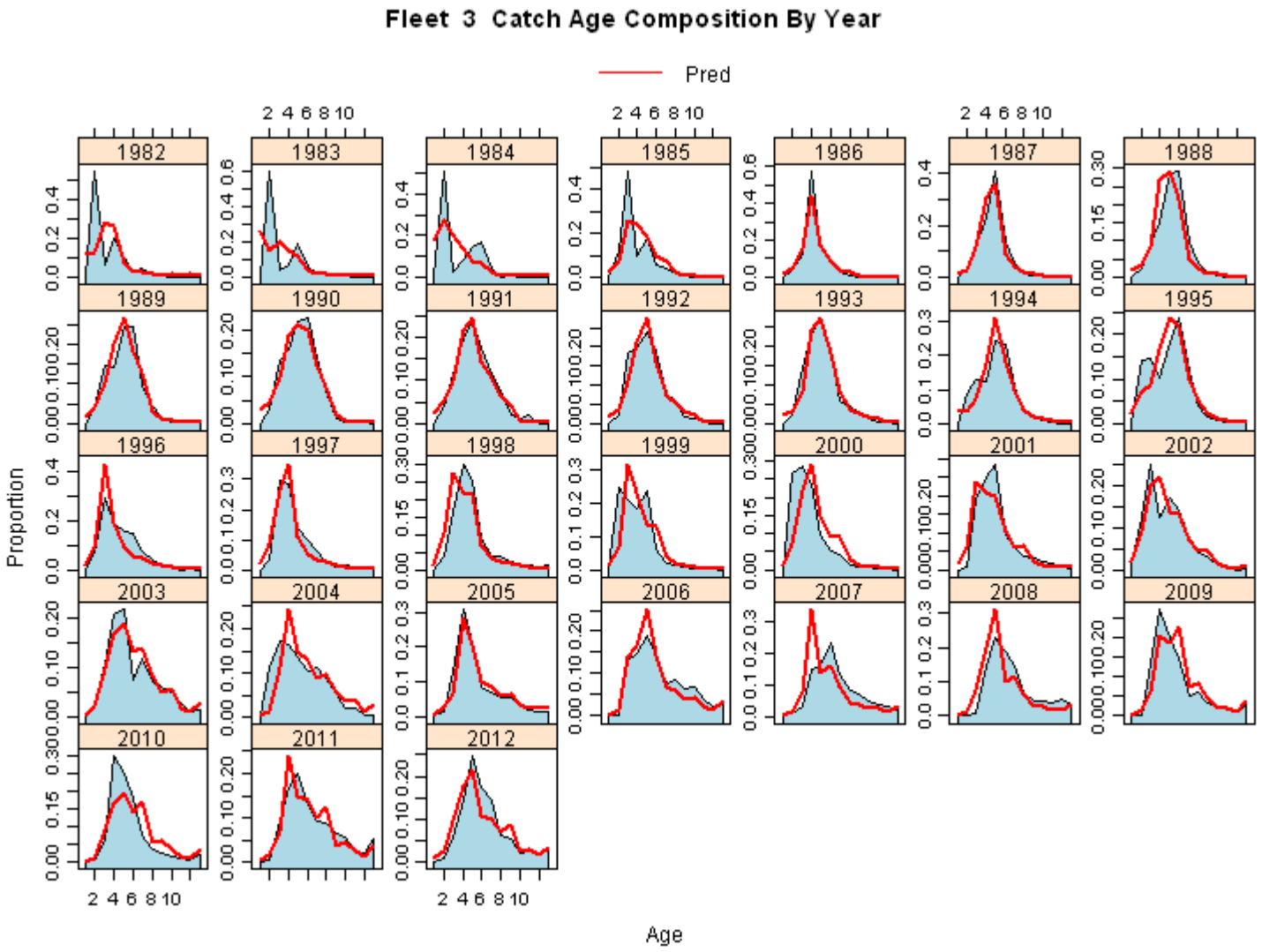


Figure 2. Standardized residuals of catch proportions-at-age by year for each fleet.

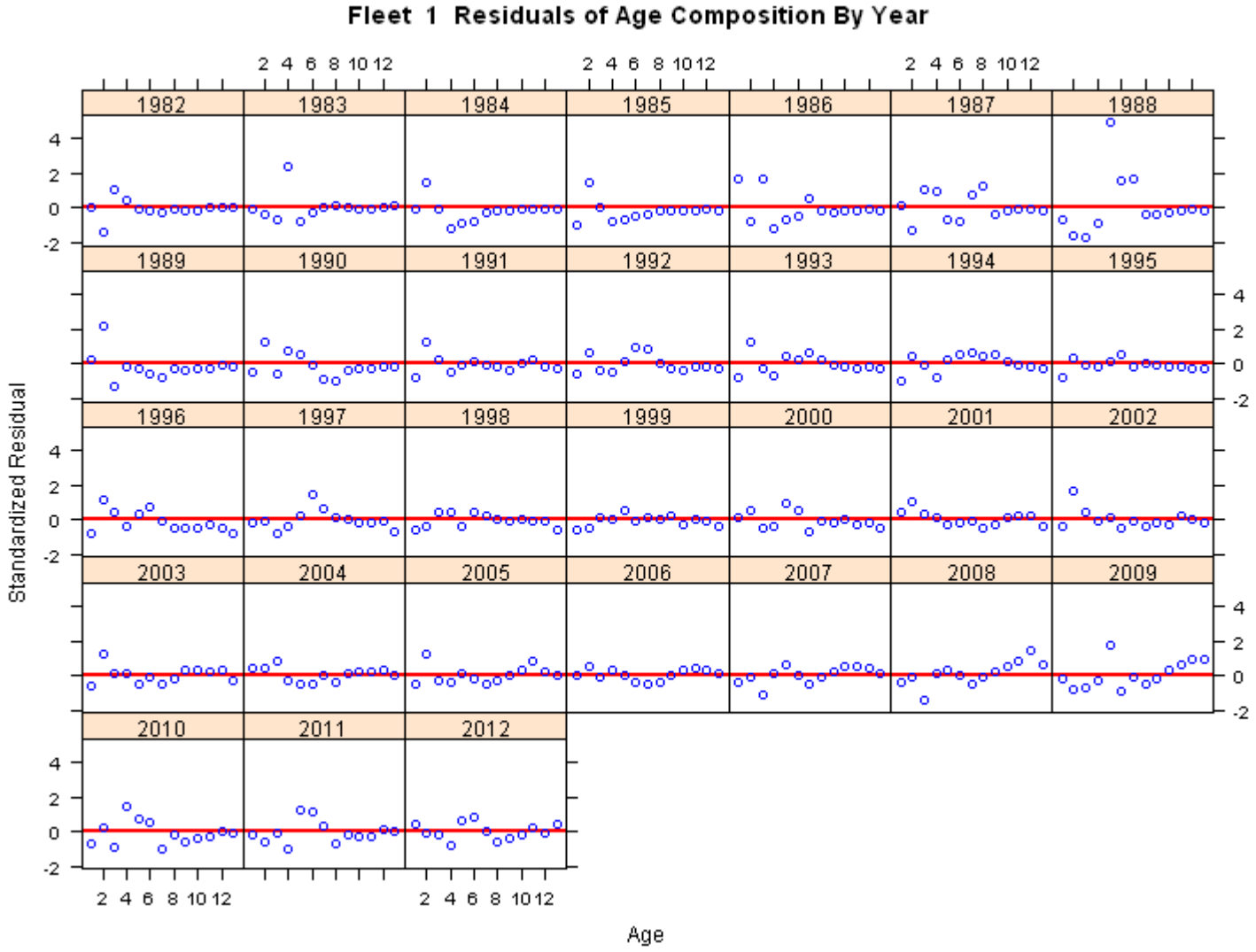


Figure 2 cont.

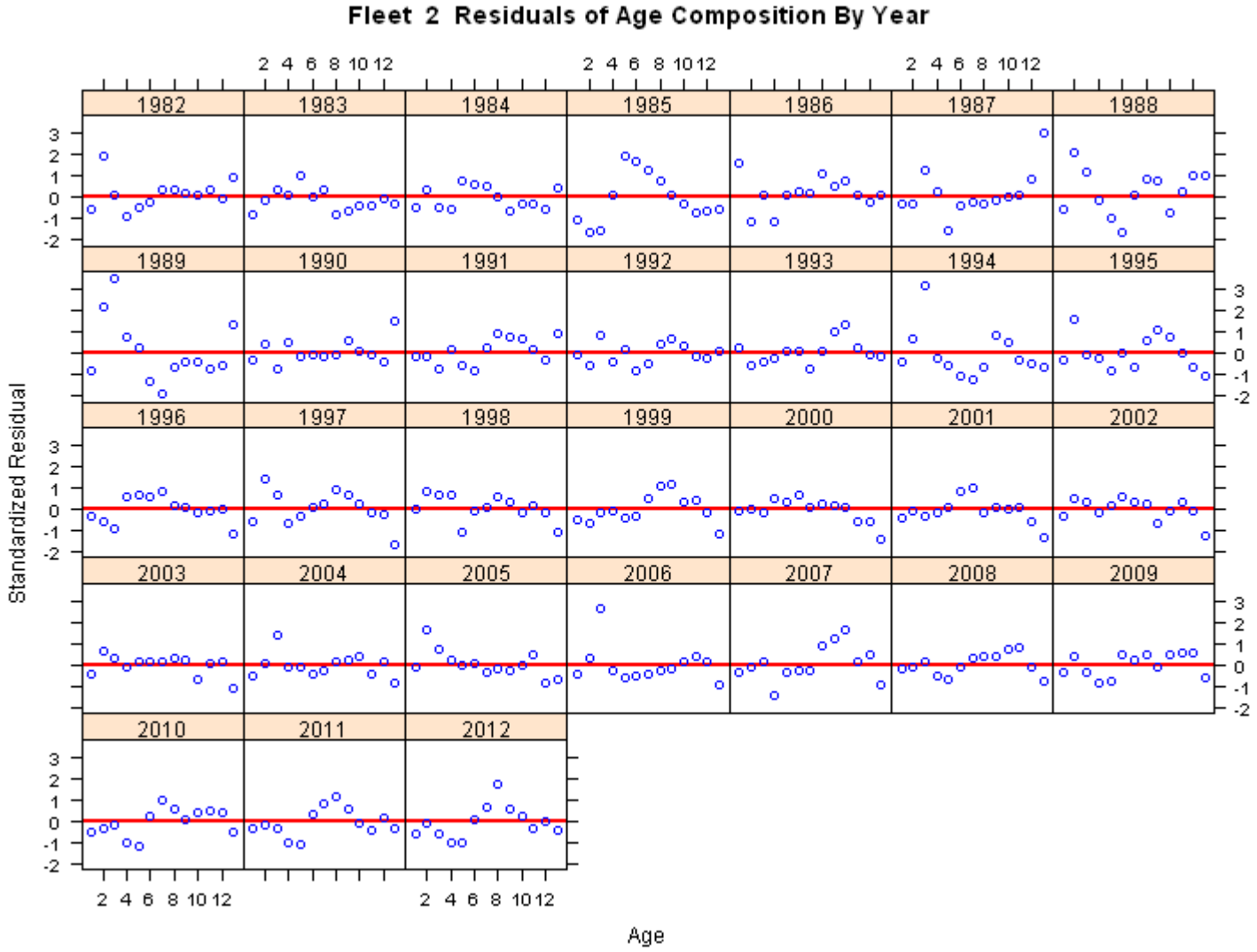


Figure 2 cont.

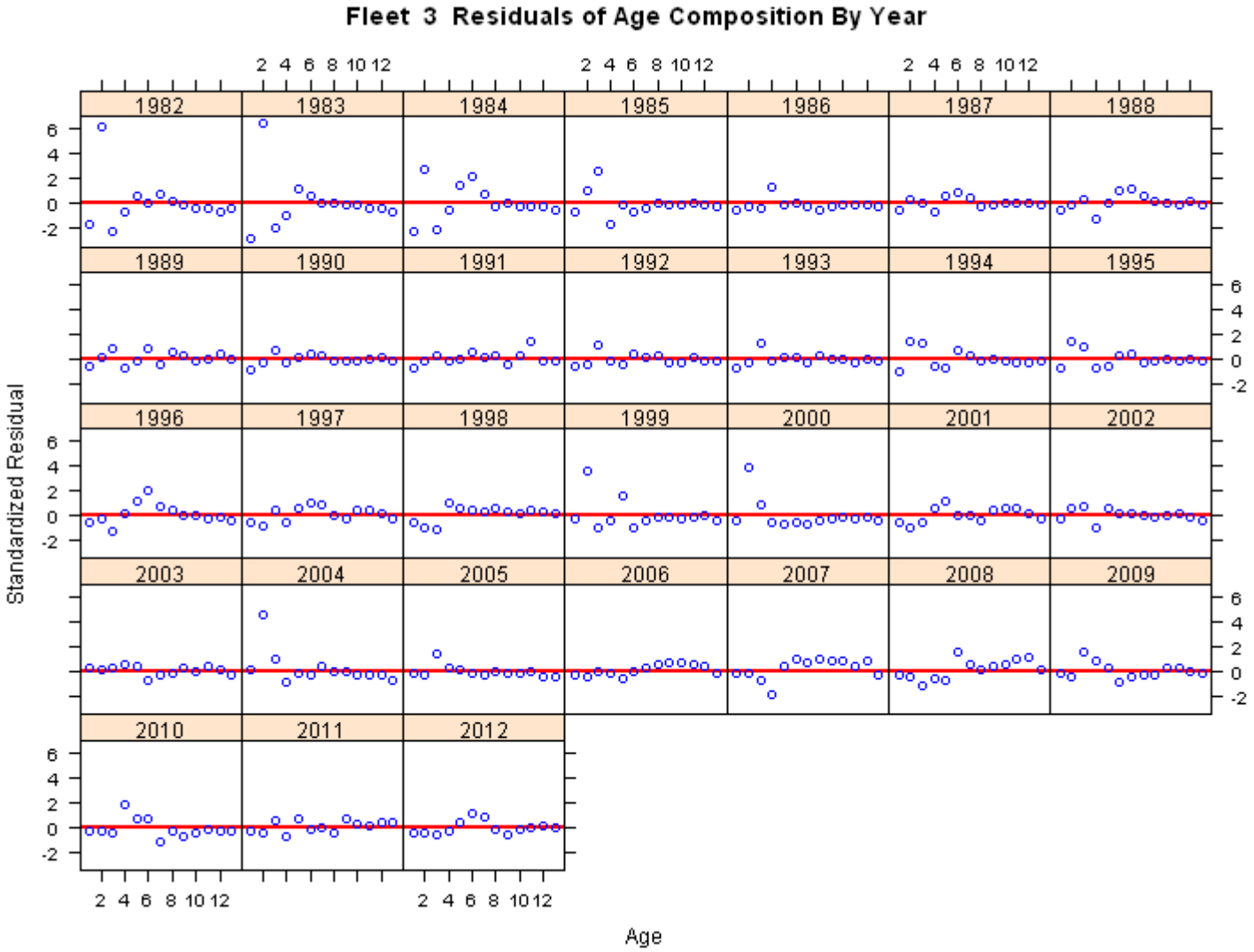


Figure 3 .Observed and predicted catch proportions-at-age by age for each fleet

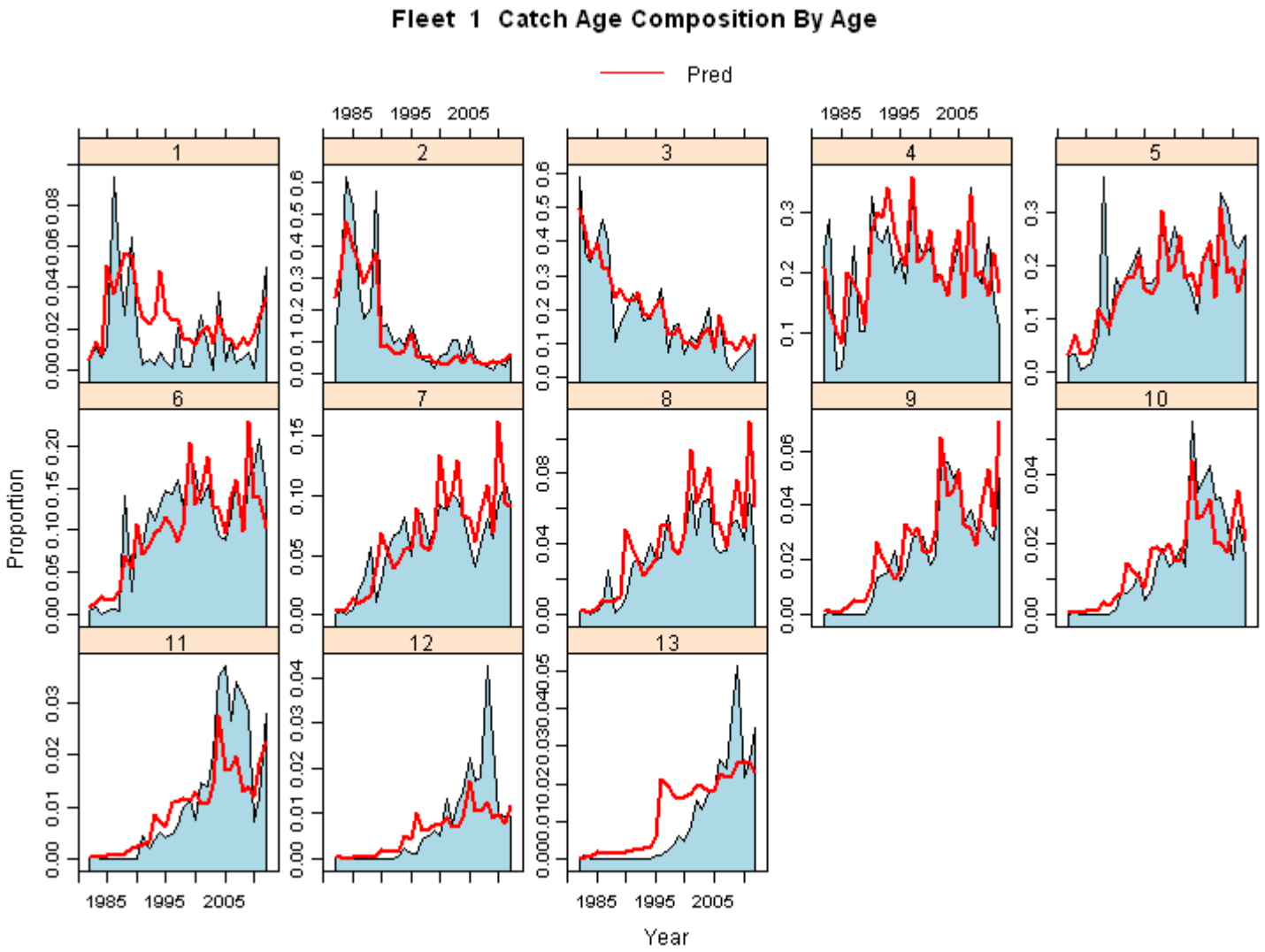


Figure 3 cont.

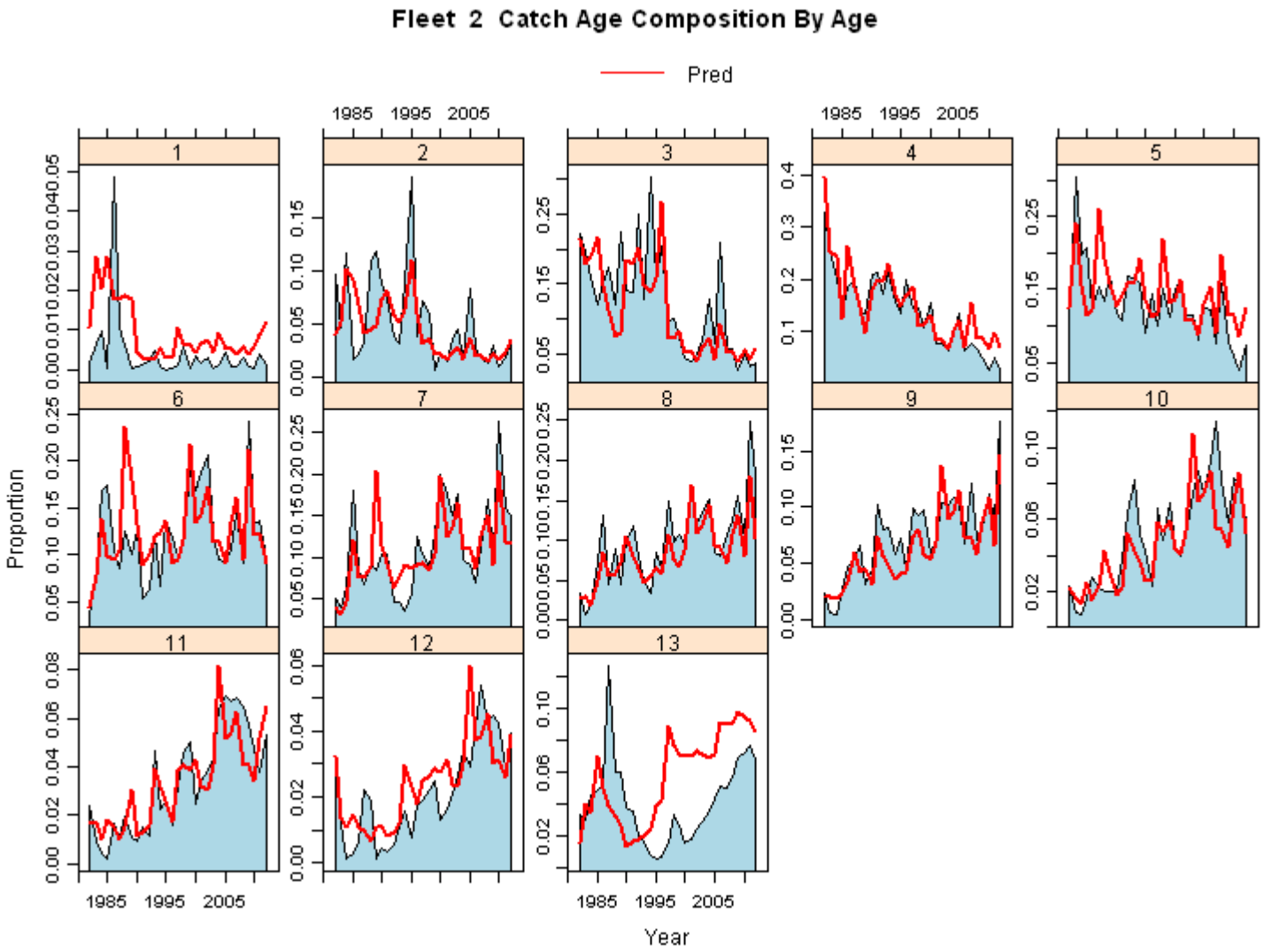


Figure 3 cont.

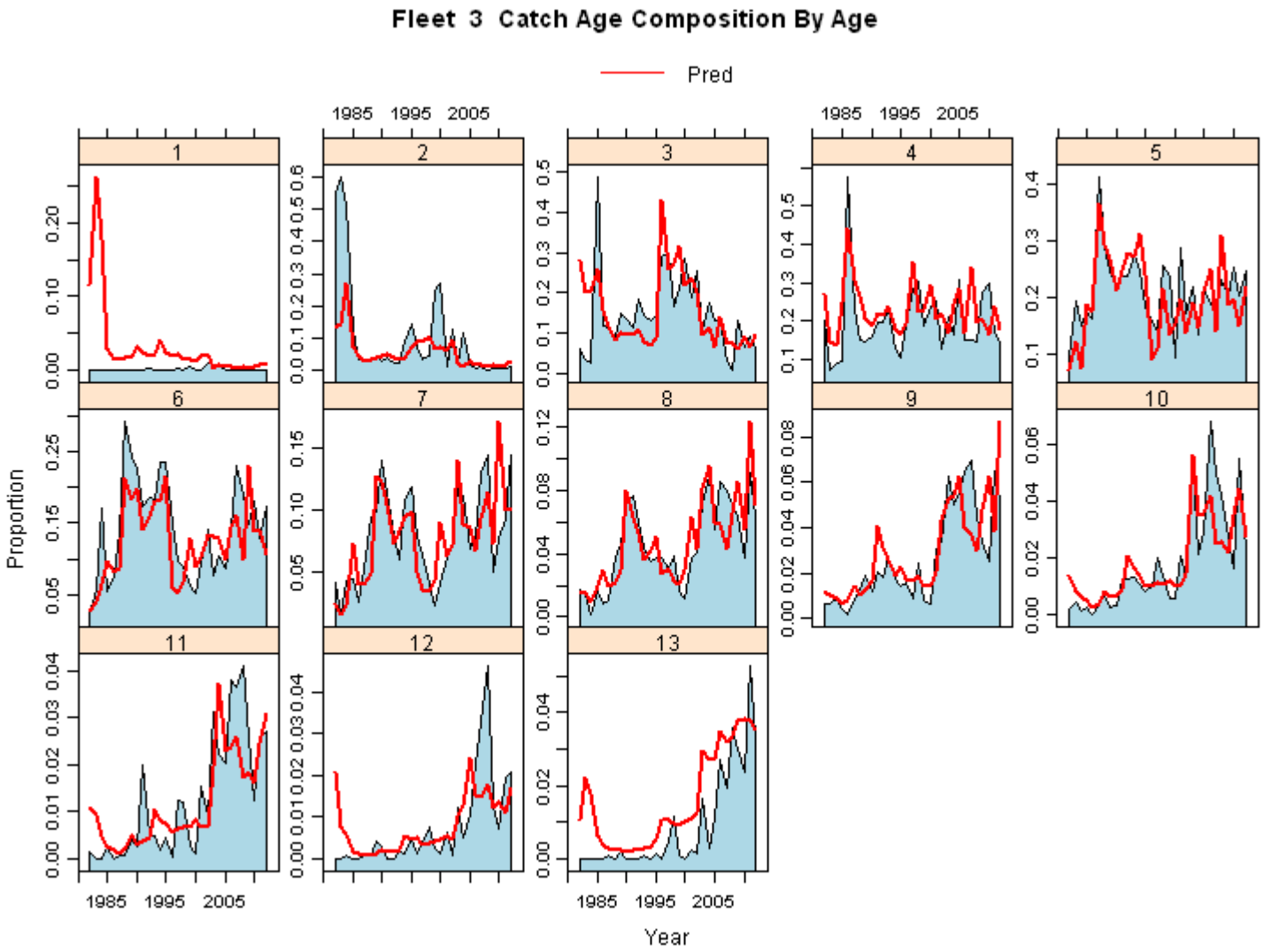


Figure 4. Standardized residuals of catch proportions-at-age by age.

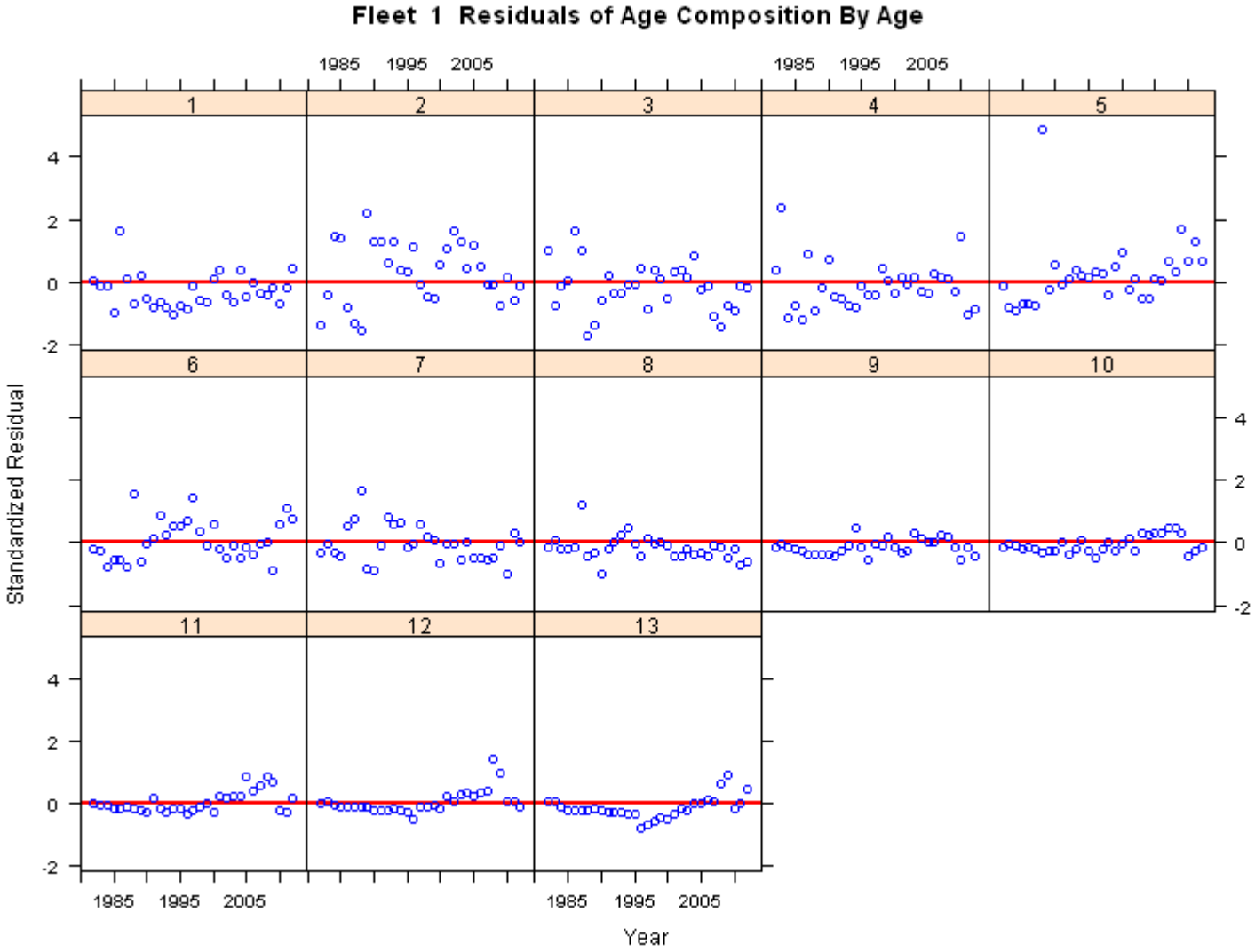


Figure 4 cont.

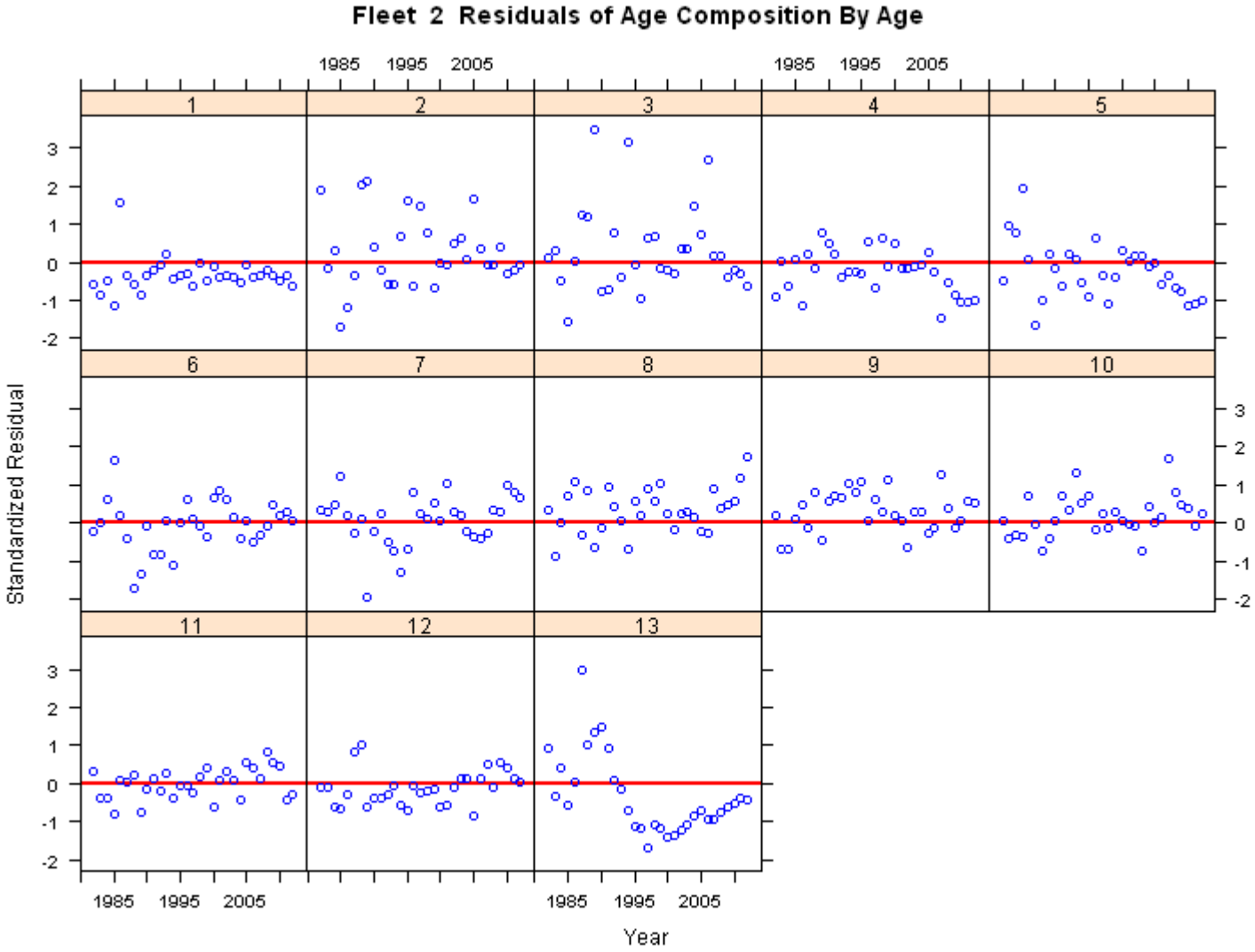


Figure 4 cont.

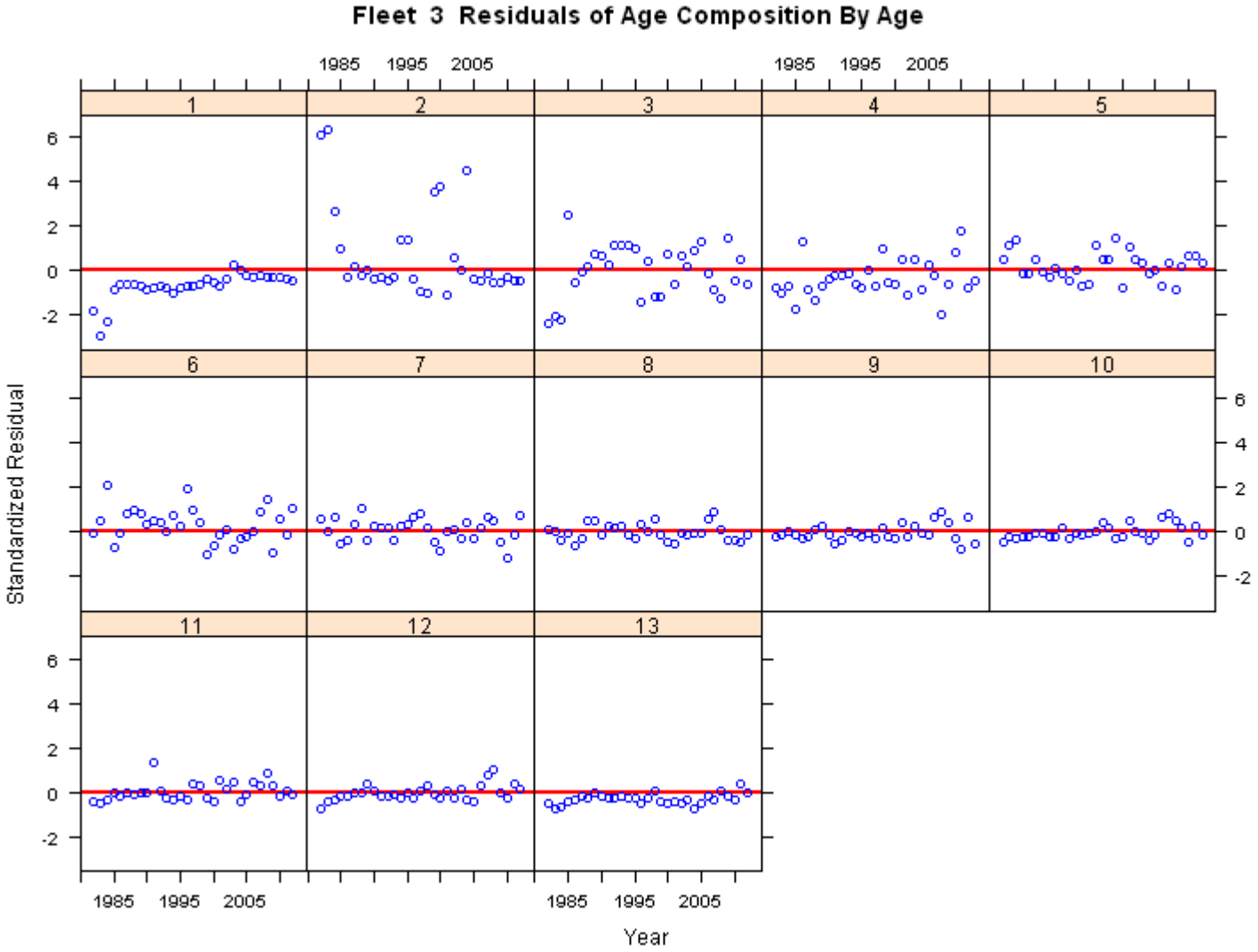


Figure 5. Observed and predicted values and standardized residuals for young-of-the-year and yearling surveys tuned to Age 1 and 2, respectively.

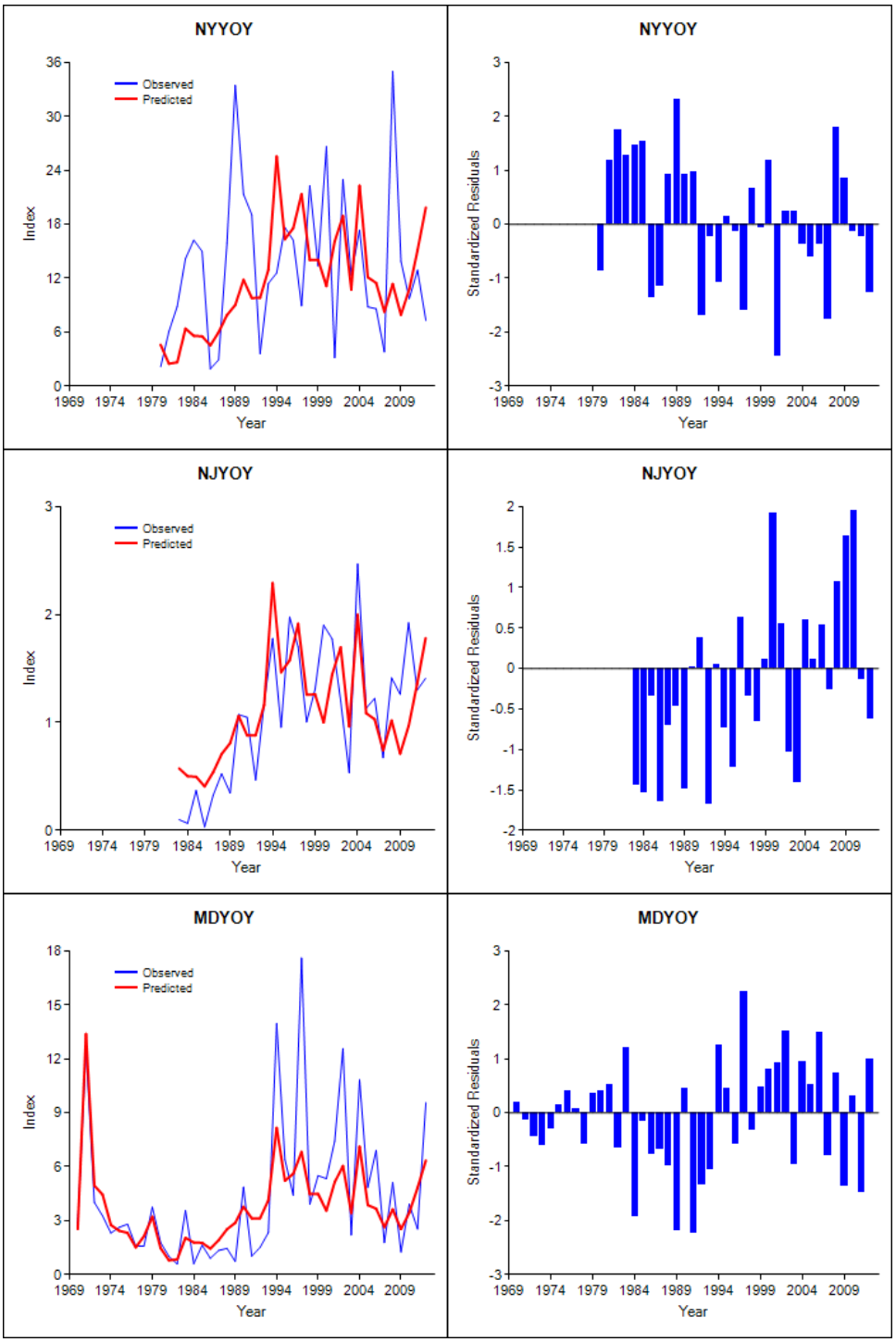


Figure 5 cont.

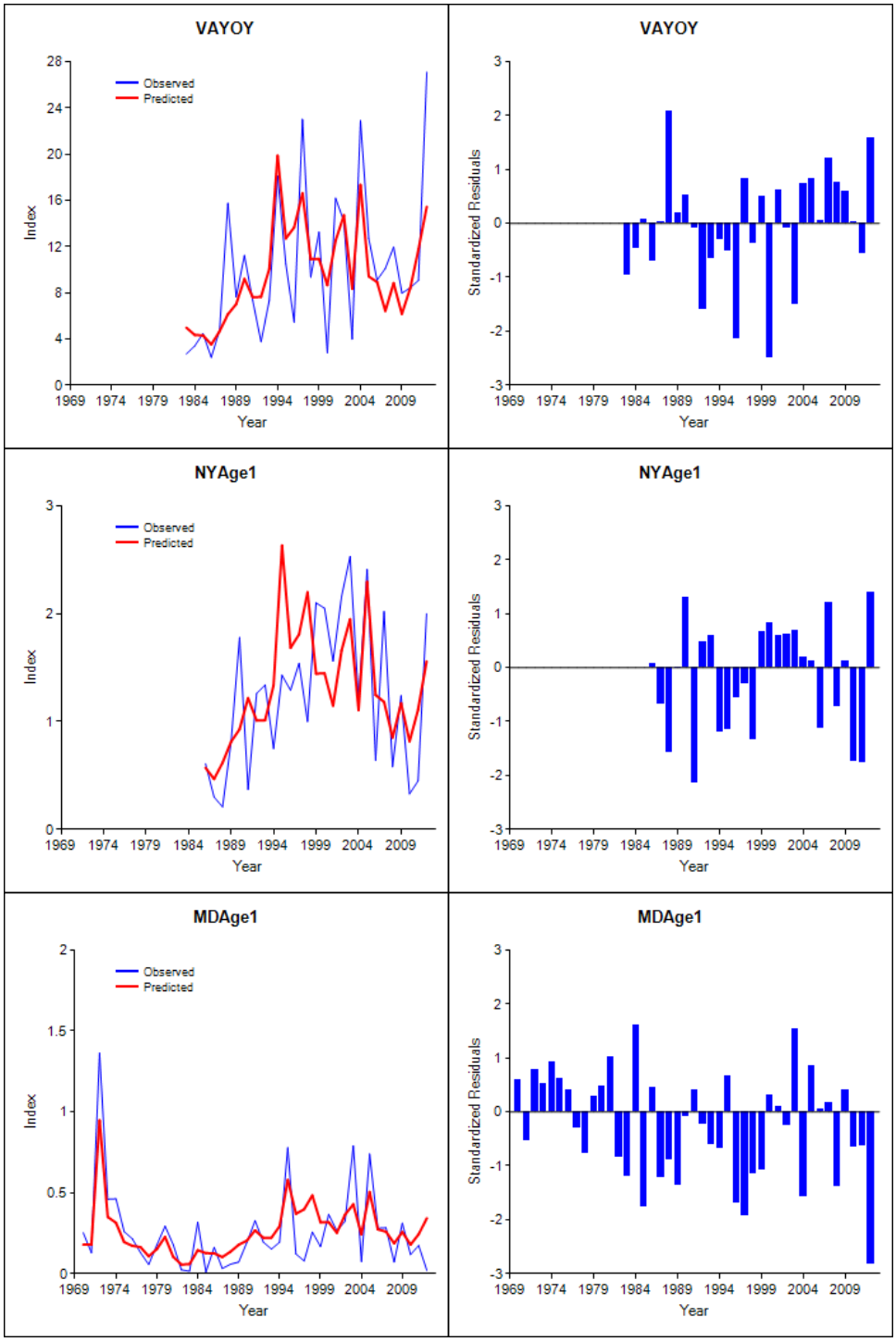


Figure 6. Observed and predicted values and standardized residuals for age-aggregated surveys.

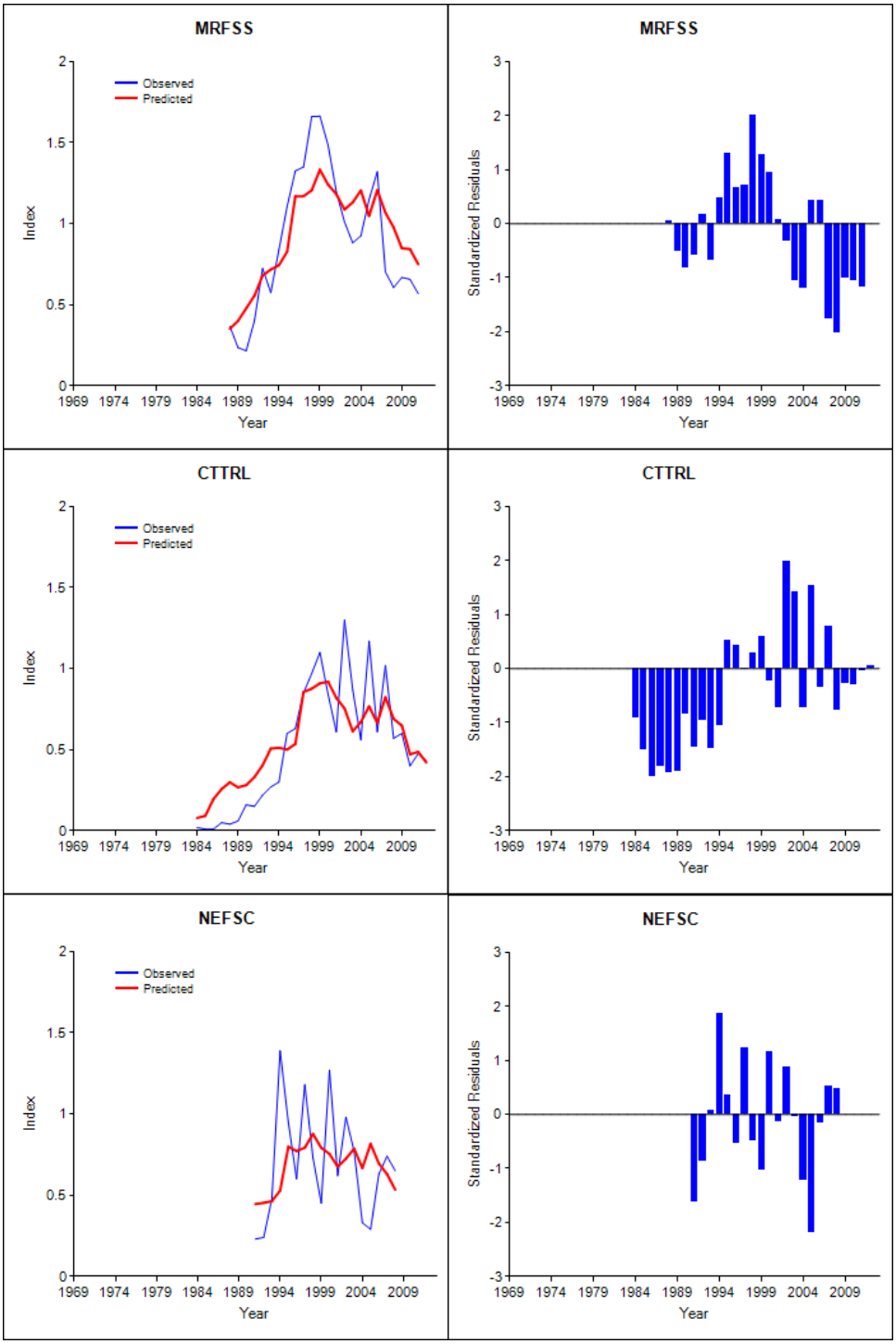


Figure 7. Observed and predicted values of the total index and standardized residuals for surveys with age composition data.

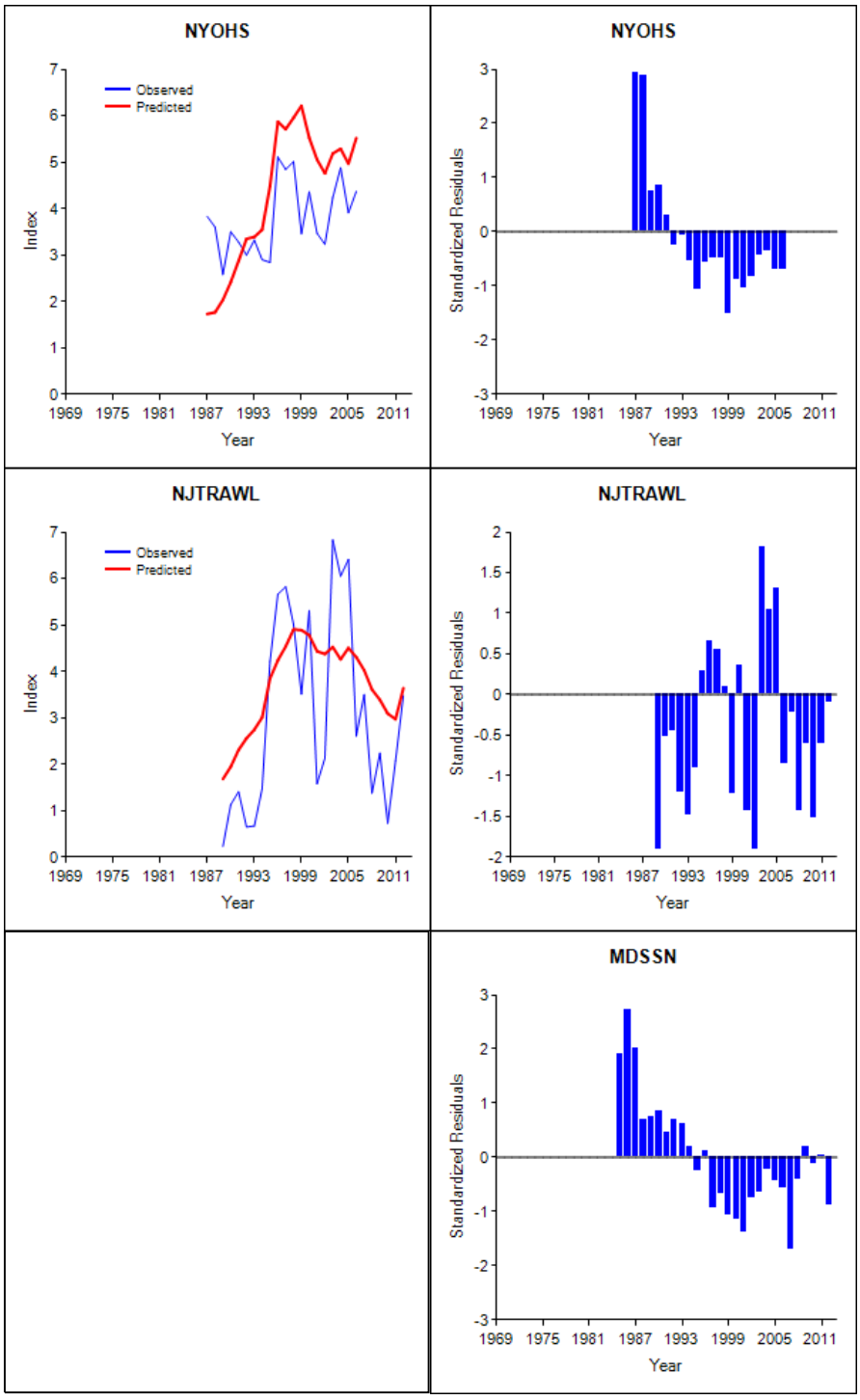


Figure 7 cont.

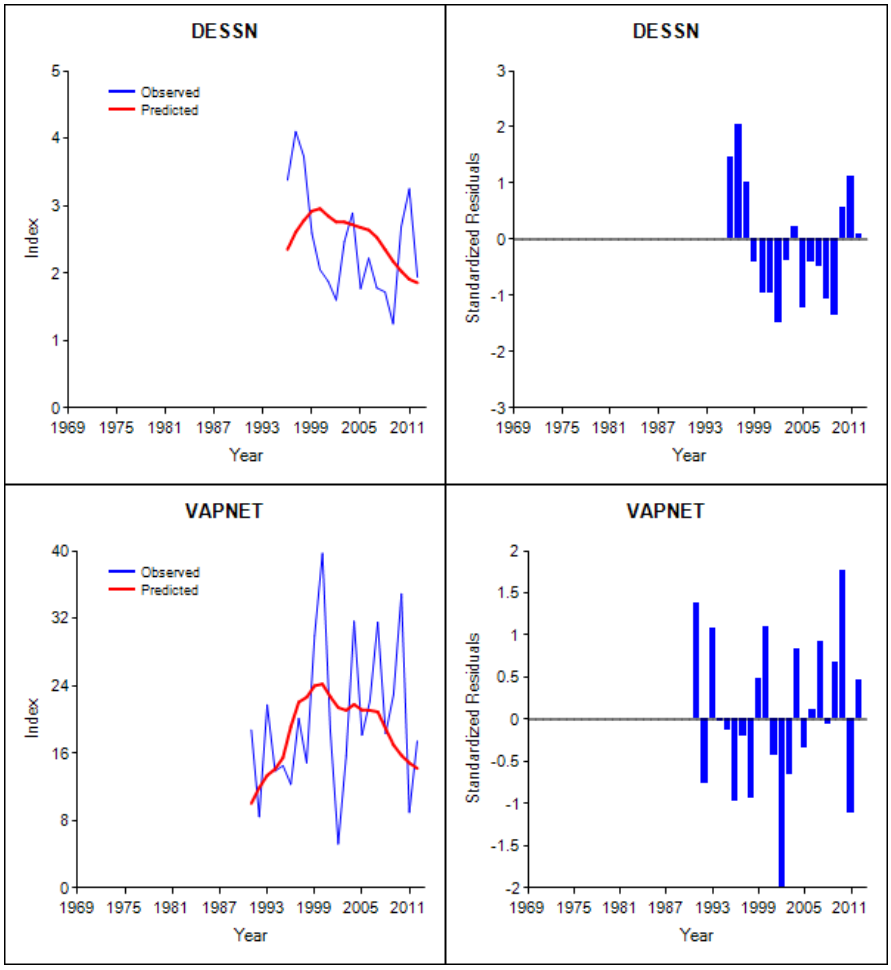


Figure 8. Selectivity patterns estimated for the NYOHS, NJ Trawl, MD SSN, DE SSN surveys and VAPNET.

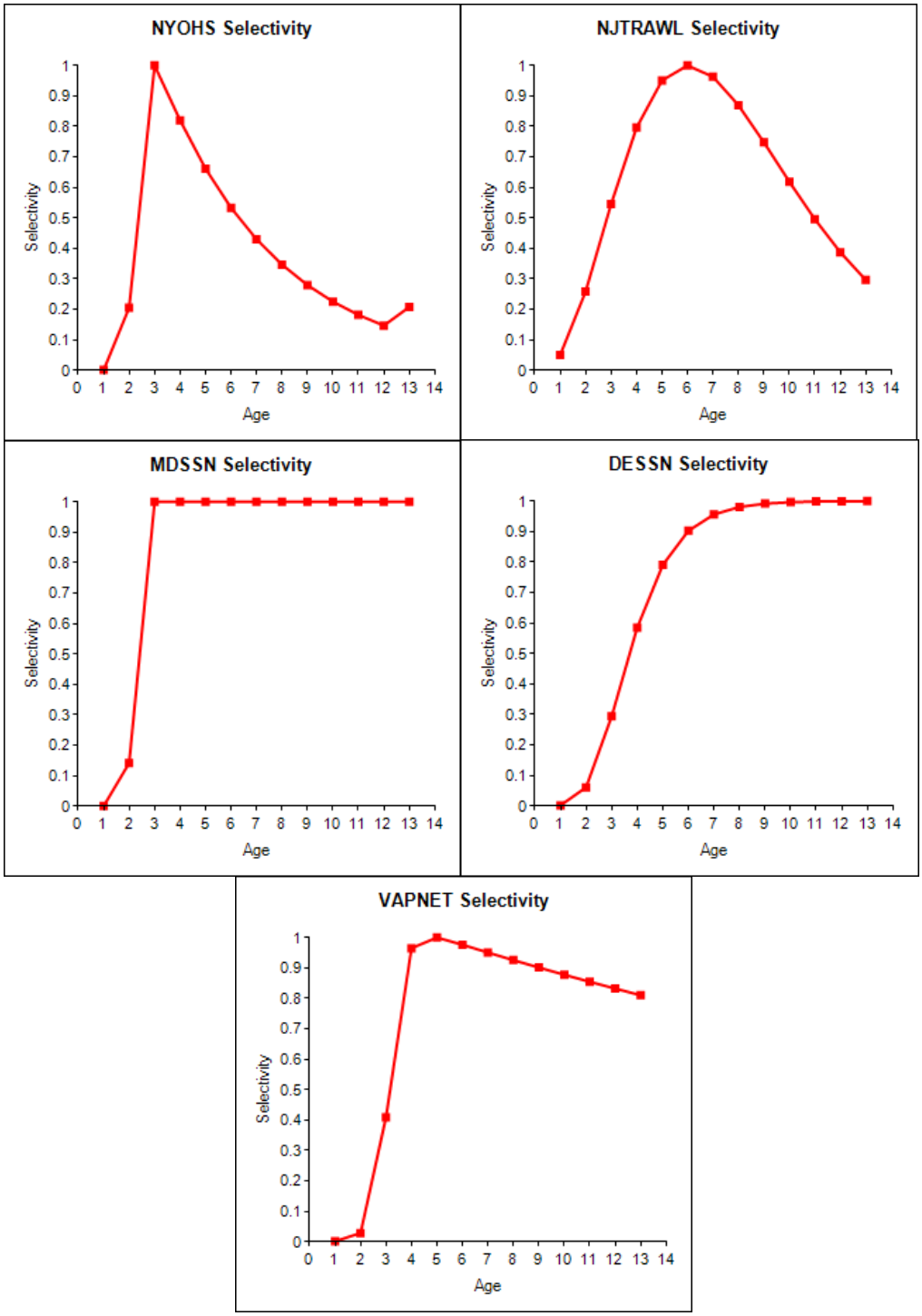


Figure 9. Observed and predicted proportions-at-age and standardized residual for each age by year for the NYOHS survey.

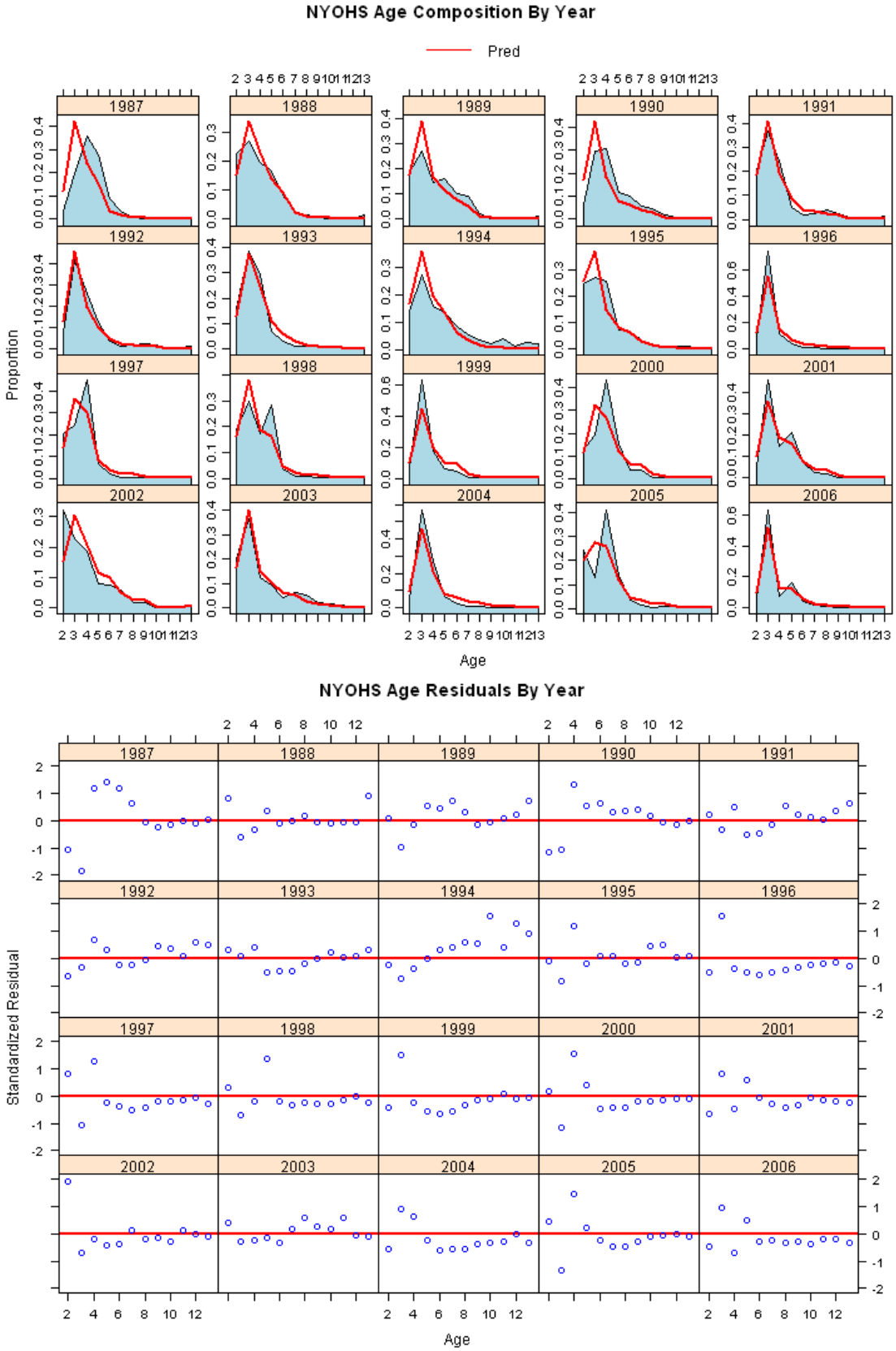


Figure 10. Observed and predicted proportions-at-age and standardized residual for each year by age for the NYOHS survey.

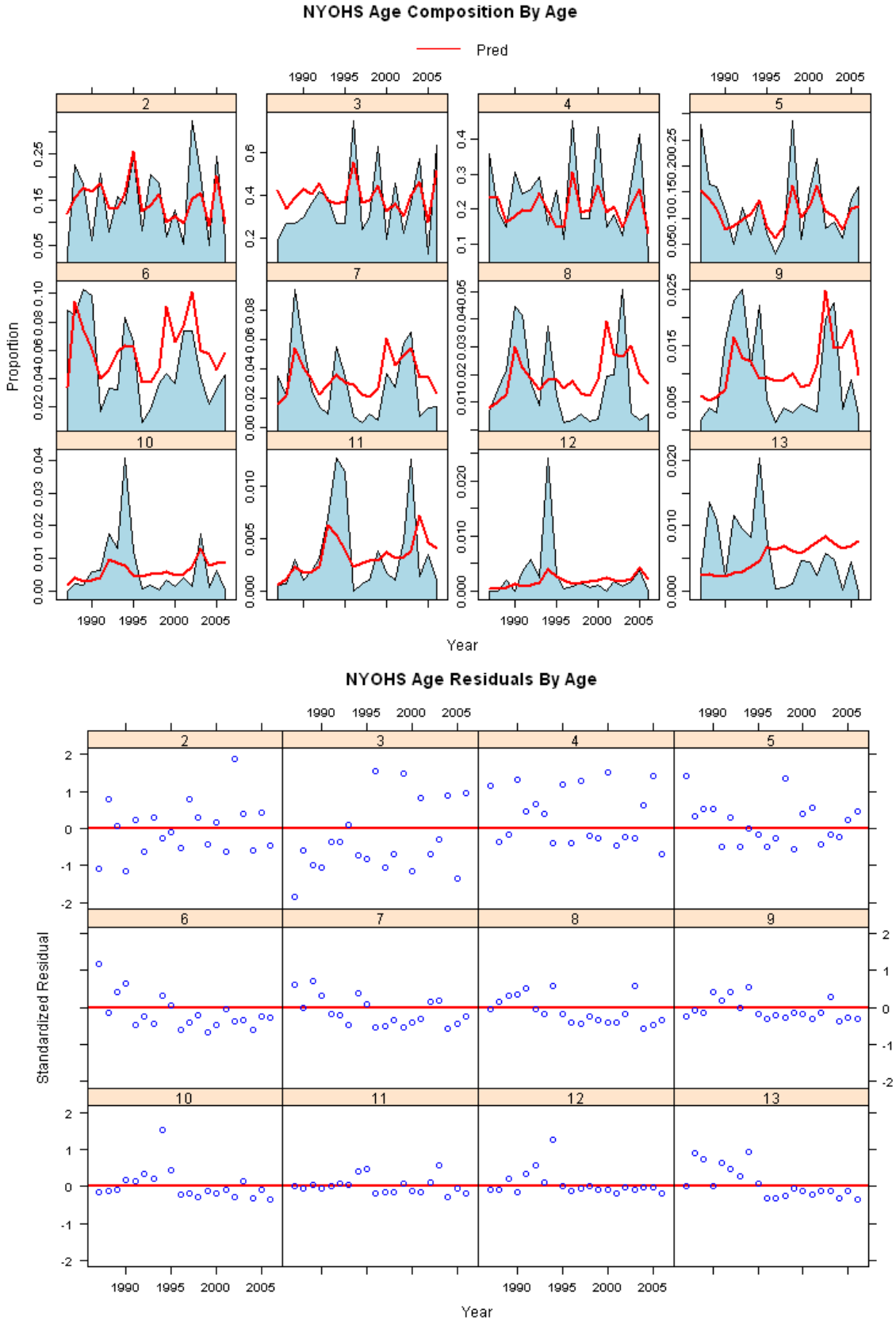


Figure 11. Observed and predicted proportions-at-age and standardized residuals for each age by year for the NJ Trawl survey.

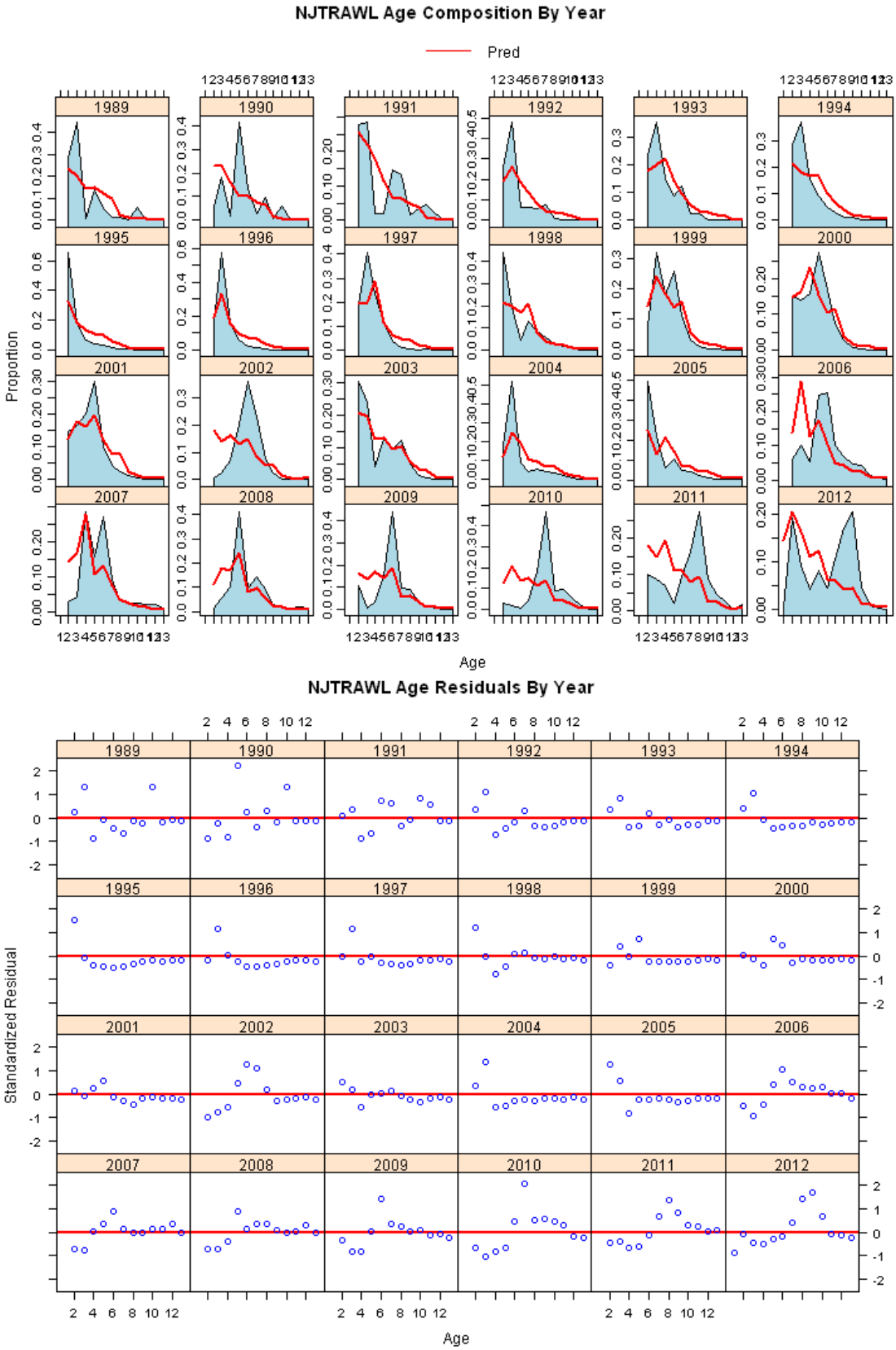
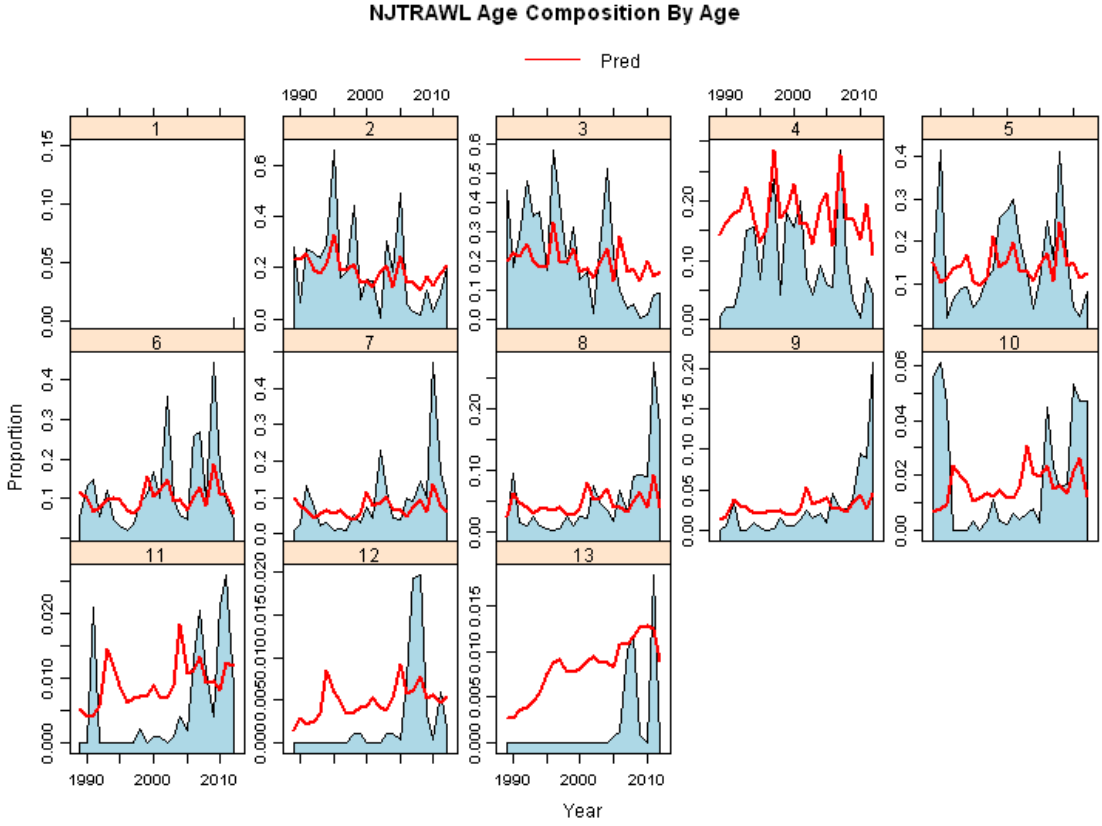


Figure 12. Observed and predicted proportions-at-age and residuals for each year by age for the NJ Trawl survey.



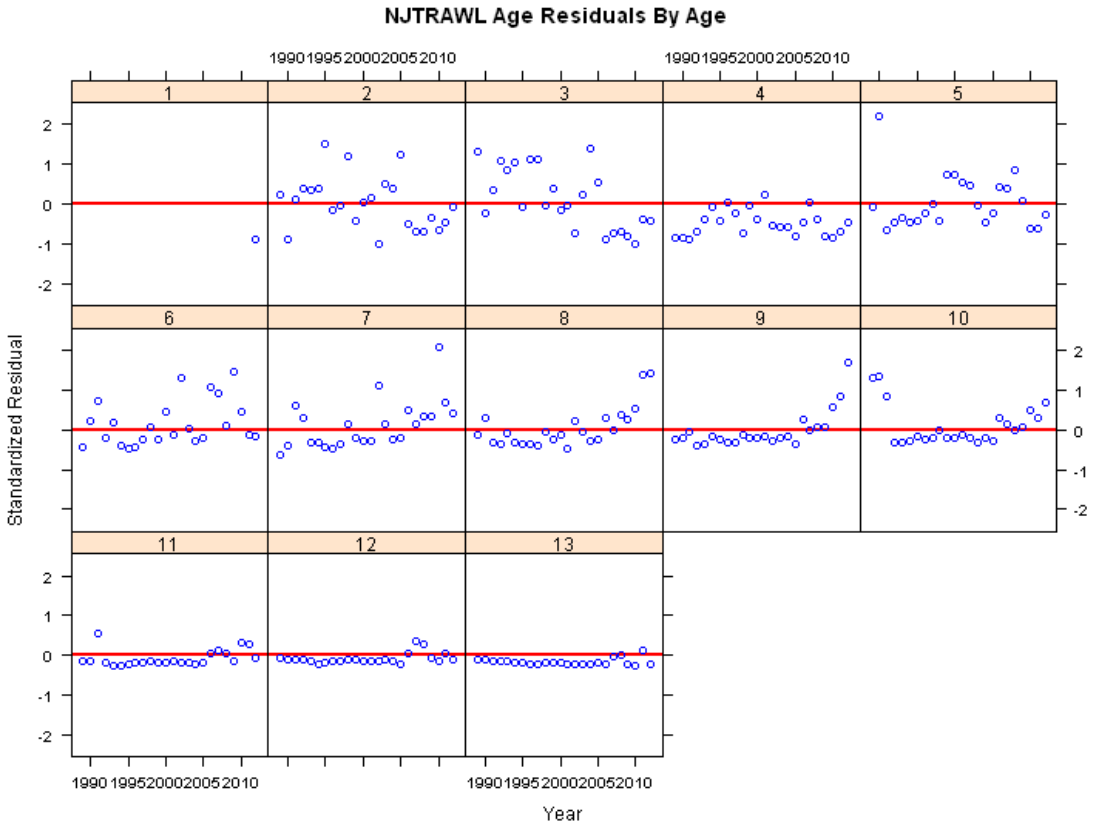


Figure 13. Observed and predicted proportions-at-age for each age by year for the MD SSN gillnet survey.

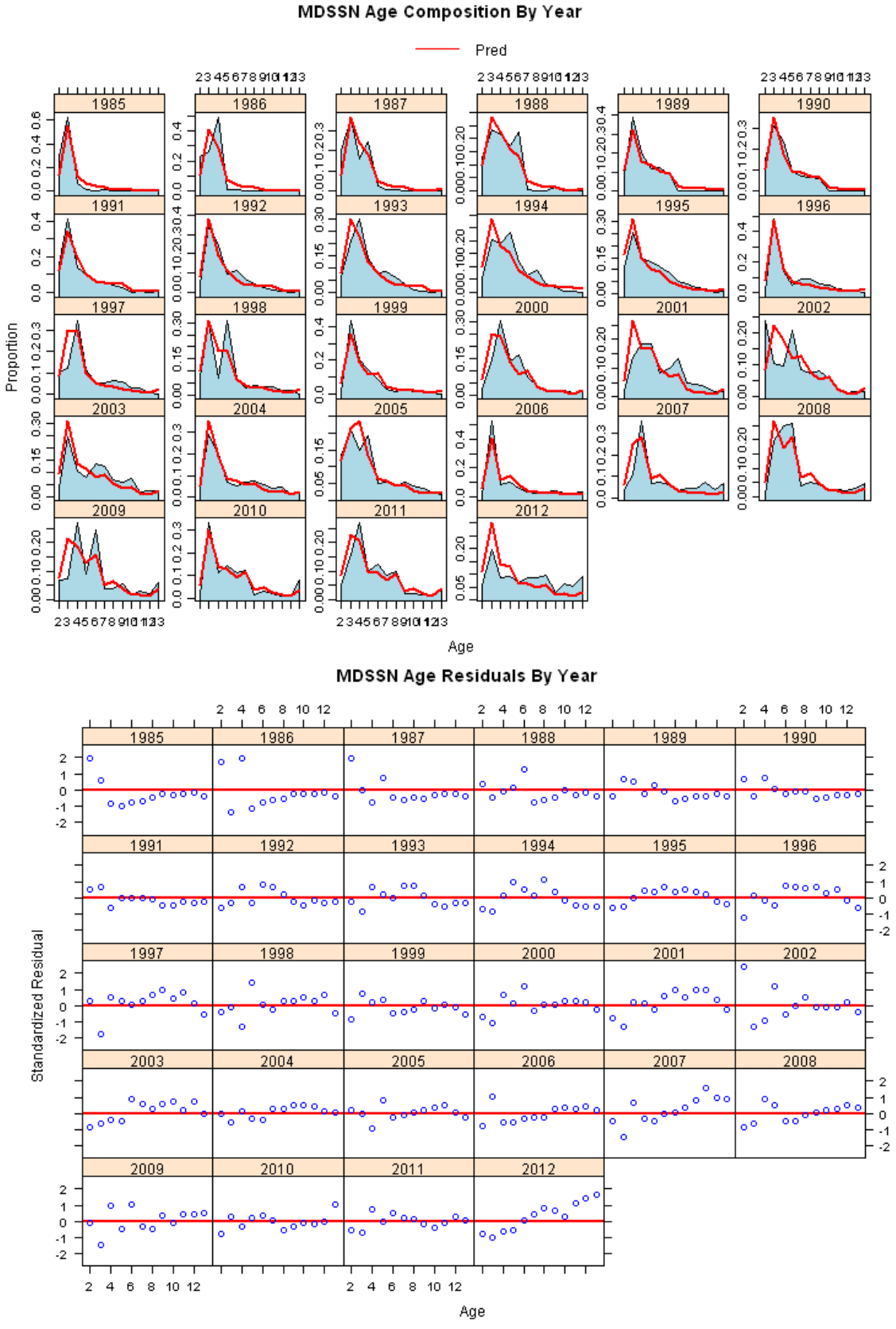
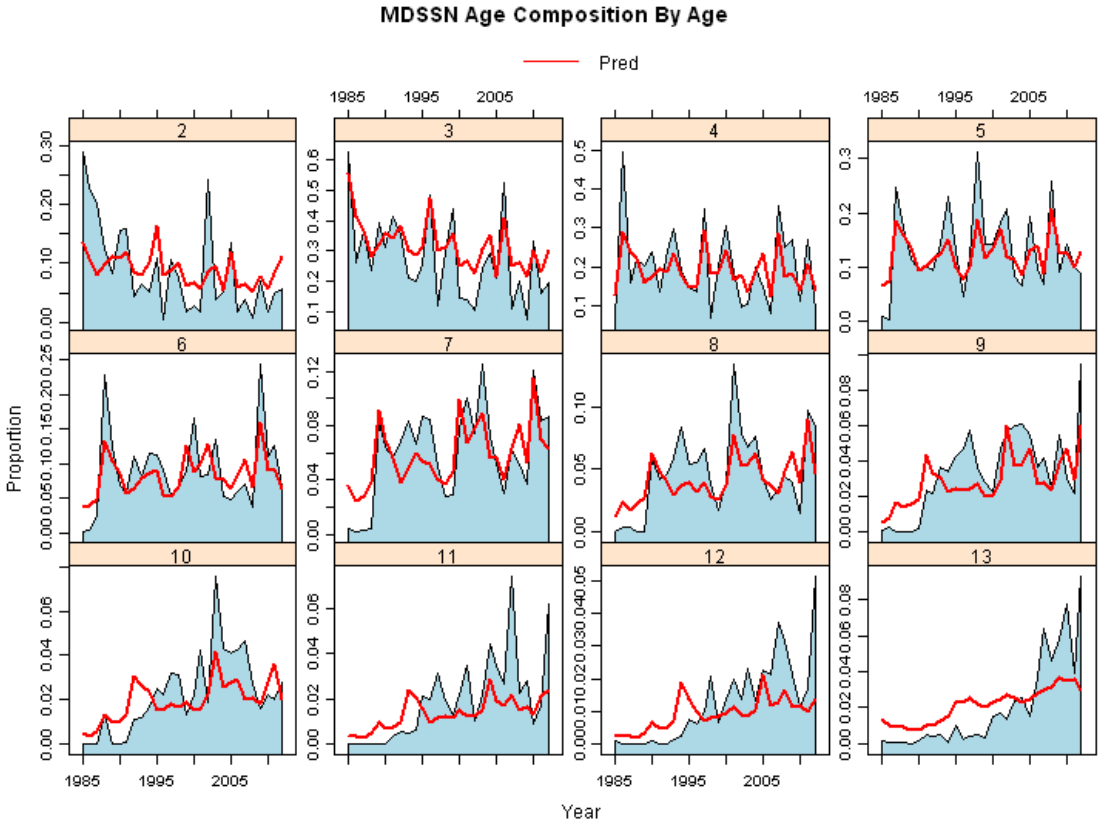


Figure 14. Observed and predicted proportions-at-age and standardized residuals for each year by age for the MD SSN gillnet survey.



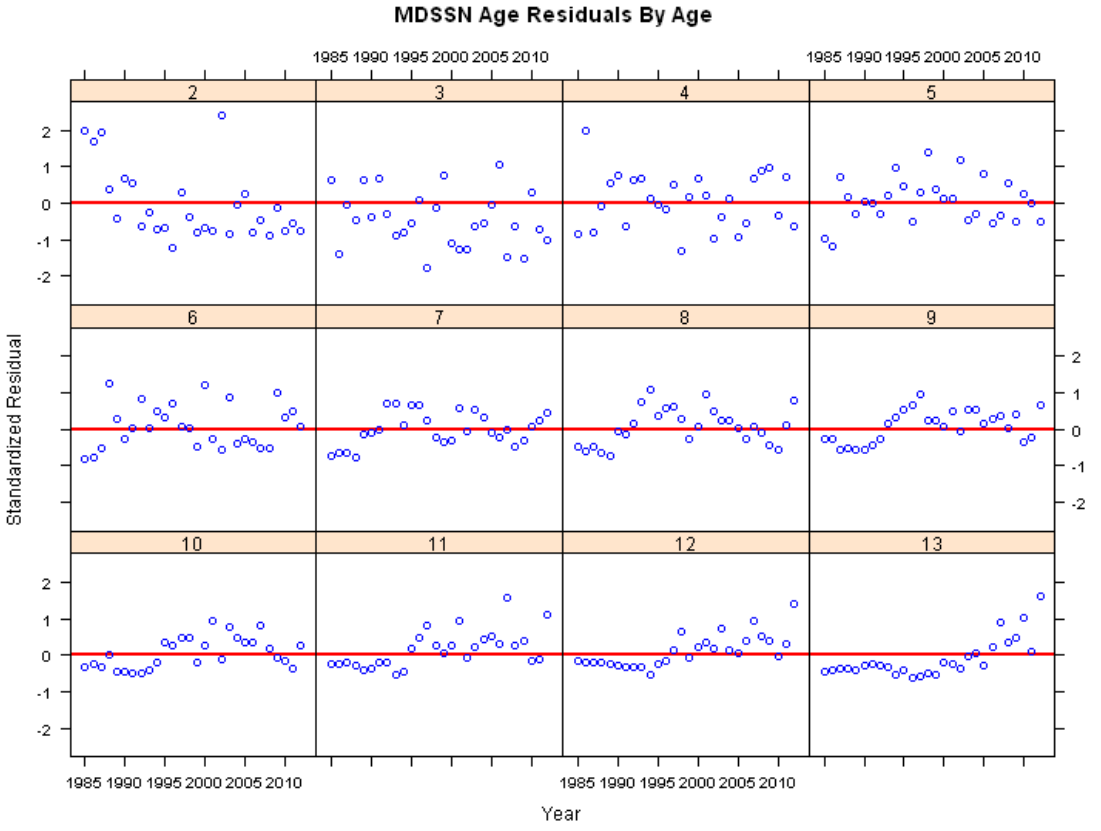


Figure 15. Observed and predicted proportions-at-age and standardized residuals for each age by year for the DE SSN electrofishing survey.

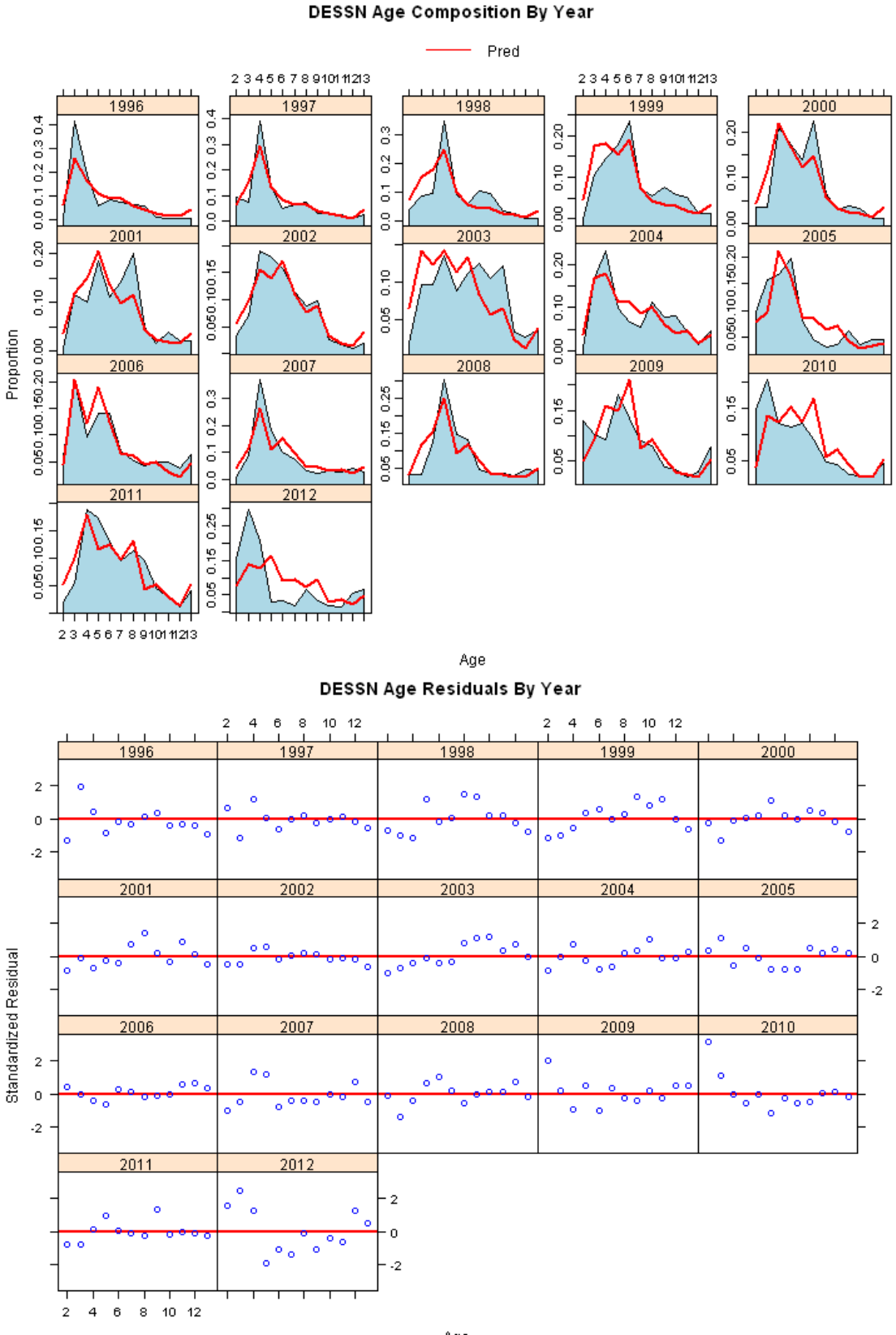


Figure 16. Observed and predicted proportions-at-age and standardized residuals for each year by age for the DE SSN electrofishing survey.

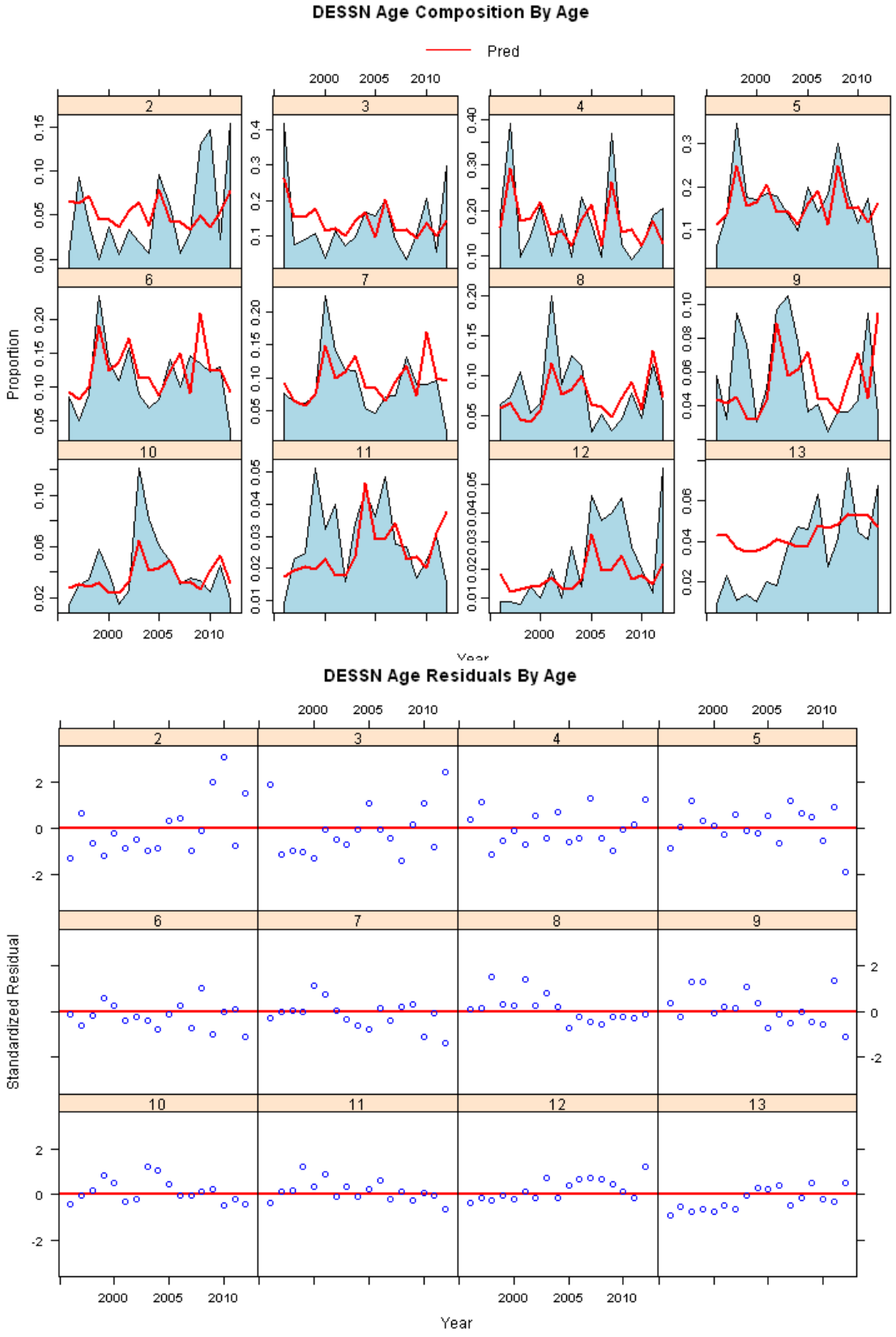


Figure 17. Observed and predicted proportions-at-age and standardized residuals for each age by year for the VAPNET survey.

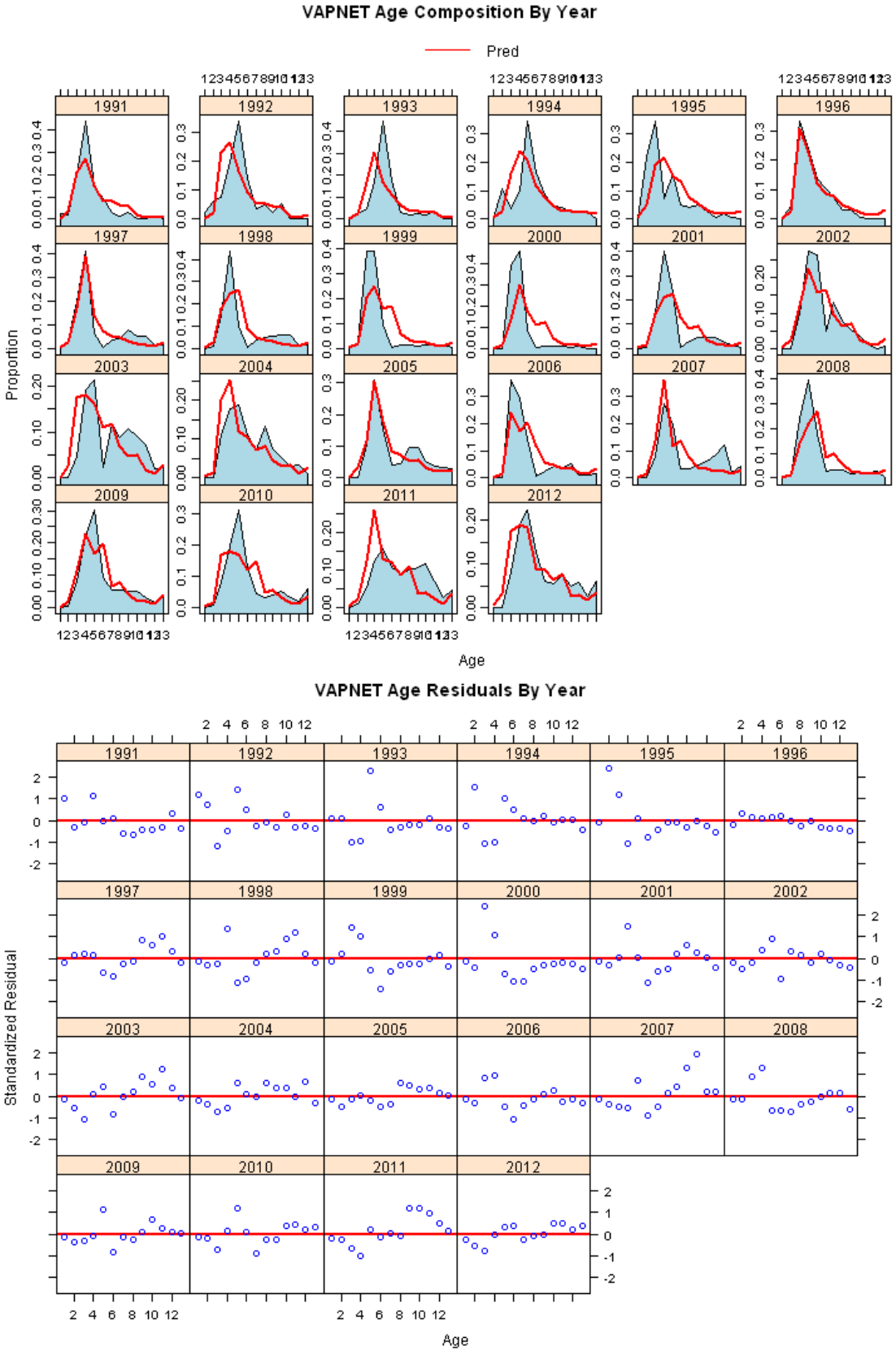
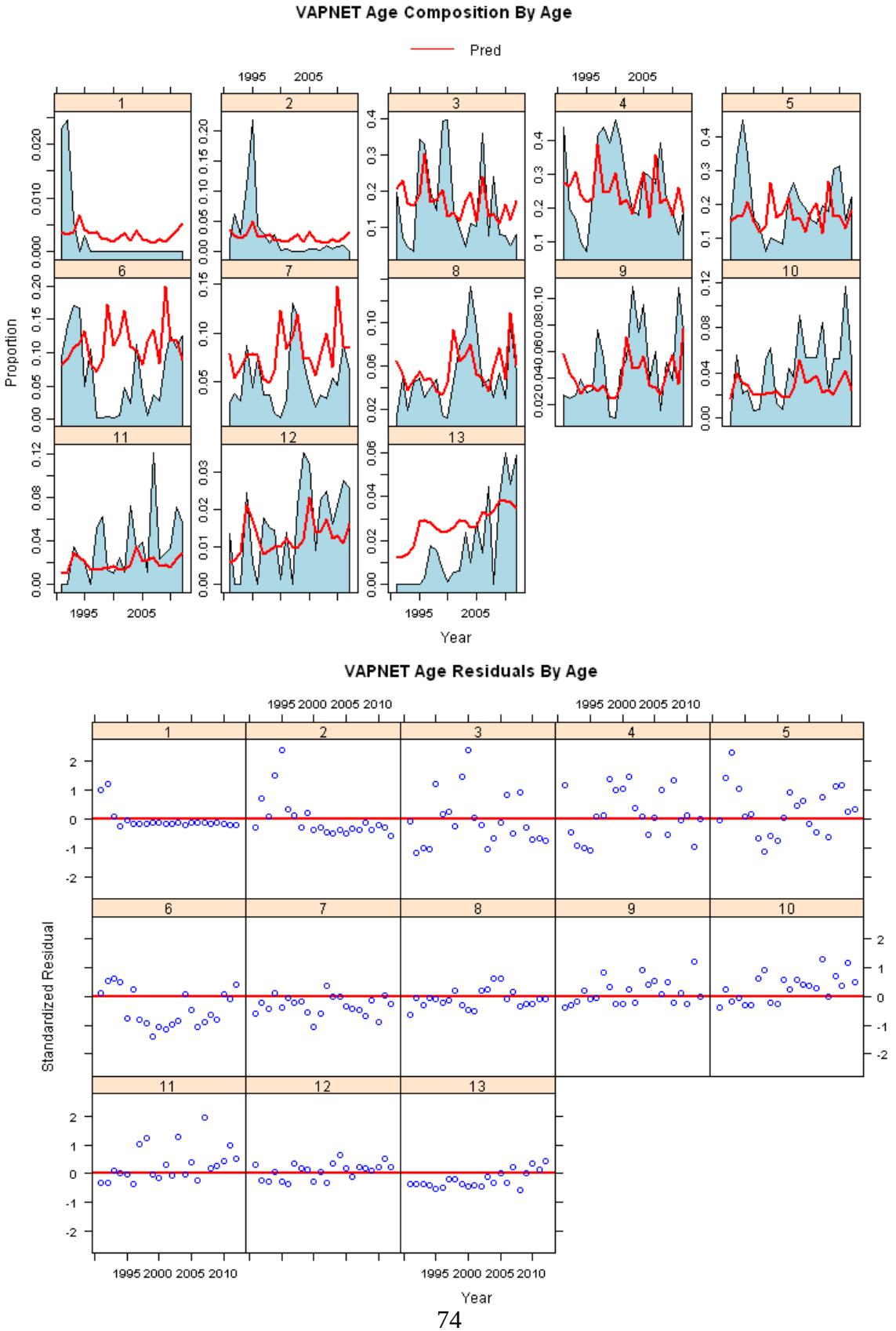


Figure 18. Observed and predicted proportions-at-age and standardized residuals for each year by age for the VAPNET survey.



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

October 10, 2013

TO: **Atlantic Striped Bass Management Board**

FROM: **Mike Waine, FMP Coordinator**

RE: **2013 Atlantic Striped Bass Benchmark Stock Assessment Reports**

Enclosed please find the benchmark stock assessment updated with finalized 2012 landings data and the peer review summary report from the 57th Stock Assessment Review Committee.

Please recall the benchmark assessment was completed using preliminary 2012 landings data (final landings data were not available at the time of the assessment workshop). Following the peer review summary report release in September 2013, the TC updated the assessment with the final 2012 landings data. Therefore, the information in the updated benchmark assessment will have slightly different final numbers then the SAW/SARC summary report (see enclosures).

Please let me know if you have any questions (mwaine@asmfc.org).

Summary Report of the 57th Northeast Regional Stock Assessment Review Committee (SARC 57)

Stock Assessment Review Committee (SARC) Meeting
23-26 July 2013
Northeast Fisheries Science Center
Wood's Hole, Massachusetts

Prepared by the Stock Assessment Review Committee
Benchmark Assessments for Summer Flounder and Striped Bass (SAW/SARC 57)

16 August 2013

SARC 57 Panel Members

Cynthia M. Jones (Chair)
Robin Cook
John Simmonds
Henrik Sparholt

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1. Introduction

1.1 Background

The 57th SARC (Stock Assessment Review Committee) met in the Aquarium Conference Room at NOAA's Northeast Fisheries Science Center in Woods Hole, MA from 23-26 July 2013 to review stock assessments for summer flounder (*Paralichthys dentatus*) and striped bass (*Morone saxatilis*). The review committee was composed of Dr. Cynthia M. Jones (MAFMC SSC and Old Dominion University Center for Quantitative Fisheries Ecology, Chair) and three scientists appointed by the Center for Independent Experts: Dr. Robin Cook (Senior Research Fellow, MASTS Population Modelling Group, University of Strathclyde, Glasgow), Dr. Henrik Sparholt (Deputy Head of Advisory Department, ICES Secretariat), and Mr. John Simmonds (Vice Chair of the ICES advisory committee dealing the provision of fisheries advice).

The SARC was assisted by the NEFSC Stock Assessment Workshop (SAW) Chairman, Dr. James Weinberg, Ms. Anne O'Brian, and staff, especially Dr. Paul Rago (NEFSC). Supporting documentation for the summer flounder assessment was prepared by the Southern Demersal Working Group (SDWG), and presentations at the meeting on summer flounder were made by Dr. Mark Terceiro (NEFSC). Materials for the striped bass assessment were prepared by the ASMFC striped bass Technical, Stock Assessment, and Tagging Committee and presentations were made by Dr. Gary Nelson (MA DNR). Heather Corbett (NJ DFW), and Dr. Alexi Sharov (MD DNR). Rapporteurs were provided for each session of the SARC meeting by the NEFSC. A total of 36 people participated in the SARC 57 meeting.

1.2 Review of Activities and SARC Process

Before the meeting, assessment documents and supporting materials were made available to the SARC Panel via a server on the NEFSC website. On the morning of 23 July 2013, before the meeting, the SARC panel met with Drs. Weinberg and Rago to review and discuss the meeting agenda (See Appendix, Annex 3), reporting requirements, and meeting logistics. During the SARC meeting, background and working documents were available electronically and in print. The meeting opened on the morning of Tuesday 23, July, with welcoming remarks and comments on the agenda by Dr. Weinberg and Dr. Jones. All participants and audience members were introduced at the opening of the SARC meeting and at each of the sessions during the first three days of the meeting. Following introductions, sessions on 23 July were devoted to presentations and discussion of the summer flounder assessment. During this meeting, Dr. Steve Martell, representing the Save the Summer Flounder Fishery Fund (SSFFF), presented comments to the SARC concerning alternative stock assessment approaches

constructed by sex, from a five-page analysis that was made available to the committee (but without time for proper review by the SARC). Striped bass assessment and discussion sessions were conducted on the morning and afternoon of 24 July, followed by continued discussion of the summer flounder assessment in the late afternoon. In that session, the SARC Panel requested additional analysis of the striped bass assessment to re-evaluate the BRPs and projections as consistently empirical or fully parametric.

Follow-up discussion on the striped bass assessment took place in the morning of 25 July. The afternoon of 25 July was spent reviewing and editing the Summer flounder and Striped bass Assessment Summary Reports and hearing results of the follow-up striped bass analyses. The SARC Panel spent the final day, 26 July, deliberating on whether the SAW WGs had addressed Terms of Reference (ToR) in each of the assessments and drafting elements of this Panel Summary Report.

The SARC Panel and SAW WGs worked collectively during the meeting to reach agreement and consensus on the summer flounder and striped bass assessments. The meeting was collegial. Considerable time was devoted to facilitate dialog among SARC Panel members, working group scientists, NEFSC assessment scientists, MAFMC staff, and industry representatives.

The completion of, the Assessment Summary Report for summer flounder and striped bass, with contributions by the NEFSC staff and the SARC Panel, was accomplished by correspondence on 9 August 2013. The SARC Panel completed drafting this Summary Report by correspondence, evaluating each ToR that had been addressed by the SAW WGs. The SARC Chair compiled and edited the draft Summary Report, which was distributed to the Panel for final review before being submitted to the NEFSC. Additionally, each of the CIE Panelists drafted and submitted an independent reviewer's report to the NEFSC.

The SARC Panel agreed that each of the assessments (Atlantic summer flounder and striped bass) was effective in delineating stock status, determining *BRP*s and proxies, and in projecting probable short-term trends in stock biomass, fishing mortality, and catches. Issues and concerns related to each of the stock assessments are discussed below. The SARC process was effective in structuring a critical review of the work of the SAW WGs and in identifying areas of concern and needs for additional work in future assessments.

2. Review of Summer Flounder

The summer flounder, *Paralichthys dentatus* (Linnaeus, 1766), is an important part of the US east coast fisheries. Its range extends from Nova Scotia in the north to Florida in

the south, but it is most abundant in the region extending from Cape Cod to Cape Hatteras in North Carolina, i.e. the Mid-Atlantic Bight (MAB) (Wilk *et al.*, 1980; Packer *et al.*, 1999). Summer flounder is a migratory species that moves every year from the estuaries to the continental shelf on a seasonal basis (Wilk *et al.*, 1980; Sackett *et al.*, 2007). As reviewed by Packer *et al.* (1999), it moves into the warmer waters of estuaries and the shallow continental shelf during spring until fall, whereupon it moves back out into the deeper waters of the continental shelf to weather the winter. Adult summer flounder reproduce off New Jersey, along the Virginia-North Carolina waters, and just south of Cape Hatteras during fall-winter (Smith, 1973). The larval period may be quite protracted, extending between September and May, and the larvae drift into the coastal or estuarine systems that comprise their nursery habitats at about this time (Smith, 1973; Able *et al.*, 1990; Szedlmayer *et al.*, 1992; Kraus and Musick, 2001). Once larvae metamophose into juveniles, flounder grow rapidly in the estuaries before migrating offshore in the fall, joining the adult population (Szedlmayer *et al.*, 1992; Szedlmayer and Able, 1993; Walsh *et al.*, 1999). The median age of maturity occurs before age-1 and virtually all males and females are mature by age-3. Recent research funded by the Partnership for mid-Atlantic Fisheries Science (PMAFS) has shown dimorphic growth, with females growing larger than males. Recent NMFS surveys have evidenced a decreasing mean length and weight at age in all seasons and for sexes combined. One explaination for this is the recent inclusion of more older males that have lower weight-at-age than females.

Summer flounder have been managed by the Mid-Atlantic Fisheries Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC) as a unit stock from the southern border of North Carolina to the US-Canada border. The National Marine Fisheries Service (NMFS) serves as the federal implementation and enforcement entity. Cooperative management was developed because significant catch is taken from both state (0-3 miles offshore) and federal waters (3-200 miles offshore).The population is modeled with ASAP, a forward projecting age-structured model. It is divided into two “fleets”, one for landings from the combined commercial and recreational fisheries, and one for discards from the combined fisheries.

Combined commercial and recreational landings peaked in 1983 at 26,100 mt and decreased through the 1980s and reached a low of 6,500 mt in 1990. Landings have risen since to 8,900 mt in 2012. There is recent evidence for a northern shift in commercial landings with the largest landings now south of Rhode Island and more large catches on Georges Bank. Commercial landings are assumed to be reported with minimal error. Discard rates in the commercial fishery are obtained from observers and from vessel trip reports. Recreational fishing (party and charter boats, and private individual anglers) was estimated historically by the NMFS Marine Recreational Fishery Statistics Survey (MRFSS; 1982-2003), and recently by the Marine Recreational Information Program (MRIP; 2004-present), which are statistically based sampling programs. Landings can be observed by survey agents, but discards are self-reported by anglers (non-party boat anglers).

2.1 Synopsis of Panel Review

The SARC Panel agreed with the SDWG's conclusion that the summer flounder stock from the southern border of North Carolina to the US-Canada border is not overfished and overfishing is not occurring in 2012. Fishing mortality has decreased since 1997, is estimated to be 0.285 and was below the new F_{MSY} proxy of $F_{35\%= 0.309}$. SSB in 2012 was estimated to be 51,238 mt, 82% of the new proxy reference point of $SSB_{35\%}$ = 62,394 mt.

Annual projections have been provided for 3 years. This was carried out with AGEPRO, with no retrospective adjustment using a CV=100 for the OFL. Note this CV level is the MAFMC SSC assumption for the OFL of level 3 stocks, based on evidence from the literature for a range of stocks; the MCMC-based CV for the summer flounder 2014 OFL is 15%. A sensitivity analysis including stochastic recruitment was based on resampling the 1982-2012 recruitment distribution. Annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass are provided for the options.

A variety of fishery-independent and fishery-dependent studies are available to characterize the stock. Among fishery-independent studies, the NEFSC trawl survey is based on a large scale stratified random design and has historically provided an index of summer flounder abundance in federal waters. There are also nine state survey indices available and additionally a survey of Chesapeake Bay (ChesMMAP) and the North East Area Monitoring and Assessment Program (NEAMAP) which sample juvenile and adult fishes. The SARC Panel discussed the value of these surveys to the assessment and if these surveys could be coordinated in space and time to better match summer flounder habitat use temporally.

Fishery-dependent sampling approaches differ by sector. Landings for the commercial sector are obtained from dealer and Vessel Trip Reports (VTR) and discards are obtained from Observer reports. Several studies have shown a discard mortality of round 80% for this sector. Landings for the recreational sector come from for-hire party and charter boat VTR, while private anglers are intercepted at fishing access points through the MRFSS/MRIP sampling. For private anglers, discards are self-reported. The party/charter VTR reports estimate lower landings and the MRFSS higher landings for this sector. Studies of recreational discard mortality are taken as 10% in the assessment. The SARC Panel commented on the potential uncertainty in the assessment that might result if the discard mortality were actually higher. The working group provided a sensitivity analysis to this aspect of the assessment.

Studies undertaken by NMFS NEFSC and PMAFS have shown that there is sex-specific difference in growth with females living longer and growing larger at age. Recent NEFSC surveys have evidenced a trend of overall slower growth in length and weight and the

increased proportion of older males. Sexually dimorphic growth and survival would argue for developing sex-specific components of the model; the value of such an approach relies on the availability of obtaining sex ratios of the landings, which is not currently feasible for the recreational landings. Moreover, the sex-at-age and sex-at-length keys that were developed for the ocean trawl survey were found to be inappropriate in describing the sex ratios of the recreational landings.

The present assessment uses a statistical catch-at-age model, ASAP, which assumes a multinomial distribution for proportions at age. The results of this new model configuration compared well to the previous ASAP model which assumed independent lognormal distributions for numbers at age in the catch. Moreover, the previous assessments showed retrospective patterns in F and SSB that are not present in the current assessment. In the stock assessment, the stock is modeled as two "fleets": landings and discards, thus combining both commercial and recreational sectors into these components. Although the validity of the assessment results are not affected by this, the SARC Panel commented that the results were difficult to interpret into factors from each fishing sector, and suggest that future assessments use approaches that make this more interpretable.

Special Comments:

Some progress has already been made developing an assessment model that accounts for sexually dimorphic growth distribution and exploitation rates. Currently it has not been possible to split recreational landings or catch by sexes. The review group would like to encourage further development in this area, with the aim of allowing sexually split assessment to better model summer flounder population.

2.2 Evaluation of Terms of Reference for Summer Flounder

Note : * indicates that completion of specific sub-task is contingent on analytical support from staff outside of the NEFSC.

A. Summer flounder

1. Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.

   This ToR was met.

   Data were available from the two main fisheries, recreational and commercial. The commercial landings are the larger component and data are sourced from official landings records at both state and federal level. These data are regarded as having minimal error. Recreational catch data are estimated from the

MRFSS/MRIP survey. The MRIP methods for catch estimation which have been applied to the original MRFSS data, available since 2004, is an improvement in statistical design on the MRFSS survey design, however, the estimates of this component of the catch is not regarded as particularly precise. Comparison of the MRFSS/MRIP party-charter vessel estimates with those estimated from the VTR system for the party-charter mode differed by a factor of 2-3 during 1995-2011. This disparity is not explained and may give some insight into the uncertainty in the recreational fishery catch estimates.

Discard estimates for the commercial fishery were obtained from an observer program. A number of different methods were investigated to raise observer samples to fleet level. Raising factors based on the catch of all species by trip was considered to be the most robust approach.

Estimates of the recreational fishery discards were made from the MRFSS/MRIP surveys and used an estimate of release mortality to derive dead discards. The release mortality is low but uncertain and small changes in the value used for this mortality can have a large effect on the estimate of dead discards.

The spatial and temporal distribution of catch and effort was investigated using vessel trip records.

No formal estimates of the variances of the catch components are given in the report but the sources of uncertainty are discussed and carefully considered.

2. Present the survey data available for use in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.), and explore standardization of fishery-independent indices*. Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data. Describe the spatial distribution of the stock over time.

This Tor was met

The available surveys are listed and described. They comprise a survey of the whole stock area performed by the NEFSC and a number of state surveys that typically cover a small geographical area. Some of the abundance indices are aggregate measures, while others are age structured or sample only the young of the year (YOY). For the NEFSC surveys the most recent indices were corrected for a change in vessel and sampling protocol in 2009, which is an additional source of uncertainty.

An agreed and reviewed protocol of the inclusion/exclusion of surveys in the assessment exists and this was applied by the SDWG.

A number of fishery dependent LPUE/CPUE indices were investigated. Attempts were made to derive standardized indices by fitting GLMs to vessel trip records. Overall the working group concluded that these indices were not adequate for inclusion in the assessment. Given the availability of fishery independent surveys and the well-known problems with abundance indices based on commercial fishery data this appears to be an appropriate conclusion.

The spatial distribution of the stock was investigated using data from the NEFSC surveys that cover the stock distribution. This shows that the center of distribution of the stock is now more northerly than in earlier years. Larger fish are generally found further north.

There are advantages to standardizing statewide surveys to better address the temporal and spatial availability of this stock so that they give a combined index at the management unit level and consider spatial and temporal patterns of availability.

3. Review recent information on sex-specific growth and on sex ratios at age. If possible, determine if fish sex, size and age should be used in the assessment*.

This ToR was met

Analyses of both NEFSC, commercial and recreational fishery data were performed. The PMAFS funded working papers were also helpful in evaluating this ToR. These show that growth differs by sex, with females typically larger at age than males. There are also long-term trends in weight at age with lower mean weights in more recent years for the older fish. This trend coincides with a greater proportion of males at older ages in recent years and may relate to higher survival of fish resulting from lower fishing mortality.

When fish are sampled from the fishery no sex determination is made which means the only source of data to split the catch data by sex is to use survey data. However a study of the commercial and recreation catches showed that the NEFSC sex compositions were not the same as those in the recreational fishery data and could not be used to split these catches by sex. This prevented a full sex disaggregated assessment.

It appeared that the commercial catch could be split by sex. If possible, we encourage further evaluation of methods to measure sex in the recreational fishery.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-3), and

estimate their uncertainty. Explore inclusion of multiple fleets in the model. Include both internal and historical retrospective analyses to allow a comparison with previous assessment results and previous projections.

This ToR was met.

An age structured statistical catch-at-age model (ASAP) was used to estimate population parameters. The catch data were assigned to two "fleets". Landings from the commercial and recreational fishery were combined into a single "fleet" and the same approach was used to create a discard "fleet". The Panel felt that this classification to fleets was somewhat artificial since is does not describe the operation of true fleets and the estimated selectivity values are not easily interpreted for management purposes. Modeling the commercial fleet and recreational fleets as true fleets would be a more natural way of partitioning the catch and would give meaningful values of fleet selectivity. However the panel did not believe this issue would be important for the estimation of total fishing mortality.

A new statistical assumption was made in the model which assumes that the proportions at age are described by a multinomial distribution, whereas in the previous assessment model numbers at age were assumed to be independent and drawn from a lognormal distribution.

A structured approach was used to investigate the new model configuration and the updated data. This shows the effect of the new configuration when analyzing the same data as the previous assessment and the incremental changes arising by introducing updated data. Qualitatively the new assessment shows the same historical trends in F and SSB as the old model but there are differences in scale.

Comprehensive diagnostics of model fit are given for all the surveys and the catch at age data. In addition, a retrospective analysis was performed and a likelihood profile produced over a range of values for natural mortality. Fits to the total catch and catch age compositions are generally good. Some state surveys are poorly fit but receive low weight in the likelihood. The retrospective pattern for recent years shows no strong pattern. The profile over M indicates that a value between 0.2 and 0.3 receives the highest support.

Overall the panel agreed that the assessment provided satisfactory estimates of fishing mortality, recruitment and spawning stock biomass.

5. State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending

alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

This ToR was met.

Current BRPs are based on the $F_{35\%}$ MSY proxy. The Working Group considered a number of analyses which have addressed the basis for BRPs for this stock and which have suggested a less conservative approach, such as $F_{30\%}$. Applying a non-parametric approach where mean recruitment is applied to the yield/SSB per recruit calculation suggests that moving from $F_{35\%}$ to $F_{30\%}$ would result in a very small increase (2%) in yield but a moderate reduction (14%) in equilibrium SSB and 22% increase in fishing mortality (ie. 0.378/0.309). For this reason the Working Group proposed that the $F_{35\%}$ BRPs should be retained. The panel discussed this issue at some length and noted that simulations run with a Beverton-Holt stock recruitment model gave sustainable SSBs and higher yields when run at $F_{30\%}$. However, the Working Group felt that the fit of the stock recruitment curve did not reliably estimate steepness and undermined the quality of the analysis. As a result there was no consensus that $F_{30\%}$ should be preferred over $F_{35\%}$ as a basis for BRPs.

6. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model developed for this peer review.
    a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.
    b. Then use the newly proposed model and evaluate stock status with respect to "new" BRPs and their estimates (from TOR-5).

This ToR was met.

We agreed with the SDWG evaluation of stock status. Using both the old and new reference points and with both old and new assessment models, the stock is not overfished and overfishing is not occurring.

6a. The old model used BRPs established by the 2008 SAW 47 review based on a model wherein age-dependent indices were independent and lognormally distributed. When updated with data through 2011, model results showed that the stock was not overfished and overfishing was not occurring.

6b. The new model used BRPs established by the 2013 SDWG and a model based on multinomial distributed proportions at age. Graphs and tables were presented that showed consistent results with the old and new models and similar values for stock status.

7. Develop approaches and apply them to conduct stock projections and to compute the statistical distribution (e.g., probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
    a. Provide annual projections (3 years). For given catches, each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach in which a range of assumptions about the most important uncertainties in the assessment are considered (e.g., terminal year abundance, variability in recruitment).
    b. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.
    c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

This ToR was met.

7a. The working group provided a three-year projection, 2014-2016 using the program AGEPRO, with no retrospective adjustment and a CV=100 for the OFL as applied for stocks of this tier by the MAFMC SSC. They provided a sensitivity analysis by including stochastic recruitment based on resampling the 1982-2012 recruitment distribution. They did not partition the catch into commercial and recreational fishery sectors, but into landings and discard "fleets". A partition into commercial and recreational components is provided by the MAFMC subsequently. The WG projections showed no chance that $F > F_{MSY}$ and $SSB < ½*SSB_{MSY}$. No retrospective problems were noted as seen in previous assessments.

7b. The SARC panel expressed concern that the effect of differential survival and spatial mixing adds uncertainty to the projections. Summer flounder show sexually-dimorphic growth (females larger) that varies in time and space which has been confirmed by NEFSC research surveys and PMAFS fishery sampling. The stock assessment does not fully account for these dynamics and does not partition the model by sex based on the difficulty in evaluating the landings by sex. It is difficult to discern whether there will be significant effects on the projections of R, F, and SSB due to the uncertainty in dimorphic growth and survival.

Landings are assumed reported without error and this implies a lower-bound estimate if under-reporting occurs.

7c. The AGEPRO 2014-2016 projection results showed that at the MSY proxy of $F_{35\%}$ there was no chance of $F > F_{MSY}$ or $SSB < ½*SSB_{MSY}$ and less than a 13% chance of exceeding the ABC. The panel agrees that this stock does not appear to be vulnerable to

overfishing based on the projections, and notes that projections were provided with sensitivity analysis where release mortality was halved and doubled to show that F was not very sensitive to changes in the recreational discard mortality.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports, as well as MAFMC SSC model recommendations from 2012. Identify new research recommendations.

This ToR was met

There were 15 old and 13 new research recommendations that were addressed. The WG provided the status of progress on the old research recommendations, but not the new. NMFS and PMAFS have made progress, for example on otolith collections, confirmation of sexually dimorphic growth, reporting accuracy in the recreational fishery, sex ratios in the landings, and otolith chemistry to evaluate spatial structure. The WG sees as a priority the development sex-specific sampling of surveys and landings to provide improved model input, sampling of discards and changing the model to include sex-specific parameterization. The SARC panel agrees that these are priorities and may improve the assessment.

3. Review of Striped Bass

The striped bass (*Morone saxatilis*) is an anadromous, schooling species ranging from the Canadian Maritime Provinces to the Gulf of Mexico, though it is absent from certain parts of Florida. The subpopulation of striped bass between the St. Lawrence River and Albemarle Sound in North Carolina is mainly migratory, moving annually from the ocean into the rivers to spawn and returning to the ocean where they also move latitudinally according to the season (Boreman and Lewis, 1987); the subpopulations south of the Albemarle Sound and in the Gulf of Mexico are considered nonmigratory (e.g. (Mcllwain, 1980; Richkus, 1990). The migratory northern striped bass spawn principally (but not exclusively) either in the Chesapeake Bay (and its tributaries), the Delaware River or the Hudson River (e.g. (Kernehan *et al.*, 1981; Setzler-Hamilton and Hall Jr, 1991; Wirgin *et al.*, 1993; Richards and Rago, 1999). The timing of spawning usually ranges between mid-April and mid-June across the main spawning areas (e.g. (Dovel, 1971; Kernehan *et al.*, 1981; Boreman and Klauda, 1988). Eggs drift downstream and the larvae develop into juveniles in the river delta at the nearby estuary (Rulifson, 1992; Rulifson *et al.*, 1992). Juveniles usually move downstream into the estuaries during summer-fall, joining the adult population (Shepherd, 2006).

The coastal migratory striped bass stocks have been managed by the Atlantic States Marine Fisheries Commission (ASMFC) under the regulatory authorization of the Striped Bass Conservation Act and Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped bass approved in 2003. Regulations are enforced by the states for inshore waters. Fishing in the EEZ has been banned for both commercial and recreational fisheries since 1990 and is enforced by NMFS and the US Coast Guard.

Commercial fisheries operate in eight of the 14 jurisdictions regulated by ASMFC and recreational fisheries in all jurisdictions. Fisheries are seasonal because of fish migration and regulations. Commercial fisheries are limited by size and quotas, while recreational fisheries are limited by size and daily bag limits. Historically, commercial landings peaked in 1973 at 6,804 mt, declined to 63 mt by 1986 and have fluctuated around 3,162 mt since 2005. Commercial harvests are primarily on age 4-10, while harvest in Chesapeake Bay is on ages 3-6. There is little reliable data on discards of striped bass in state waters and discard ratios rely on ratio estimates from the recreational survey.

Recreational harvest and release statistics were obtained from the MRFSS from 1982-2003 and subsequently from MRIP methods for catch estimation applied to the original MRFSS data. Due to the nature of angler surveys, harvests and discards (releases) are originally reported as numbers and converted to weights. Harvests increased from 1,010 mt in 1990 to 14,082 mt in 2006 and have declined to 8,740 mt in 2012. The recreational harvest currently accounts for over 70% of the total. Moreover discards (releases) have

averaged 85-90% of the catch in most years. Most of the studies of discard mortality in the recreational fishery have been done in freshwater, which is thought to be higher than in saline waters. Estimates of discard mortality had ranged from 9-27%. Based on the effects of temperature and salinity, a discards mortality of 9% was judged to be more appropriate for estuarine and marine waters.

3.1 Synopsis of Panel Review

The SARC Panel agreed with the Striped Bass Technical Committee's (SBTC) conclusion that the stock is not overfished and overfishing is not occurring in 2012. Fishing mortality, is estimated to be 0.188 and was above the new F_{MSY} proxy of F_{target}= 0.175, but below the new proxy of $F_{threshold}$=0.213. Female SSB in 2012 was estimated to be 61,500 mt, 85% of the new proxy target reference point of 125%SSB_{1995}= 72,380 mt and above the new proxy $SSB_{threshold}$=SSB_{1995}=57,904mt. When compared with the BRPs used in the 2011 assessment (Female SSB_{target}=46,101 mt, Female $SSB_{threshold}$=36,000 mt, F_{target}=0.30, $F_{threshold}$=0.34), the stock is not overfished and overfishing is not occurring.

Annual projections were provided for 3 years. Several modeling approaches were used based on corrected and uncorrected Beverton-Holt and Ricker recruitment functions and on an empirical simulation using nonparametric estimates of the recruitment/SSB distributions. Sensitivity analyses were provided. The SARC Panel requested additional simulations based on the empirical simulations.

A variety of fishery-independent and fishery-dependent studies were available to characterize the stock. Nine fishery-independent indices were included in the model to evaluate trends in relative striped bass abundance. A formal review of these indices was done by ASFMC in 2004. Recently the Virginia Pound Net Study was re-instated as an index. The MRFSS/MRIP Total Catch Rate Index (fishery-dependent) was also included as an index of relative abundance. The SARC did not review the inclusion of these indices, but noted that coordination of fishery-independent surveys to better match the temporal and spatial use of habitats would permit better evaluations of relative abundances of striped bass. Fishery-dependent sampling is through state and federal dealer and fisherman reporting systems for the commercial landings and through survey sampling of the recreational fishery through MRFSS/MRIP surveys.

The Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) provided estimates of F from 0.10-0.15. The F from the IRCR has averaged 0.13 since 1995, varying without trend. The F estimates obtained for the Chesapeake Bay however, provided low values that were not consistent with the level of estimated harvest.

The present assessment uses a statistical catch-at-age (SCA) model that was programmed in ADMB to estimate F, recruitment, total abundance and stock biomass.

Similar to the summer flounder SCA model, they also portioned components into Bay, Coast and Commercial discard "fleets". Commercial and recreational catches are combined in the first two fleets. There is a sexually-based difference in habitat use with largely males comprising the Bay fleet and females the Coast fleet, each with a different mortality. There was a slight retrospective pattern that may result in an overestimate of F and an underestimate of SSB. The SARC noted that such aggregation of commercial and recreational catches make the results difficult to attribute and also that F derived from the SCA is a composite of sexes.

In view of the large differences in growth between males and females the SARC Panel encourages work to develop a fully sex-disaggregated model that accounts for differences in survivorship and growth. Not only should this improve estimates of population parameters, it should assist in obtaining better estimates of female biomass and enable less biased calculation of MSY reference points.

Special Comments:

Management of striped bass has a long history and ad hoc reference points, such as SSB_{1995}, have been written into regulations and affect the choice of BRP and the approach in population projects to simulate the effect of F. Although this information was included among the reports, the ramifications were not clearly stated such that reviewers, unfamiliar with this long history, could readily discern the appropriateness of subsequent empirical and parametric approaches for population projections. The SARC Panel agreed that clearer exposition of these restraints would increase clarity in future presentations of the striped bass stock assessment.

3.2 Evaluation of Terms of Reference for Striped Bass

Note: ** indicates that completion of specific sub-task is contingent on analytical support from staff outside of the NEFSC.

B. Striped bass**

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources. Evaluate evidence for changes in natural mortality in recent years.

This ToR was met.

The report provided an extensive set of indices of both abundances at age and aggregate abundance. As it was stated that these had been reviewed elsewhere, the preparation of the indices was not included in this review. The very large quantity of

data available implies that a substantial amount of work was involved in preparing these data sets. The available data was considered to be assembled well, though from the SAW report it was unclear initially exactly which data sets were used in the model. This was clarified in the meeting. A change in the sampling program from MRFSS to MRIP adjustments was noted and considered not to be a problem. Both MRFSS/MRIP adjustments and the raw intercept data was used in this assessment. Overall the review group concluded that the data sets provided were suitable for the assessment.

In the longer run there would be clear advantages in assembling a composite survey that could be expected to represent the whole area, rather than the current collection of small state-wide surveys that are currently brought into the assessment as individual indices. Such local surveys may accurately measure movement between areas that are then obscured in the main assessment model. This process variability (stock movement) is effectively treated as observation error by the model; this is acceptable but not ideal.

The use of age aggregated SDNSS index is based on flat selection from 3 year and older. This index fits particularly poorly in the assessment (see below). Given the non-uniform spatial distribution of the stock by age it may be useful to try to obtain a better model of selection for this index or to truncate the age range.

The working group presented the information on natural mortality derived from tag data and concluded that the value to be used in the assessment should be replaced with new values with higher M at younger ages. The SARC reviewers agreed with this conclusion. There were some minor concerns that M at 2-4 ages were rather high, this was discussed and the differences in longevity between males and females were thought to be important in this respect. Overall it was concluded that the revised values represented the best available estimates at the moment. It was noted that it may be possible to combine tag data on mortality in the assessment model directly (see below).

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.

This ToR was met.

The review concluded that the assembled catch data represented the best current estimates of catch (landings and dead discards) and they are suitable for the assessment. It was recognized that the estimate of both recreational and commercial dead discards is sensitive to the assumed values of post-release mortality and because a rather high proportion are considered to survive for most gears this may result in a high error on these estimates.

Overall the catch is assembled into three fleets; bay landings, coastal landings and commercial dead discards. By combining the data in this way it is not possible to use the

assessment to evaluate the impact of different 'fisheries' as combined landings and discards. With this formulation estimated Fs on landings can change separately from F on discards in the same fishery, which may not be appropriate. Organizing the data by 'Fishing Fleet' may be a more useful approach. Although it is suggested that this model formulation be examined, it is not thought that the current method affects the main conclusions on the state of stock.

It is noted that the catches are not currently sampled for sex ratio. As there is clear evidence of sexual dimorphism, and sex dependence in the catch rates, there may be advantages in considering splitting the assessment into sex components. If this were to be done it implies estimating a sex split in the catch. Some very reasonable practical restrictions on this were noted. If traditional market sampling methods are not practical to determine sex ratios, it may be possible to develop cooperative approaches with recreational anglers and fish buyers or to use state surveys to collect sex ratio data in a different way.

No formal estimates of the variances of the catch components are given in the report but the sources of uncertainty are discussed and carefully considered.

3. Use the statistical catch-at-age model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component, where possible, and for total stock complex.

This ToR was met.

The review concludes that this ToR was completed and the current assessment is acceptable and suitable for estimating the state of the stock.

It is noted that the assessment was particularly sensitive to two surveys (MDSSN and MRFSS). The pattern of residuals for both these two surveys are of some concern and the sensitivity analysis shows that the assessed SSB and F would be different over at least the last 8 years if either of these surveys was omitted from the assessment data set. While including these in the assessment was considered acceptable (and removing both would probably give only minor changes) it is of concern that data with such diverse signals are included and individually they can have substantial influence. Further detailed evaluation of these two data sources and their utility in the assessment would be helpful.

The assessment model is based on three 'fleets' that don't correspond to real fisheries (see above). Reformulating the assessment into two or more fleets each with landings and discard components may give added value to the assessment results, as it would

allow the commercial and recreational fisheries to be considered separately in a more useful way.

The assessment is carried out using data combined across sexes. The female biomass is then estimated using temporally invariant age dependent factors. There is some concern that this split factor would depend on F and thus the constant values may be biased in some periods. It is considered that splitting the assessment by sex may be possible and given the implications on mortality and the estimation of reference points it should be considered in the future.

The estimation of F in 1982 is considered particularly uncertain. This is illustrated by the poor fit to the selection for the catch data in that year. The SARC review group endorsed the decision to delete this from the results.

The Working Group presented an extensive range of sensitivity tests that, when taken as a whole, support the conclusion that the assessment can be used for management. With the exception of the sensitivity of the two surveys mentioned above, the assessment was robust to a number of different formulations. The comparison with previous assessments confirmed the relative stability of the modeling approach.

The model formulation in terms of the use effective of sample size for multinomial data and indices fitted with residuals and scaled CVs is complex and hard to understand. The methods to estimate effective sample size appear to be somewhat *ad hoc*, based on initial values equal for each survey and then modified subsequently by inspection. Sensitivity to the some aspects of this were explored, however, it is unclear how important this is. Manual iterative reweighting has been used via amendment of CVs for each survey data set. If this approach is the preferred method for the assessment model it should be implemented as an automated process to ensure correct and complete implementation.

It was noted that there was aging bias caused by the use of scales to age individuals. It was a shown that this could affect the estimate of SSB and F. However, while this results in different values for both assessment and reference points the perception of the state of the stock is unaltered. Although the perception of stock status may be unchanged, it is the extent to which F is affected that matters for the forecast which may, in turn, be sensitive to this bias. Further exploration should be considered.

4. Use the Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) and associated model components applied to the Atlantic striped bass tagging data to estimate F and abundance from coast wide and producer area tag programs along with the uncertainty of those estimates. Provide suggestions for further development of this model.

This ToR was met.

A study was carried out and presented. This study concluded that tag based total mortality was similar to the total mortality in the assessment, though there are some differences in short term trends within the time-series. Estimates of F and M are sensitive to tag reporting rate, so although Z may be well estimated it is more difficult to estimate F. It is suggested that inclusion of tag estimated mortality in the assessment may be helpful. It may for example be possible to use this to estimate or confirm the discard survival rates that are important for estimating catch.

It was noted that there were a few thousand tags recovered from re-releases. This data had not been specifically analyzed. It may be interesting to compare re-releases of tagged fish as these may be more typical of fishery releases than those released by tagging program.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY). Define stock status based on BRPs.

This ToR was only partly completed but it was not clear how BRPs had been estimated because there appeared to be inconsistencies in SSB reference values presented. Additional analyses were requested by the panel and performed during the meeting to clarify these problems.

Attempts were made to estimate Fmsy from analyses using parametric approaches with a variety of stock recruit relationships. These analyses produced disparate results and were particularly sensitive to the recruitment relationships assumed. This was mostly because different functions implied different mean recruitment in the future, though the basis for these differences was weak. Following additional analysis it was concluded that the use of the estimated 1995 SSB as an SSB threshold would be compatible with current management objectives. Once this was defined, a set of internally consistent F and SSB thresholds and targets were defined based on a non-parametric assumption that future recruitment will be similar to past recruitment (1990 to present). The distribution of SSB implied by the target and threshold Fs were examined and it was concluded that the proposed values would give high long term yield and be consistent in terms of F and SSB. Overall this approach does not estimate F_{MSY} or SSB_{MSY} explicitly but gives management reference points that give high and stable long term yield.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.

This ToR was met.

An extensive range of sensitivity tests support the conclusion that the forecast is robust. However, following the discussion of the BRPs and the choice of recruitment model, (see above) there is a potential for inconsistency between projections and BRPs. In the future the projections need to be run with the same recruitment model which is used for calculation of BRP reference points, as the current BRP model differs from the models used in the projections. In practice, short term projections would not be expected to be sensitive to the choice of recruitment model unless the fishery is highly dependent on recruiting year classes. In striped bass fish are fully recruited by the age 4-5 so recruitment should only have a minor effect on projections.

The three fleet approach, which combines discards from both fisheries, makes it difficult to estimate mortality separately for the two main fisheries. As noted above reformulation of the model into recreational and commercial fleets including dead discard components may be of assistance in providing appropriate separate fleetwise catch options.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

This TOR was met.

The Working Group provided an extensive list of research recommendations and they have clearly identified three levels of importance: high, moderate and low. The Group also identified research priorities as being met or in progress. Section B11.2 identifies the need for a coastal population index as of moderate priority. We consider that if this could be linked to state surveys to obtain a population wide survey this would be of high priority. We also propose that issues surrounding sexually differentiated migration be examined. The assessment group presented information on different migration patterns for males and females. There was a perception that females tend to migrate out of the rivers into the coastal region while males remain in the inshore areas. There were reports of catches being composed of 90% or 95% males within Chesapeake Bay and selection on females was high in the coastal fisheries. The separate exploitation of these different groups could potentially affect the exploitation and certainly influence the evaluation of F_{MSY}. Management targets based on only female SSB may need to be considered carefully if very heavy exploitation of males is occurring but not included in the management targets. It is suggested that simulation of the problem through a two area model could be used to evaluate the consequences for management of sex and space on MSY reference points, the need for precautionary exploitation to protect males or females, and the data needed to manage under these circumstances. In this context it may be useful to evaluate if a two area spatial assessment model could be

parameterized in order to better model the spatially diverse Chesapeake Bay and coastal fisheries.

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5. Appendices

Task Order T37-06, final 28 February 2013

Statement of Work

57th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark stock assessments for striped bass and summer flounder

Statement of Work (SOW) for CIE Panelists (including a description of SARC Chairman's duties)

BACKGROUND

The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are independently selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

SCOPE

Project Description: The Northeast Regional Stock Assessment Review Committee (SARC) meeting is a formal, multiple-day meeting of stock assessment experts who serve as a panel to peer-review tabled stock assessments and models. The SARC is the cornerstone of the Northeast Stock Assessment Workshop (SAW) process, which includes assessment development (SAW Working Groups or ASMFC technical committees), assessment peer review, public presentations, and document publication. This review determines whether the scientific assessments are adequate to serve as a basis for developing fishery management advice. Results provide the scientific basis for fishery management in the northeast region.

The purpose of this panel review meeting will be to provide an external peer review of stock assessments for striped bass (*Morone saxatilis*) and summer flounder (*Paralichthys dentatus*). Striped bass and summer flounder are commercially and recreationally important species found along the US east coast. This review determines whether the scientific assessments are adequate to serve as a basis for developing fishery management advice.

OBJECTIVES

The SARC review panel will be composed of three appointed reviewers from the Center of Independent Experts (CIE), and an independent chair from the SSC of the New England or MidAtlantic Fishery Management Council. The SARC panel will write the SARC Summary Report and each CIE reviewer will write an individual independent review report.

Duties of reviewers are explained below in the "**Requirements for CIE Reviewers**", in the "**Charge to the SARC Panel**" and in the "**Statement of Tasks**". The stock assessment Terms of Reference (ToRs) are attached in **Annex 2**. The draft agenda of the panel review meeting is attached in **Annex 3**. The SARC Summary Report format is described in **Annex 4.**

Requirements for the reviewers: Three reviewers shall conduct an impartial and independent peer review of the striped bass and summer flounder stock assessments, and this review should be in accordance with this SoW and stock assessment ToRs herein. The reviewers shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise should include statistical catch-at-age, state-space and index methods. Reviewers should also have experience in evaluating measures of model fit, identification, uncertainty, and forecasting. Reviewers should have experience in development of Biological Reference Points that includes an appreciation for the varying quality and quantity of data available to support estimation of Biological Reference Points. For both striped bass and summer flounder, it is desirable to have knowledge of stock assessments involving spatially distributed populations, migratory behavior, and natural mortality rates that vary with time or sex.

PERIOD OF PERFORMANCE

The contractor shall complete the tasks and deliverables as specified in the schedule of milestones within this statement of work. Each reviewer's duties shall not exceed a maximum of 16 days to complete all work tasks of the peer review described herein.

Not covered by the CIE, the SARC chair's duties should not exceed a maximum of 16 days (i.e., several days prior to the meeting for document review; the SARC meeting in Woods Hole; several days following the open meeting for SARC Summary Report preparation).

PLACE OF PERFORMANCE AND TRAVEL

Each reviewer shall conduct an independent peer review during the panel review meeting scheduled in Woods Hole, Massachusetts during July 23-26, 2013.

STATEMENT OF TASKS

Charge to SARC panel: During the SARC meeting, the panel is to determine and write down whether each stock assessment Term of Reference (ToR) of the SAW (see **Annex 2**) was or was not completed successfully. To make this determination, panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. **If alternative assessment models and model assumptions are presented, evaluate their strengths and weaknesses and then recommend which, if any, scientific approach should be adopted.** Where possible, the SARC chair shall identify or facilitate agreement among the reviewers for each stock assessment Term of Reference of the SAW.

If the panel rejects any of the current BRP or BRP proxies (for B_{MSY} and F_{MSY} and MSY), the panel should explain why those particular BRPs or proxies are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs or BRP proxies are the best available at this time.

Each reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Tasks prior to the meeting: The contractor shall independently select qualified reviewers that do not have conflicts of interest to conduct an independent scientific peer review in accordance with the tasks and ToRs within the SoW. Upon completion of the independent reviewer selection by the contractor's technical team, the contractor shall provide the reviewer information (full name, title, affiliation, country, address, email, and FAX number) to the COR, who will forward this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The contractor shall be responsible for providing the SoW and stock assessment ToRs to each reviewer. The NMFS Project Contact will be responsible for providing the reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact will also be responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Foreign National Security Clearance: The reviewers shall participate during a panel review meeting at a government facility, and the NMFS Project Contact will be

responsible for obtaining the Foreign National Security Clearance approval for the reviewers who are non-US citizens. For this reason, the reviewers shall provide by FAX (or by email if necessary) the requested information (e.g., 1.name [first middle and last], 2.contact information, 3.gender, 4.country of birth, 5.country of citizenship, 6.country of permanent residence, 7.whether there is dual citizenship, 8.country of current residence, 9.birth date [mo, day, year], 10.passport number, 11.country of passport) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/.

Pre-review Background Documents and Working Papers: Approximately two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the SARC chair and CIE reviewers the necessary background information and reports (i.e., working papers) for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the COR on where to send documents. The reviewers are responsible only for the pre-review documents that are delivered to the contractor in accordance to the SoW scheduled deadlines specified herein. The reviewers shall read all documents deemed as necessary in preparation for the peer review.

Tasks during the panel review meeting: Each reviewer shall conduct the independent peer review in accordance with the SoW and stock assessment ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and contractor.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the stock assessment ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

(SARC chair)
Act as chairperson, where duties include control of the meeting, coordination of presentations and discussions, making sure all stock assessment Terms of Reference of the SAW are reviewed, control of document flow, and facilitation of discussion. For each assessment, review both the Assessment Report and the draft Assessment Summary Report. The draft Assessment Summary Report is reviewed and edited to assure that it is consistent with the outcome of the peer review, particularly statements that address stock status and assessment uncertainty.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of their analyses. It is permissible to discuss the stock assessment and to request additional information if it is needed to clarify or correct an existing analysis and if the information can be produced rather quickly.

(SARC CIE reviewers)
For each stock assessment, participate as a peer reviewer in panel discussions on assessment validity, results, recommendations, and conclusions. From a reviewer's point of view, determine whether each stock assessment Term of Reference of the SAW was completed successfully. Terms of Reference that are completed successfully are likely to serve as a basis for providing scientific advice to management. If a reviewer considers any existing Biological Reference Point or BRP proxy to be inappropriate, the reviewer should try to recommend an alternative, should one exist. Review both the Assessment Report and the draft Assessment Summary Report. The draft Assessment Summary Report is reviewed and edited to assure that it is consistent with the outcome of the peer review, particularly statements that address stock status and assessment uncertainty.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of their analyses. It is permissible to request additional information if it is needed to clarify or correct an existing analysis and if the information can be produced rather quickly.

Tasks after the panel review meeting:

SARC CIE reviewers:
Each CIE reviewer shall prepare an Independent CIE Report (see **Annex 1**). This report should explain whether each stock assessment Term of Reference of the SAW was or was not completed successfully during the SARC meeting, using the criteria specified above in the "Charge to SARC panel" statement.

If any existing Biological Reference Points (BRP) or their proxies are considered inappropriate, the Independent CIE Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRPs are the best available at this time.

During the meeting, additional questions that were not in the Terms of Reference but that are directly related to the assessments may be raised. Comments on these questions should be included in a separate section at the end of the Independent CIE Report produced by each reviewer.

The Independent CIE Report can also be used to provide greater detail than the SARC Summary Report on specific stock assessment Terms of Reference or on additional questions raised during the meeting.

SARC chair:
The SARC chair shall prepare a document summarizing the background of the work to be conducted as part of the SARC process and summarizing whether the process was adequate to complete the stock assessment Terms of Reference of the SAW. If appropriate, the chair will include suggestions on how to improve the process. This document will constitute the introduction to the SARC Summary Report (see **Annex 4**).

SARC chair and CIE reviewers:
The SARC Chair, with the assistance from the CIE reviewers, will prepare the SARC Summary Report. Each CIE reviewer and the chair will discuss whether they hold similar views on each stock assessment Term of Reference and whether their opinions can be summarized into a single conclusion for all or only for some of the Terms of Reference of the SAW. For terms where a similar view can be reached, the SARC Summary Report will contain a summary of such opinions. In cases where multiple and/or differing views exist on a given Term of Reference, the SARC Summary Report will note that there is no agreement and will specify - in a summary manner – what the different opinions are and the reason(s) for the difference in opinions.

The chair's objective during this SARC Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement. The chair will take the lead in editing and completing this report. The chair may express the chair's opinion on each Term of Reference of the SAW, either as part of the group opinion, or as a separate minority opinion.

The SARC Summary Report (please see **Annex 4** for information on contents) should address whether each stock assessment Term of Reference of the SAW was completed successfully. For each Term of Reference, this report should state why that Term of Reference was or was not completed successfully. The Report should also include recommendations that might improve future assessments.

If any existing Biological Reference Points (BRP) or BRP proxies are considered inappropriate, the SARC Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRP proxies are the best available at this time.

The contents of the draft SARC Summary Report will be approved by the CIE reviewers by the end of the SARC Summary Report development process. The SARC chair will complete all final editorial and formatting changes prior to approval of the contents of the draft SARC Summary Report by the CIE reviewers. The SARC chair will then submit the approved SARC Summary Report to the NEFSC contact (i.e., SAW Chairman).

DELIVERY

Each reviewer shall complete an independent peer review report in accordance with the SoW. Each reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each reviewer shall complete the independent peer review addressing each stock assessment ToR listed in **Annex 2**.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting at the Woods Hole, Massachusetts scheduled during July 23-26, 2013.
3) Conduct an independent peer review in accordance with this SoW and the assessment ToRs (listed in **Annex 2**).
4) No later than August 9, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and to Dr. David Sampson, CIE Regional Coordinator, via email to david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each assessment ToR in **Annex 2**.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

June 19, 2013	Contractor sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
July 9, 2013	NMFS Project Contact will attempt to provide reviewers the pre-review documents
July 23-26, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
July 26, 2013	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
August 9, 2013	Reviewers submit draft independent peer review reports to the contractor's technical team for independent review
August 9, 2013	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *

August 16, 2013	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
August 23, 2013	Contractor submits independent peer review reports to the COR who reviews for compliance with the contract requirements
August 30, 2013	The COR distributes the final reports to the NMFS Project Contact and regional Center Director

* The SARC Summary Report will not be submitted, reviewed, or approved by the CIE.

The SAW Chairman will assist the SARC chair prior to, during, and after the meeting in ensuring that documents are distributed in a timely fashion.

NEFSC staff and the SAW Chairman will make the final SARC Summary Report available to the public. Staff and the SAW Chairman will also be responsible for production and publication of the collective Working Group papers, which will serve as a SAW Assessment Report.

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on substitutions. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: The deliverables shall be the final peer review report from each reviewer that satisfies the requirements and terms of reference of this SoW. The contract shall be successfully completed upon the acceptance of the contract deliverables by the COR based on three performance standards:

(1) each report shall be completed with the format and content in accordance with **Annex 1**,
(2) each report shall address each stock assessment ToR listed in **Annex 2**,
(3) each report shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Upon the acceptance of each independent peer review report by the COR, the reports will be distributed to the NMFS Project Contact and pertinent NMFS science director, at which time the reports will be made publicly available through the government's website.

The contractor shall send the final reports in PDF format to the COR, designated to be William Michaels, via email William.Michaels@noaa.gov

Support Personnel:

William Michaels, Program Manager, COR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

Dr. James Weinberg, NEFSC SAW Chairman, NMFS Project Contact
Northeast Fisheries Science Center
166 Water Street, Woods Hole, MA 02543
James.Weinberg@noaa.gov (Phone: 508-495-2352) (FAX: 508-495-2230)

Dr. William Karp, NEFSC Science Director
National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
166 Water St., Woods Hole, MA 02543
william.karp@noaa.gov Phone: 508-495-2233

Annex 1: Format and Contents of Independent Peer Review Report

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The main body of the report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each ToR of the SAW was completed successfully. For each ToR, the Independent Review Report should state why that ToR was or was not completed successfully. To make this determination, the SARC chair and reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the SARC Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SARC Summary Report. The independent report shall be an independent peer review of each ToR, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of this Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: 57th SAW/SARC Stock Assessment Terms of Reference

(file vers.: 12/18/2012)

A. Summer flounder

1. Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.

2. Present the survey data available for use in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.), and explore standardization of fishery-independent indices*. Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data. Describe the spatial distribution of the stock over time.

3. Review recent information on sex-specific growth and on sex ratios at age. If possible, determine if fish sex, size and age should be used in the assessment*.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series (integrating results from TOR-3), and estimate their uncertainty. Explore inclusion of multiple fleets in the model. Include both internal and historical retrospective analyses to allow a comparison with previous assessment results and previous projections.

5. State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

6. Evaluate stock status with respect to the existing model (from previous peer reviewed accepted assessment) and with respect to a new model developed for this peer review.
    a. When working with the existing model, update it with new data and evaluate stock status (overfished and overfishing) with respect to the existing BRP estimates.
    b. Then use the newly proposed model and evaluate stock status with respect to "new" BRPs and their estimates (from TOR-5).

7. Develop approaches and apply them to conduct stock projections and to compute the statistical distribution (e.g., probability density function) of the OFL (overfishing level) and candidate ABCs (Acceptable Biological Catch; see Appendix to the SAW TORs).
    a. Provide annual projections (3 years). For given catches, each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach in which a range of assumptions about the most important uncertainties in the assessment are considered (e.g., terminal year abundance, variability in recruitment).
    b. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions.
    c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports, as

well as MAFMC SSC model recommendations from 2012. Identify new research recommendations.

(*: Completion of specific sub-task is contingent on analytical support from staff outside of the NEFSC.)

Annex 2 (cont.):

B. Striped bass**

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources. Evaluate evidence for changes in natural mortality in recent years.

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.

3. Use the statistical catch-at-age model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component, where possible, and for total stock complex.

4. Use the Instantaneous Rates Tag Return Model Incorporating Catch-Release Data (IRCR) and associated model components applied to the Atlantic striped bass tagging data to estimate F and abundance from coast wide and producer area tag programs along with the uncertainty of those estimates. Provide suggestions for further development of this model.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY). Define stock status based on BRPs.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach covering a range of assumptions about the most important sources of uncertainty, including potential changes in natural mortality.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Indentify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

(**: These TORs were developed by the ASMFC Striped Bass Stock Assessment Subcommittee and Tagging Subcommittee, with approval from the Technical Committee and Management Board.)

Annex 2 (cont.):

Appendix to the SAW Assessment TORs:

Clarification of Terms used in the SAW/SARC Terms of Reference

Appendix to the Assessment TORs:

Explanation of "Acceptable Biological Catch" (DOC Natl. Standard Guidelines, Fed. Reg., vol. 74, no. 11, 1/16/2009):

> *Acceptable biological catch (ABC)* is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of [overfishing limit] OFL and any other scientific uncertainty…" *(p. 3208) [In other words, OFL ≥ ABC.]*
>
> *ABC for overfished stocks.* For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*
>
> NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)
>
> ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, [optimal yield] OY does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

Explanation of "Vulnerability" (DOC Natl. Standard Guidelines, Fed. Reg., vol. 74, no. 11, 1/16/2009):

> *"Vulnerability.* A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce MSY and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality)." (p. 3205)

Rules of Engagement among members of a SAW Assessment Working Group:

> Anyone participating in SAW assessment working group meetings that will be running or presenting results from an assessment model is expected to supply the source code, a compiled executable, an input file with the proposed configuration, and a detailed model description in advance of the model meeting. Source code for NOAA Toolbox programs is available on request. These measures allow transparency and a fair evaluation of differences that emerge between models.

Annex 3: Draft Agenda

57th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC): Benchmark stock assessments for summer flounder and striped bass

July 23-26, 2013

Stephen H. Clark Conference Room – Northeast Fisheries Science Center
Woods Hole, Massachusetts

AGENDA* (version: 28 Feb. 2013)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Tuesday, July 23

10 – 10:30 AM
Welcome — **James Weinberg**, SAW Chair
Introduction — **Cynthia Jones**, SARC Chair
Agenda
Conduct of Meeting

10:30 – 12:30 PM Assessment Presentation (Stock A.)
TBD TBD **TBD**

12:30 – 1:30 PM Lunch

1:30 – 3:30 PM Assesssment Presentation (Stock A.)
TBD TBD **TBD**

3:30 – 3:45 PM Break

3:45 – 4 PM Public Comments

4 - 6 PM SARC Discussion w/ Presenters (Stock A.)
Cynthia Jones, SARC Chair **TBD**

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Wednesday, July 24

9 – 10:45 AM	Assessment Presentation (Stock B.)		
	TBD	TBD	**TBD**
10:45 – 11 AM	Break		
11 – 12:30 PM	(cont.) Assessment Presentation (Stock B.)		
	TBD	TBD	**TBD**
12:30 – 1:45 PM	Lunch		
1:45 – 2 PM	Public Comments		
2 – 3:30 PM	SARC Discussion w/presenters (Stock B.)		
	Cynthia Jones, SARC Chair		**TBD**
3:30 -3:45 PM	Break		
3:45 – 6 PM	Revisit with presenters (Stock A.)		
	Cynthia Jones, SARC Chair		**TBD**
7 PM	**(**Social Gathering **)**		

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Thursday, July 25

8:30 – 10:15	Revisit with presenter (Stock B.) **Cynthia Jones**, SARC Chair		**TBD**
10:15 – 10:30	Break		
10:30 – 12:45	Review/edit Assessment Summary Report (Stock B.) **Cynthia Jones**, SARC Chair		**TBD**
12:45 – 2 PM	Lunch		
2 – 2:45 PM	(cont.) edit Assessment Summary Report (Stock B.) **Cynthia Jones**, SARC Chair		**TBD**
2:45 – 3:00 PM	Break		
3:00 – 6:00 PM	Review/edit Assessment Summary Report (Stock A.) **Cynthia Jones**, SARC Chair		**TBD**

Friday, July 26

9:00 AM – 5:00 PM	SARC Report writing. (closed meeting)		

*All times are approximate, and may be changed at the discretion of the SARC chair. The meeting is open to the public, except where noted.

The NMFS Project contact will provide the final agenda by May, 2013.

Reviewers must attend the entire meeting.

Annex 4: Contents of SARC Summary Report

1.

The main body of the report shall consist of an introduction prepared by the SARC chair that will include the background, a review of activities and comments on the appropriateness of the process in reaching the goals of the SARC. Following the introduction, for each assessment reviewed, the report should address whether each Term of Reference of the SAW Working Group was completed successfully. For each Term of Reference, the SARC Summary Report should state why that Term of Reference was or was not completed successfully.

To make this determination, the SARC chair and CIE reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. If the CIE reviewers and SARC chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

The report may include recommendations on how to improve future assessments.

2.

If any existing Biological Reference Points (BRP) or BRP proxies are considered inappropriate, include recommendations and justification for alternatives. If such alternatives cannot be identified, then indicate that the existing BRPs or BRP proxies are the best available at this time.

3.

The report shall also include the bibliography of all materials provided during the SAW, and relevant papers cited in the SARC Summary Report, along with a copy of the CIE Statement of Work.

The report shall also include as a separate appendix the assessment Terms of Reference used for the SAW, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.

New York Coalition for Recreational Fishing
89 Narwood Road Massapequa, NY 11758-5925
Tel: 516-647-8492

September 2013

Dear Mike Waine,

The New York Coalition for Recreational Fishing is writing this letter to present our views and suggestions concerning a reduction in striped bass mortality.

We applaud information found in current communications indicating that the ASMFC intends to reduce mortality by 40%.

Similar to other clubs, organizations, conservation groups, and media editorials, the Coalition is, and has been, concerned about a dramatic decline in the stock sizes and migration runs of striped bass, as well as documentation showing an erratic and generally poor recruitment pattern.

The following represents a summary of our positions and recommendations.

1. **Minimum Size:** We support a 32-inch minimum harvest size in the marine district. Furthermore, we believe this size limit should be increased to 28" in the spawning estuaries. It is time to correct the action taken years ago when a sudden and dramatic decrease in the minimum size from 36-inches to 28-inches was instituted. It was mistake. It was too much, too soon, and sent a bad psychological message to anglers. At the time, many anglers were opposed to the new minimum size, and urged a more conservative approach be taken. That is, to implement a wait and see policy in which the minimum size would be lowered 2 inches at a time and each reduction in the minimum size followed by an extensive evaluation of stock sizes.

2. **Bag Limit:** We believe a one fish per person per day for all users of the resource including party boats and charter boats is appropriate.

3. **Reduction of the commercial harvest:** We applaud the share of the proposed 40% reduction.

   Options:

   a. Quotas

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b. Seasonal closures
c. Reduction of by-catch
d. Seasonally, during spring and fall migrations, move draggers farther off the beach to reduce by-catch waste.

4. **Prohibit Possession of striped bass in winter along the entire coast.**

5. **Reduce mortality on the spawning grounds during the spawning period. Options:**

    a. Significant increase in minimum size.
    b. One fish per day per person.
    c. Daytime possession only.
    d. No possession during peak 5-day period of spawning.

6. **Poaching:** Although the striped bass management plan does attempt to account for poaching, the plan has never properly addressed the high level of poaching that occurs. Each year millions of very small fish are poached, ending up on dinner plates, local restaurant menus, and most significantly in local markets and sidewalk displays in these inner cities.

    Historically, enforcement has been challenging for a variety of reasons including a lack of adequate numbers of conservation police, ignorance regarding the problem among local police, a lack of cooperation from local residents, and city judges who dismiss charges rather quickly and arbitrarily, complaining that they have “murders, rapes, and drug dealers to deal with.” Of course we understand the importance of dealing with the crimes noted, but preservation of living resources is also important to our entire society.

    We suggest the problem might be managed more efficiently and effectively with the application of more creative enforcement strategies. Such as:

    a. Involve Fish and Wildlife. Effective enforcement might be easier to achieve in Federal Courts.
    b. Respectfully request that each individual State post bilingual educational signs regarding saltwater fishing regulations.
    c. Combine enforcement agency personnel for periodic sweeps of appropriate areas. A task force with officers from DEC (or equivalent), city police, state troopers, and federal agents would be more effective and send a sincere message of commitment to poachers.

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7. **Increased federal funding of mycobacteriosis research:** The goal would be to both develop strategies to eliminate the organism from the environment as well as discover effective treatment approaches of diseased striped bass that could be carried out in the estuaries.

8. **YOY Trigger Mechanism.** It has taken almost a decade for managers to react and consider taking action following a noticeable decline in the stocks. Thus, it is clear that the new (current) YOY trigger is not effective. We suggest that the management plan return to the original YOY trigger, and that other protocols be tightened to ensure a more rapid and effective response to declining stocks.

Thank you for consideration. The Coalition believes we are at a critical crossroads in striped bass management. It is the right time to correct prior mistakes and modify the plan with reduced mortality targets that will allow for a more stable fishery. We know many fish species cycle in abundance and this is true of striped bass, but a lower year-to-year mortality would reduce the severity of downturns because the population would be larger longer. Finally and to emphasize, the decline began in the early 2000s, yet we are only attempting to change the regulations in 2013!! The response time to poor recruitment and declining stocks must be faster.

Respectfully,

William A. Young - President NYCRF
89 Narwood Rd.
Massapequa, NY 11758

516-647-8492

Mike Waine

From: Diane Schwartz [schwartzdar@aol.com]
Sent: Thursday, October 10, 2013 9:31 AM
To: Mike Waine
Subject: PLEASE DO SOMETHING TO HELP THE STRIPED BASS. THEY ARE BEING DEPLETED AND THIS IS NOT A GOOD THING.

Mike Waine

From: Louis Costa [lou.flukester@gmail.com]
Sent: Wednesday, October 09, 2013 4:46 PM
To: Mike Waine

I have seen a reduction in striped bass in all of the places I fish,which is all over Long Island. We need a reduction in Striped bass mortality. Thank you, Lou Costa

Mike Waine

From: Ron Hoff [bronh22@yahoo.com]
Sent: Tuesday, October 08, 2013 11:56 AM
To: Mike Waine
Subject: Striped Bass

Mike Waine
FMP Coordinator
ASMFC

October 8, 2013

I live in Long Beach, NY and I have witnessed the same decline in Striped Bass in our local waters.

Mike Waine

From: Jeff Clabault [jeffcccc@gmail.com]
Sent: Saturday, October 05, 2013 9:14 AM
To: Mike Waine
Subject: Striped bass comments

Hello- My name is Jeff Clabault and I am the owner/operator of Forestdale Bait and Tackle in Forestdale, MA. Over the last few years the striped bass fishing in my area (Cape Cod) has been in steady decline. We are at the point now that unless you target the 15"-18" fish that were the products of that one great breeding year a couple years ago you are hard pressed to catch a fish. I have numerous customers who have been fishing hard (many with boats) who have not caught a 28" bass all year! I myself take pride in finding fish by working area beaches and inlets after work, mostly in the primetime of night, and finding bass has been a struggle. It has been a sad thing to witness this once great fishery go steadily downhill. Hopefully there is still time to save the situation from a 1980's type crash but that will require immediate and significant action on the part of fisheries managers. The most obvious changes involve bag limits and commercial quotas. It is absolutely imperative that the limit go from two fish to one in states like Massachusetts which currently allow two bass. Changing the limit to 30" or even 32" would also help since it would ensure that all of those fish had a few opportunities to spawn before being harvested. Considering the state of the striped bass fishery, I believe very few people would object to these changes and if they did their motives would have to be questioned. In concert with the reduction in the recreational harvest there must be a lowering of the commercial take. In my area, the one-million-plus pound quota was filled quickly each of the last two years (leading some to disingenuosly profess that there were still plenty of striped bass) based largely on on big schools of 34"-plus fish which were schooled up off Chatham. Those large groups of breeding sized fish were systematically removed by the 300-500 boats that were fishing there. Those boats made up almost the entire commercial fleet in our area and they were all fishing Chatham because there were no fish anywhere else! Please consider these changes. If both the recreational and commercial sides of this debate- and this includes charter boat captains-are willing to accept the necessary steps involving this fish we may yet be able to stave off a total crash. Thank you.
Jeff Clabault
Forestdale Bait and Tackle

Mike Waine

From: Tony Marchisotto [tmarchisotto@yahoo.com]
Sent: Monday, September 30, 2013 11:57 AM
To: Messina, Edward; Mike Waine
Subject: Re: Striped Bass

Hi Ed

As always Ed thank you. Hopefully someone is listening, but then why should they, your letter was only very clear and concise.
This reminds me of something my Dad was fond of saying "Don't confuse me with the Facts... my mind is already made up"

Best Regards
Tony

From: "Messina, Edward" <EJ_MESSINA@NYMC.EDU>
To: "'mwaine@asmfc.org'" <mwaine@asmfc.org>
Sent: Monday, September 30, 2013 11:06 AM
Subject: Striped Bass

Mr. Mike Waine
FMP Coordinator
ASFMC

Dear Mr. Waine:

We are at a critical juncture in time with regard to the future of striped bass. As I have not had a response from you, based on my last communication to you, since our meeting at your talk on Long Island, I feel compelled to once again point out the TOTAL mismanagement of striped bass by the ASMFC.

For starters, the Recruitment = Mortality paradigm is so flawed because of inaccurate data and assessments. This has to change and it is my recommendation that when coast wide reports by commercial and recreational anglers indicate a problem in the fishery that this information be incorporated into policy decisions.

The Thresholds established by the Commission are not valid as they do not take into account the vagaries of data collection, climatic conditions, water temperatures, disease and poaching. These thresholds have to be changed so that a more rapid response is possible. The coast wide landings of striped bass by commercial and recreational fisherman have been declining since 2006, yet here we are seven (7) years later considering a 40% reduction in landings. By the time policy changes are put into effect it could be eight (8) years too late. The thresholds are such that the ASMFC can sit on their preverbal collective asses and do nothing while the fishery collapses even when reliable on the water reports indicate a problem with the population year after year.

Something has to be done and done NOW before it is too late!

I look forward to a timely response.

Sincerely,

Edward J. Messina, Ph.D.
Professor of Physiology
New York Medical College
Valhalla, NY 10595

Phone: 914-594-4099
Cell: 914-391-5803
Facsimile: 914-594-4018

Mike Waine

From: Messina, Edward [EJ_MESSINA@NYMC.EDU]
Sent: Monday, September 30, 2013 11:06 AM
To: Mike Waine
Subject: Striped Bass

Mr. Mike Waine
FMP Coordinator
ASFMC

Dear Mr. Waine:

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