Atlantic States Marine Fisheries Commission

Tautog Management Board

October 25, 2016
1:15 – 3:15 p.m.
Bar Harbor, Maine

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 (*A. Nowalsky)*	1:15 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from August 2016	1:15 p.m.
3.	Public Comment	1:20 p.m.
4.	Review 2016 Stock Assessment Update (*J. McNamee*)	1:30 p.m.
5.	Provide Plan Development Team Guidance on Draft Amendment 1 (*A. Harp & A. Nowalsky*)	2:10 p.m.
6.	Update on Tautog Tagging Trial (*A. Harp*)	3:10 p.m.
7.	Other Business/Adjourn	3:15 p.m.

The meeting will be held at the Harborside Hotel; 55 West Street; Bar Harbor, ME; 207.288.5033

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEETING OVERVIEW

Tautog Management Board Meeting
October 25, 2016
1:15 – 3:15 p.m.
Bar Harbor, Maine

Chair: Adam Nowalsky (NJ) *Assumed Chairmanship: 05/15*	Technical Committee Chair: Jason McNamee (RI)	Law Enforcement Committee Representative: Jason Snellbaker
Vice Chair: David Simpson (11/15)	Advisory Panel Chair: VACANT	Previous Board Meeting: August 2, 2016
Voting Members: MA, RI, CT, NY, NJ, DE, MD, VA, NMFS, USFWS (10 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from August 2016

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. Review the 2016 Stock Assessment Update (1:30 – 2:10 p.m.)
Background • A benchmark stock assessment for a three-region management approach was approved for management use in February 2015. A regional stock assessment (using the same methodology as the benchmark) for a four-region management approach was approved for management use in August 2016. • At the August 2016 meeting, a four-region management approach was selected for inclusion in Draft Amendment 1. • The 2016 update includes data through 2015 for the four regions + coastwide **(Briefing Materials)**
Presentations • Presentation of the Stock Assessment Update by J. McNamee Report

5. Provide Plan Development Team Guidance on Draft Amendment 1 (2:10 – 3:10 p.m.)

Background • The PDT has developed the background sections for Draft Amendment 1 and will begin developing management options for each region + coastwide (status quo) after the annual meeting and based on stock status. The PDT Chair will provide an overview of the management categories and the Board will have the opportunity to suggest specific management measures be included in the document.
Presentations • Discussion facilitated by A. Nowalsky, Chair • Presentation of Draft Amendment 1 management categories by A. Harp
Board Guidance • Provide the PDT guidance on options in the draft amendment on reference points (See reference point guidance document (**Supplemental Materials**), rebuilding timeframes, monitoring, commercial and recreational regional measures.

6. Update on Tagging Trial (3:10 – 3:15 p.m.)
Background • The Law Enforcement Sub-Committee developed objectives for a commercial harvest tagging program, selected tags to test and reviewed the design of a tautog tank trial to test the feasibility of applying tags to live tautog. • The tank trial, led by New York Division of Marine Resources and Stony Brook University, began on September 28, 2016. The trial was delayed because it was difficult to find enough tautog at any one time for the trial—the pots were in the water for approximately two months. In total, 15 tautog received tags and 6 are untagged for controls. • A final report will be presented at the February 2017 meeting.
Presentations • Tautog Tagging Trial Update by A. Harp
Board Guidance • The Board can instruct the PDT to include the potential for a tagging program under adaptive management in Draft Amendment 1. It would allow a tagging program to be fully developed in an addendum at a later date.

7. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

TAUTOG MANAGEMENT BOARD

The Westin Alexandria
Alexandria, Virginia
August 2, 2016

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

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INDEX OF MOTIONS

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

2. **Approval of Proceedings of February, 2016 by Consent** (Page 1).

3. **Move to approve the Long Island Sound and New Jersey-New York Bight stock assessment and peer review report for management use** (Page 12). Motion by Dave Simpson; second by Bill Adler. Motion carried (Page 13).

4. **Move to approve four region management approach for Tautog Draft Amendment 1** (Page 16). Motion by Tom Fote; second by Bill Adler. Motion carried (Page 18).

5. **Motion to adjourn by Consent** (Page 22).

ATTENDANCE

Board Members

David Pierce, MA (AA)
Dan McKiernan, MA, Administrative proxy
William Adler, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Bob Ballou, RI, proxy for J. Coit (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Rep. Craig Miner, CT (LA)
Dave Simpson, CT (AA)
John McMurray, NY, proxy for Sen. Boyle (LA)
James Gilmore (AA)
Steve Heins, NY, Administrative proxy
Emerson Hasbrouck, NY (GA)
Russ Allen, NJ, proxy for D. Chanda (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Michael Luisi, MD, proxy for D. Blazer (AA)
Rachel Dean, MD (GA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Joe Cimino, VA, proxy for J. Bull (AA)
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Derek Orner, NMFS
Wilson Laney, USFWS

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

Ex-Officio Members

Jason McNamee, Technical Committee Chair

Staff

Bob Beal
Toni Kerns
Tina Berger
Pat Campfield
Megan Ware
Ashton Harp
Katie Drew
Amy Hirrlinger

Guests

Mike Millard, USFWS
Debra Lambert, NOAA
Colleen Giannini, CT DEEP
Justin Davis, CT DEEP
Brandon Muffley, NJ DFW
Mike Armstrong, MA DMF
Doug Christel, MA F&G
Steve Doctor, MD DNR
Lynn Fegley, MD DNR
Jeff Deem, VMRC
Jack Travelstead, CCA
Braxton Davis, NC DNR
Aaron Kornbluth, PEW
Arnold Leo, E. Hampton, NY
Raymond Kane, CHOIR
Jenny Zeng, Ofc. of NYS Governor, DC
Jacob Kasper
Andrew Shiels, PA Fish & Boat Comm

The Tautog Management Board of the Atlantic States Marine Fisheries Commission convenedin the Edison Ballroom of the Westin Hotel, Alexandria, Virginia, August 2, 2016, and was called to order at 12:53 o'clock p.m. by Chairman Adam Nowalsky.

CALL TO ORDER

CHAIRMAN ADAM NOWALSKY: Good afternoon, everyone. I would like to call to order the Tautog Management Board.

APPROVAL OF AGENDA

CHAIRMAN NOWALSKY: Our first order of business this afternoon will be to approve the agenda as has been provided. Are there any changes to the agenda? Seeing none; is there any objection to acceptance of the agenda, as provided? Therefore, the agenda is adopted by consent.

APPROVAL OF PROCEEDINGS

CHAIRMAN NOWALSKY: Our next order of business is approval of the proceedings from the February, 2016 board meeting; any discussion about those proceedings? Any objection to accepting them as provided? Seeing none; they are hereby accepted.

PUBLIC COMMENT

CHAIRMAN NOWALSKY: Our next order of business will be public comment for any items that are not on the agenda today. Is there any member of the public that would like to comment on anything not on the agenda? Seeing none; we'll move right along.

REGIONAL STOCK ASSESSMENTS REPORTS

CHAIRMAN NOWALSKY: We'll next go through a couple of presentations about the regional stock assessments that have been done for Long Island Sound and the New Jersey/New York Bight regions. What we'll do is we'll receive those reports on those two assessments. After those two reports have been given, we'll stop and pause for any questions that pertain to those reports.

We'll then go on to the presentation of the Peer Review Panel report, stop after that for questions, and then at that point the decision point before the board would be whether to accept those for management use. We're not making the decision about the amendment; we'll have that discussion afterwards, but we'll just have to decide whether to accept those assessment reports for management use. With that, I'll turn to Ashton, and she can direct the discussion of those stock assessments.

LONG ISLAND SOUND STOCK ASSESSMENT REPORT

MS. ASHTON HARP: I'm actually going to turn it over to Jacob to begin the Long Island Sound Stock Assessment report.

MR. JACOB KASPER: First of all, I would like to thank everybody who is involved in producing the Long Island Sound Stock Assessment and the New York/New Jersey Bight Stock Assessment; Dr. Eric Schultz, my advisory at UConn; Jeffrey Brust, unfortunately he can't be here today, and Jason McNamee is going to be presenting in his absence.

Greg Wojcik, Sandy Dumais, Dr. Katie Drew, Ashton Harp and there was significant input from the Technical Committee and the Stock Assessment Subcommittee. We're presenting here the Long Island Sound Stock Assessment, which is shown in green/yellow, and also the New Jersey/New York Bight, which is shown in orange.

Previously, tautog was assessed by a single stock unit. But there are some flaws in the coastwide single stock unit assumption, such as regional differences in the fishery, strong site fidelity, localized spawning, and variations in life history. In response to that in the previous benchmark stock assessment, an alternative stock assessment structure was presented with three regions.

One was a southern New England, which included the Connecticut portion of Long Island Sound; the region further south from that was the New York/New Jersey, which included a portion of Long Island Sound. There was a highly regarded alternative to that, which grouped Connecticut with New York and New Jersey.

What we're presenting here is a Long Island Sound specific stock assessment, so we've split Long Island into north and south, and the north going to Long Island Sound and the south going to the New York/New Jersey Bight region. This keeps Long Island Sound as a continuous region. In addition to that, new data was accessed and included in this stock assessment.

This stock assessment runs from 1984 to 2014. We have recreational harvest and discards. For the recreational discards we've assumed a 2.5 percent mortality rate, which is consistent with the benchmark stock assessment. Commercial harvest runs from 1984 to 2014. Commercial discards were not included.

The commercial harvest is about 10 percent of the recreational harvest, and obviously, the discards are much lower than that. There wasn't enough data available to estimate that efficiently, so those were not included. There is fishery-independent survey data, fishery-dependent indexes included and also the biological samples are both fishery independent and dependent.

Data was treated in the following manner. Connecticut data was used as is with the assumption that all Connecticut harvest comes from Long Island Sound. New York had to be split to Long Island Sound and South Shore. For the recreational data, starting in 1988 there was a Long Island specific area code; which made the partitioning pretty straightforward.

Prior to that, there was no Long Island Sound specific area code, so we had to use a multiyear average to fill in those earlier years. Similarly, with commercial data, the Long Island Sound VTR statistical area started to be used in 1986, and then prior to that, we used the multiyear average. This is the harvest in metric tons for the time series for Long Island Sound.

As you can see, in the early decade and a half or so of the time series, we have a general decreasing trend and harvest. Since then, there have been pretty inter-annual fluctuations, but the harvest has generally increased. The next figure is the Long Island Sound catch-at-age. On the left we have on the Y axis the age of the fish, and on the X axis is the years. What we can see is in most recent years we have fewer older fish, and fewer smaller fish.

Obviously, the fewer younger fish are following increased regulation of minimum length. The indices included in this assessment are the Connecticut/Long Island Sound Trawl Survey, which is an adult index, the MRFS Catch-Per-Unit-Effort Index, which is also an adult index, New York Trawl Survey, which was used as an Age 1 index and two portions of the western Long Island Sand Survey, which is a young-of-the-year survey. Those sites are from Little Neck Bay and Manhasset. Generally, we see a decreasing trend in all these indices, some inter-annual variations as well. But the indices follow each other; the trends are pretty similar in the indices. The results of our model are as follows: we have our F and in red we have the three-year-average for fishing mortality.

We can see generally increasing F over the time series. Spawning stock biomass is generally decreasing over the time series, and the number of recruits is generally decreasing over the time series; with one large recruitment event most recently in 2013. The Technical Committee approved MSY as the biological reference point for this stock assessment.

There is a strong fit to the stock recruit relationship. We have included the SPR reference points for this, because the New Jersey/New York Bight region relied on SPR reference points. For MSY the target is Fmsy and the threshold is the F that produces 75 percent MSY. In either of these approaches, MSY or SPR were1 both in overfishing and have been overfished.

Looking at the stock status over time, including our target and threshold for fishing mortality, we can see that most of the last ten years, we hit it above our threshold. Here the orange color line is our three year F average. For spawning stock biomass, we are below our threshold for most of the last ten years.

To address model uncertainty, we looked at sensitivity to input data, so we dropped various indices in the survey. We added Millstone Survey Data; Millstone is a power plant in Connecticut which has collected larvae and egg abundances for a number of years tautog; so we included that in one of the sensitivity analyses.

We started in 1988 to eliminate estimation of landings in the early years. We ran it as using a 15-year-plus group instead of a 12-year-plus group, which is the base model. Then to address the issues of estimating the New York harvest, both recreational and commercial in the early years, for those early years we either included all of the New York harvest into Long Island Sound, or we excluded all of the New York harvest into Long Island Sound; to kind of look at the extremes of those assumptions impacted our stock assessment.

We also looked at sensitivity to model structure. We merged our selectivity blocks three and four into one selectivity box, and we ended up with three selectivity blocks. Then retrospective analysis was performed using a six-year peel. Please note that this crosses a selectivity block. There is nothing outstanding in the retrospective analysis, and there are extra slides if people are interested.

The sensitivity results are shown here. We have SSB trajectory. Again, a general decline over the time series and all of the different analyses are relatively similar. For F average, in each of the sensitivity analyses are quite similar and we have a general trend of increasing F. For estimating the number of recruits, generally decreasing over time, similar patterns in all the sensitivity analyses and the strong recruitment event in 2013 is pretty consistent.

Stock status sensitivity. Because of time constraints, we weren't able to calculate F threshold for each sensitivity analysis. Presented here is the terminal F, relative to Fmsy; which is the target and not the threshold. Generally, what we see is terminal F is larger than Fmsy in all but one of our sensitivity analyses. The results of this assessment are that the model is robust to input data and model configuration. The stock is overfished and overfishing is occurring. The status is reasonably consistent with the alternate regional model configuration from the benchmark. In here I presented -- you can see the Long Island Sound MSY and SPR approaches as you've already seen, and in the last column is the Southern New England MSY from the previous benchmark. The trends are quite similar in all of these. That's what I have for Long Island Sound.

CHAIRMAN NOWALSKY: Thank you very much, Jacob, we'll go to Jay next to do the New York/New Jersey Bight, and then we'll come back to questions on both of these reports.

NEW YORK/NEW JERSEY BIGHT STOCK ASSESSMENT REPORT

MR. JASON McNAMEE: My name is Jason McNamee; I work for the Rhode Island Division of Marine Fisheries. Jeff Brust from New Jersey, who is the analyst on this assessment, couldn't attend; so I offered to pinch hit for him. I was involved enough that I think I have a decent feel for it, and Jeff and I talked a lot before this meeting; developing this presentation.

The format. It is very similar to what you just looked at, so at least you'll be seeing the same types of information. Hopefully, you'll be able to track this fairly well. This is now -- we're calling it the New Jersey/New York Bight Assessment. What you can see is we're talking about this orange area now on there, so it is the entirety of New Jersey and the South Shore of New York's Long Island.

Data types. Just to know up front, these are all consistent with choices that were made for the benchmark assessment; more or less. But we used recreational harvest from 1984 to 2014, recreational discards for the same time period, the assumption being that 2.5 percent of them end up as removals.

Commercial harvest for the same time period, commercial discards are not included; and this was also consistent with the benchmark. We did some sensitivity testing on that in the benchmark; we didn't do that here, just because of the timeframe that we were working with. We used fishery-independent survey data, fishery-dependent index data and fishery-independent and fishery-dependent biological samples.

The treatment of the data. The New Jersey data, was used as is; meaning New Jersey was easy to deal with. We just had to grab the New Jersey data; didn't have to do anything special to it. The New York data was split by area, so we had the Long Island Sound piece of New York and the South Shore piece of New York.

Based on the work that Jacob did for the Long Island Sound version, we just removed the remaining New York harvest and that was attributed to the South Shore. The recreational data goes from '88 to 2014. Just as Jacob described, this is when we can kind of pick out, from the MRIP data, this Long Island Sound specific area code. We can kind of identify it as occurring in Long Island Sound.

Prior to that, we used a multiyear average harvest approach, just like Jacob described. Again, the South Shore is all of New York minus New York information that is attributed to Long Island Sound. Commercial data, very similar approach, '88 to 2014, used VTR statistical areas, how we kind of partitioned that information up. Then in the period of time when we didn't have that '84 to '87, we, again, used a multiyear average harvest approach. Here is a look at harvest. You can see the top graph there on the Y axis is metric tons, along the bottom is year. You can see a lot of inter-annual variability; not surprising, given that this is a predominantly recreational fishery, so it is very much dependent on the estimates coming out of MRIP. You see that jagged but basically, you had a higher period of harvest early in the time series that has dropped down to a lower harvest in more recent time.

The bottom chart there, the bubble plot, what you have on the Y axis there is age. It goes from Age 1 up to Age 12 going up the Y axis. Along the bottom, again, is year. The idea here, couple of things you can get out of these plots. I don't know that you get either of them from this plot; but you can track cohorts to some degree. I would show you if I could get my cursor up there, but I can't.

You can use your imagination. What you're looking at is you're following things up diagonally from left to right going up the Y axis, and what you want to see are those bubbles kind of getting smaller in size, and that is kind of the decay that occurs on a cohort through time. It is not as pronounced in this graph. You saw it in Jacob's graph pretty nicely, but as management measures went in, you see that shift in harvest.

I don't know, if you use your imagination, maybe you can see it there, as well, but it showed up real nice in the Long Island Sound version. Okay, the fishery independent information that went into this assessment, the New Jersey Ocean Trawl was the main fishery-independent trawl survey that went into this.

There was also MRFSS or MRIP Catch-Per-Unit-Effort Index that went into this assessment; both of those alias adult portions of the population. Then there was the Jamaica Bay Seine Survey, so this is a piece of the Western Long Island Seine Survey, but this is a piece that we thought was a little more applicable to this stock assessment region; and so we kind of peeled off that data and used that as a young-of-the-year index.

Model results. Just as Jacob described, top left is fishing mortality, so fishing mortality increases going up the Y axis; year increases going along the bottom left to right. What you see is a solid blue line. That is the actual point estimate year to year, it is the median estimate; and then there are some bounds of uncertainty. Those are the hashed lines; 95th and 5th confidence interval.

But for tautog, what we've done in the past and what also came out of the benchmark is a three-year average. A lot of that is due to the inter-annual variability we get, so we use a three-year average and that is what that red line is that seems a little bit smoother; going across the blue line there.

What you can see is that fishing mortality, beginning in the early 2000s to present, has been kind of increasing, again, with some variability. Top right hand side – is that your right, yes, it's your right too – is SSB, spawning stock biomass; same sort of information without that three-year average here. But you've got the solid line as your median, point estimate with bounds of uncertainty, and then bottom left hand side is recruitment information.

Again, the median estimate is the solid blue line there, and you can see, I think there was -- in this case, I'm not sure if it is 2012 or 2013, but later in the time series is a large recruitment event in this information as well, which is interesting.

Biological reference points. In the case of New Jersey/New York Bight, the MSY based reference points were deemed unreliable. There was a poor fit to the spawner-recruit relationship. There is an estimate of steepness that the model produces, and as it gets really close to one, what the model is telling you that there is no information with which to estimate that steepness parameter.

Take home point is we weren't able to use MSY based reference points here; we had to default to SPR based reference points for the New Jersey/New York Bight Stock Assessment. Based on what we agreed to in the benchmark assessment, the targets were 40 percent SPR metrics, and then the threshold was a 30 percent SPR metric; depending on which you're talking about F or SSB.

Again, these are consistent with the benchmark, and in the table there you can see what those targets and thresholds are for both fishing mortality and spawning stock biomass. I've got some graphs, so I won't linger on this too long; but it's here if you wanted us to flip back to it.

Stock status. Take home point here is that the New Jersey/New York Bight region is overfished, and overfishing is occurring. The top graph there is the stock status with regard to fishing mortality, and the orange hashed line is the threshold. The green dashed line is the target, and you can see, in particular when looking at the three-year average, which is the one that we're focused in on, we are above both the threshold and the target since the early 2000s for this region.

Bottom right hand side there is the stock status with regard to spawning stock biomass. Again, the green line is the target, orange line is the threshold, and you can see that spawning stock biomass has been below both for almost starting back in the early 1990s. It looks like it's kind of come up in the most recent period of time, and the uncertainty bounds kind of jump up above the threshold at least. But the terminal estimate for spawning stock biomass is below the reference point.

A little bit about model uncertainty. To test the sensitivity of the model to input data, we dropped individual surveys, reran and saw the effects. We also started in 1995, so that is a later start date to see the effect of some of the information that we interpolated.

Then we fixed the 1995 severe underestimation in the New Jersey recreational harvest. What we mean by that is there was as anomalously low estimate for New Jersey, which has a significant impact on the removals for that year, so we kind of looked at that; tested it by putting in a more averaged value, and so that was another sensitivity. You see how sensitive the model was to that single data point.

Sensitivity to the model structure. The base model had four selectivity blocks, but we added one with three selectivity blocks; and they are kind of outlined, there underneath the years. We chose the years based on major changes to the regulations during those periods.

Retrospective analysis. This was done just like Jacob noted. We did a six-year peel; that peel goes across the selectivity block. It is generally not a good idea to run retrospectives back over selectivity blocks; but the last selectivity block was so short for this model that there really wasn't much of an option there to get a decent retrospective peel, meaning the number of years you kind of go back and start the model over again. In general, nothing was particularly outstanding, so you can make that judgment for yourself. Here are some plots; the top left is average F. You can see that the majority of the sensitivity runs are all pretty tight, not wildly different from each other. I will note the one that catches your eye, or caught my eye, is that blue line that hangs down there. That is the three-block-selectivity run; that's what that is. Effect on F, fishing mortality. Just to the right of the average F plot is the spawning stock biomass, so it is SSB metric tons up the Y axis, year across the bottom; those all look pretty tight. Then recruits on the bottom, again nothing really remarkable there, none of the sensitivities indicated there is some major misspecification in the model.

Stock status sensitivity. I'll orient you to this plot. It always takes me a minute to kind of adjust my brain to what I'm looking at. Here what Jacob showed you, was this same plot, but just with respect to the target. Here we've got both the target and the threshold; so the threshold is blue; the target is the red color.

The different sensitivity runs are the groupings along the X axis there, so those are the different selectivities. What you want to see on this plot is you want those bars to be below one, so you can see on the Y axis one, when you go about one-third of the way up there. You want those bars to be below one; that would mean that you are at or below your target or threshold. What you see in each case here is that with all of the sensitivities, they are all giving the same information, and that is that stock status in this region is not good.

Some conclusions. The smaller regional scale was not as problematic as we anticipated. We were a little nervous going into this. We didn't know if things were going to hang together, and it did. That was good. The models are robust to the input data and the model configuration, as indicated by the sensitivity runs, and the status is consistent with the alternative regional configuration from the benchmark.

We can talk about that. I bet we should probably hold off on talking about that until we get to the Peer Review Panel report. But a long story short, if you look over on the right, there is kind of a grayed out section. That is the Long Island Sound, just so you could kind of look at it and compare. That is Long Island Sound SPR.

But the two comparisons are Long Island Sound, which the Technical Committee preferred MSY, so you can see those targets, thresholds and stock status. Then the New Jersey/New York Bight is just to the right of that, and so it gives you a little bit of a reference there and information in both cases is overfished and overfishing; there's a typo there, sorry about that.

TECHNICAL COMMITTEE RECOMMENDATIONS

MR. McNAMEE: Future assessments. The Technical Committee recommends conducting a benchmark assessment in 2021, so we'd like to dig back in, in a significant way in 2021; but we'll all do an update assessment in 2016. A lot of what we do will depend on the decisions that you make today. I think there are some important decisions that you all will be making later that will dictate how many updates we're doing in the end.

We're only proposing a single update at this time, but only because we don't know what the future holds at this point. When we get to 2016, we're poised to do an update in 2016, but we'll look at whether or not we need to, or we think it's recommended to add another update before that benchmark, which is a ways off. Okay, that is enough from me, so I will stop and take any questions you have. I think you can ask both Jacob and me any questions that you might have.

CHAIRMAN NOWALKY: Thank you, Jay, thank you, Jacob very much for those presentations. We'll turn to the board. We're going to have questions on these reports and the information presented therein. Then we'll get the peer review report, and make a decision whether to accept these for management use. Then we'll have the discussion about how to apply them to Draft Amendment 1. Questions? I had Jim Gilmore and then we'll go to Bill and Dan.

MR. JAMES GILMORE, JR.: That was a great presentation, guys. This question is actually for both of you. You can either team up or do them separately. It has to do with the data sources, and you probably know where I'm going with this. I think, Jason, when you talked about the Western Long Island Sound Study, and you separate out Jamaica Bay, it is pretty easy, because geographically, north and south of Long Island are pretty separate.

I guess overall you both separated the Long Island Sound, and then you had the South Shore of Long Island. But when you get out to the East End and it gets extremely dynamic, because you have the north side of the south fork and the south side of the north fork, and by Gardener's Island or whatever. There are actually three questions here. How did you actually separate all of that out, because that is a big management issue we're going to have to deal with, so how that works.

Secondly, depending on how you separate it out, how do you think that factors into the modeland how much uncertainty that may have added, because you're not exactly sure whether it was from Long Island Sound data or South Shore data. Lastly, we all know the unreported landings in this may be pretty significant, so how that was factored, and particularly for the retrospective analysis; because that could maybe change that from nothing exciting to maybe something significant. Thanks.

CHAIRMAN NOWALSKY: Great, and I'll turn to the presenters for attempts at those three.

MR. McNAMEE: I guess I'll start with your first question about the data, how did you parse it out? It's a good question. First I'll offer a note of thanks to Greg Wojcik from Connecticut, who did a lot of that work. There are a couple of different things going on here, so you've got recreational and commercial data.

It was pretty tricky, and Greg did a lot of work digging into the MRIP data looking at the information available in there. There is an area designation that is in there, so long story short, Greg was able to parse it out. He also did a little work on whether there was a lot of scatter in that information; whether there was reason to believe that yes, the area code is X but it could have been X plus Y; or he could have gone way out of Long Island and could have been fishing in Narragansett Bay or something like that.

From the information that we looked at, it seems pretty reasonable to assume that – and I think a lot of it has to do with the nature of tautog fishing – but we didn't feel that there was a lot of reason to believe that people were dispersing very far from the areas that they were reporting. Hopefully, that answers it on the recreational side. On the commercial side there is a little less information to work with. We worked with statistical area to the extent possible. As far as assumptions go, keep in mind that the commercial portion of the harvest is very small; so if we were off there the impact on the overall model is probably not – not to say it's not important – but it's not very impactful to the outcome.

There was a lot of work done on that very issue, because that is the difficult issue with creating this assessment. It is, in fact, why we did not do it originally. But a lot of work went into that. I think it is good work. The Technical Committee was pretty comfortable with that and felt we did as good a job as we could; and felt it was pretty reliable; anything to add, Jacob?

MR. KASPER: Not right now.

MR. McNAMEE: Great. While I've been yammering away, Jim, I forgot the second part of your question.

CHAIRMAN NOWALSKY: Jim's second question was about how the modeling accommodated those data issues.

MR. McNAMEE: Okay. I think, in general, the movement to the statistical model helps that. You don't have to assume that catch is known perfectly, so there is statistical estimation going on in the model. Again, I think what we produced was pretty reliable as far as tautog data goes; so I'm pretty confident that if we were off here and there, I don't think it would have large impacts on the results.

CHAIRMAN NOWALSKY: Comments regarding how unreported catch might have factored into the modeling.

MR. McNAMEE: I can't say too much about that, Jim, other than to say in the Long Island Sound version of the universe, there wasn't a big retrospective pattern. A lot of times when you have missing catch, that can be one of the way it manifests. It is not always the reason for retrospective patterns, but the retrospective in the Long Island Sound version was not bad at all.

If there is a lot of unreported catch, of course, it's not a good thing. That means we're not working with good information, but again with regard to the fact that we're using a lot of uncertainty in the model, and that we're estimating things statistically; I think that helps that to some degree. If it is massive, two or three times what the actual harvest is, that is a problem that's not going to be solved by statistical estimation of a model.

CHAIRMAN NOWALSKY: Jim, if you have any questions during the Coastal Sharks Board, you'll need to get somebody else to ask them for you; next up, Bill Adler.

MR. WILLIAM ADLER: Going back to one of those charts for the New York Bight, New Jersey one with the SSB. It showed a little up, turn up, not good enough yet, not up to the threshold. Any reason why all of a sudden that happened like that? Is that a good sign that something good is happening down there?

MR. McNAMEE: Conjecture on my part, but it is coincidental with some pretty significant regulations that went into place during that period of time. I don't know if that's the cause, but that is something that is coincidental with that uptick in SSB.

MR. DAN McKIERNAN: Jay and Jacob, later in this meeting we're going to be talking about a tagging program, for the reasons that I think we just mentioned, the unreported commercial catch. In our conversations with Law Enforcement, there is a feeling that the unreported commercial catch may be, in some discreet geographic areas, two or three times what is reported.

Our commercial quota is only 50,000 pounds in a year; and we've had some stunning busts with huge volumes of fish post season. There is that feeling. I don't know if you can address it either today or in the future. I think it probably should be addressed before we undertake such a massive administrative program to accomplish a solution to the problem; if the problem isn't really clearly manifested in the assessment.

Maybe not today, but maybe you could tease out those parameters in the assessment that could reveal we've accomplished some goal going forward, if we are solving this localized poaching issue. I guess that is my question. If we do solve the localized poaching issue, which parameters would reveal that in the model?

DR. KATIE DREW: Ideally, what we would hope to see would be some kind of response for the stock, so that if you eliminate the source of mortality that the overall total mortality on the stock would be less, and the stock would be able to grow faster. Right now, part of the problem is, the model really uses total catch as a way to scale some of the trends we see in the indices and in the age composition.

If you're missing catch, what you're going to see is the stock looks smaller than it really is, and fishing mortality looks higher, and the productivity of the stock looks lower, if you're taking out all these secret catches. The model can fit that. It just is basically thinking the catch that it sees is having more of an impact on the stock than it really is.

If we can eliminate some of this unreported catch, then hopefully, you would see the stock begin to recover, you'd see those F rates come down, and you'd see an uptick in the population. That ideally would be what we would want to look for. If there is a way we could get some better information on the scale of the problem, and a way that we can go back in time and maybe back calculate some of these things, we can try and look at that from sort of a modeling perspective. But ideally, the result of improving our control over the fishery removals would be a better stock.

CHAIRMAN NOWALSKY: Any other questions on these two reports before we go to the Peer Review Panel Report on them? Okay, seeing none, we'll turn to Pat.

PEER REVIEW PANEL REPORT

MR. PATRICK A. CAMPFIELD: Because we did follow up regional assessment work after the original benchmark peer review, the commission organized a desk review for these new regional assessments; as we've seen Jacob and Jay presented Long Island Sound and New Jersey/New York Bight results. That is what the desk reviewers evaluated. We had two technical peer reviewers. In combination and expertise in population dynamics, stock assessment modeling, statistics and tautog biology. Their review focused on the data inputs that were selected and used in the models, and the overall quality of the assessment. As you have received, the products from the work are the stock assessment report for both sub-regions and the Desk Review Report. The two desk reviewers were Dr. Cynthia Jones from Old Dominion University, and Joe O'Hop from Florida Fish and Wildlife Commission's Wildlife Research Institute.

I'll note that Dr. Jones was the Chair of the Benchmark Review Panel. We asked her to continue in this desk review for consistency and her familiarity with not only tautog, but the assessment models we've used over time. The desk review took place; they received their reports in late June and concluded their desk review about three weeks later.

Let me stop and mention that the Review Panel commended the strong work that the Assessment Workgroup conducted here since the benchmark was completed, to tease out the data and develop these new regional assessments. They said it was very well done. Their overall review findings are that the Long Island stock they agreed is overfished and overfishing was occurring in the terminal year of 2014, and the same case for the New Jersey/New York Bight Sub-Region.

The panel finds that the regional stock assessments are acceptable for management use. You saw these two figures in the earlier presentations, but on the left you have the fishing mortality trends for Long Island Sound, and again fishing mortality is above the target and threshold. That is also the case in New Jersey/New York Bight Region.

The first review Term of Reference was to evaluate the assessment data, how the assessment team selected or excluded data, and how they use them and the ASAP model. The panel concluded that all potential fishery-dependent and fishery-independent data sources were thoroughly reviewed and selected appropriately.

The Assessment Workgroup used four criteria to decide which datasets to use, such as the duration of a time series was at ten years or more, were there adequate sample sizes, et cetera. The tautog assessments, of course, rely heavily on the MRIP recreational survey estimates. The review agreed that although there are low sample sizes generally speaking for tautog, the MRIP data were sufficient for use in the stock assessment.

They did note in future assessments, most likely for the next benchmark, to keep an eye on the changes in the MRIP survey; notably the effort survey and new calibrations to the catch data that will result from that change in MRIP effort surveys. The panel also noted that in future assessment work, the team should explore correction to the growth curve parameterization where fishery dependent data are used.

This figure, it's a little small for you to see, but it is in the desk review report in your materials. There were challenges in estimating weights at age for the earliest age classes one and two. Because of the selectivity of the fisheries, because of the minimum sizes, they don't pick up a lot of these younger fish.

The second Term of Reference was to evaluate stock structure and geographical scale of the regional assessments. Very similar to the benchmark assessment and review findings, the growth rates were found to be similar from Connecticut to New Jersey. The growth information does not make an easy distinction between areas within Connecticut to New Jersey. Also, the genetic studies that have been completed to date are inconclusive relative to trying to split out Long Island Sound and the New Jersey/New York Bight Region; although there is a new genetic study underway coastwide for tautog. They found that the new regions are reasonable and acceptable, but not necessarily any better than the various regions that were assessed in the benchmark.

The third Term of Reference was to evaluate the methods and models used to estimate population parameters. Their overall review findings were that the age-structured-assessment-program model is appropriate for use of the selected input data. Compared to other models, this ASAP model is able to pull in a lot of the available data, and its results are justified for use in making management decisions.

Again, they did see some concerns relative to the weight at age and growth curve analyses, and encouraged the Assessment Committee to explore those further in future assessments. TOR 4; evaluate the methods to characterize uncertainty. The panel's conclusions were that sensitivity to a range of data inputs and model structures were well addressed and understood; as Jay and Jacob mentioned or displayed in their sensitivity runs. The overall outcomes relative to stock status are robust.

Relative to retrospective patterns, the Long Island Sound model had relatively small retrospectives, and are not a concern for management action. In the New Jersey/New York Bight model, there are larger retrospective biases. The panel said that they were worried about this, and that the retrospectives indicate the F and SSB estimates are more uncertain.

But they also noted that the direction of the retrospective patterns switched over time and actually switched to a more favorable pattern in the most recent time period. Again, they think these results are still useful; but to continue to keep an eye on retrospective patterns. The fifth Term of Reference was to evaluate estimates of stock biomass abundance and exploitation.

The panel concluded that the ASAP model and associated reference points provide the best estimates for determining stock biomass abundance and exploitation. They did raise minor concerns relative to the plus group designations, looking at 12 plus versus 15 plus; and otherwise model estimates are robust.

In a less concerning situation, you would see similar results regardless of these relatively high plus group designations, but they did see some different results. Again, they are encouraging the assessment team to explore plus group designation in the future. For New Jersey/New York Bight, there is greater uncertainty overall in the model outputs.

I think Jay touched on this. This is relative to a poor stock recruitment relationship and the larger retrospective patterns. Jay and Jacob also touched on this, but the desk reviewers had a notable concern about the erosion of older age classes. For tautog, this is one of four plots that were in your material, but it shows if you look at, these are time on the X axis and the biomass on the Y axis, broken down into the various age classes.

What they wanted to highlight is you can see sort of the last part of those bars, the green at the top. That is the plus group, and it used to comprise roughly 20 percent of the overall composition in a given year. That was the case in the eighties and even into the nineties, but in the most recent years it's really less than 10 percent or even 5 percent of the biomass by age, so really the beginning of a truncation of the age structure for tautog. Finally, the last Term of Reference was to evaluate reference points and methods used to estimate them and recommend stock status.

The panel agreed with the stock assessments conclusions, and found that you could use either a spawning per recruit or MSY reference points for Long Island Sound; but should only use the SPR based reference points in the New Jersey/New York Bight region. Again, agreed with the overall conclusions that both regions are overfished and overfishing in the terminal year and that the Desk Review Panel finds the stock assessment acceptable for management use.

CONSIDER ACCEPTANCE OF REPORTS FOR MANAGEMENT USE

CHAIRMAN NOWALSKY: Questions for Pat on his presentation? Okay, seeing none; the next step before the board would be to consider using these as acceptable for management use. That is not a determination of which approach we're going to use in Amendment 1, but if we're going to consider them, we would need a motion to accept them for management use. I've got Dave Simpson's hand up.

MR. DAVID G. SIMPSON: Yes, move approval of the Long Island Sound and New Jersey/New York Bight stock assessments for management use.

CHAIRMAN NOWALSKY: Bill Adler will second that motion. We'll get that up on the board. Okay, move to approve the Long Island Sound and New Jersey/New York Bight stock assessments for management use; motion by Mr. Simpson, seconded by Mr. Adler. Any discussion on the motion? Emerson.

MR. EMERSON C. HASBROUCK: In thinking about this motion, I actually do have a couple of questions for Patrick. Can I ask those at this time?

CHAIRMAN NOWALSKY: Go ahead.

MR. HASBROUCK: In the review of these two assessments, there were several issues that were highlighted. The models had some problems with weight at age and growth curve, and the selectivity estimates in one of the time blocks may indicate misspecification in the model. You mention those in your presentation, but are those issues going to be addressed or if we vote on this motion we're accepting it as it is, without any of the corrections to the model?

MR. CAMPFIELD: The nature of those concerns was relatively minor. They may change, for example, the fits of the growth curves. But they would not change the stock status results. In the communication with the Assessment Team, actually during the desk review with some of their preliminary findings, I think the approach moving forward was during the update and certainly through future benchmarks to explore those suggestions; but they didn't see it as a show stopper at this point, minor concerns.

CHAIRMAN NOWALSKY: As Pat was giving that answer, a brief sidebar with Katie. She indicated that if, depending on the discussion that goes on with the next item, those concerns would be discussed in a next assessment update; and Katie is nodding her head. Any other discussion on the motion, Tom Fote and then we'll go to Joe.

MR. THOMAS P. FOTE: We've put a lot of work -- the Technical Committee and the staff has put a lot of work into bringing out this information. Even if there is not much difference, I think we should go ahead with this plan. We talked about regionalization, about breaking areas down into specific catch areas. We've talked about that with many species, and this is the first opportunity to do this.

We might be able to refine it a couple years from now; we might find that you actually push southern New Jersey into a different area. But once we start with this information, we should continue using it, because even if it doesn't make much difference right now on the mortality or what we have to do. It is a good base to start from, and in the future, we accumulate more data; it will be very helpful, and to prove that we can do this with other species. That's what I'm looking at, so I support the motion.

MR. JOE CIMINO: I just want to thank this group for the work that they've done. Well, I guess it's a question. We recently had a weakfish assessment that was done by an outside group, and I know work is being done to transition that over so that staff -- and that we can move forward with updates to that in the traditional way that we have been, and I'm wondering if that's the same case with the Long Island Sound assessment. Is an update going to be able to be done in-house, or are there considerations for how that will happen?

DR. DREW: Unlike the weakfish assessment, all of these assessments are using the same software and the same programs; so basically, it's just a matter of making sure that we have the same data input files, and we can go forward with that. It's not a significant problem or hindrance here.

CHAIRMAN NOWALSKY: Any other discussion on the motion? Okay, seeing no other hands up I'll give the states a moment to caucus, and then I will ask if there is any objection to the motion. All right, all the states have had an opportunity to caucus. **Is there any objection to the motion as presented? Seeing none; the motion carries**.

CONSIDER SPECIFIC REGIONAL MANAGEMENT APPROACH FOR DRAFT AMENDMENT 1

CHAIRMAN NOWALSKY: That will then take us on to the next agenda item, Considering Specific Regional Management Approach. Question before we go on to that. Bill Adler.

MR. ADLER: Yes, it does say in the agenda; do we have to approve the Peer Review report, as well? I mean that motion didn't do it. Is that something that needs to be approved?

CHAIRMAN NOWALSKY: Accepting them for management use implies we've accepted all the reports.

MS. TONI KERNS: **If you just add Stock Assessment and Peer Review Report, because it is one report, the whole thing; the Peer Review and the Assessment is one individual report.**

CHAIRMAN NOWALSKY: **Is there any objection from the board in proceeding in that manner? Okay, so the previous motion will then include the Peer Review Report, as well**. Thank you, Bill. Okay. We'll turn to Ashton for a presentation on regional management approaches, how we're potentially going to use these for Draft Amendment 1.

MS. ASHTON HARP: This presentation is really just to give food for thought for the future discussion that is going to happen, which is considering a regional management approach for Draft Amendment 1. Right now, you'll see a timeline, and I want to caveat that this timeline is kind of assuming that the board will choose a three or four region management approach; although I will present other actions that the board could take. But as you can see August at this meeting, we have reviewed the Long Island Sound and New York/New Jersey Bight assessment, and it has been approved for management use.

Now the TC would meet and provide a stock assessment update prior to the annual meeting. The results would be presented at the annual meeting. The PDT would also have a meeting prior to the annual meeting where they would review the Catch Reduction Analyses, and all that would then be presented at the annual meeting.

After that happens, the board would look at the results, and then they would task the PDT to kind of start developing the options for Draft Amendment 1. Draft Amendment 1 would then be presented at the February meeting, and as you can see, we would move forward with public hearings in the spring and possibly implementing Draft Amendment 1 at the May meeting.

But if there were any kind of difference, there could be changes to the timeline if a management approach is not chosen at this meeting. It could potentially have delays. Right now, I want to present to you the three regions. The three-region approach, which is one, Massachusetts through Rhode Island, two, Connecticut, New York and New Jersey, and three, Delaware, Maryland and Virginia.

Those are the regions in the three-region approach versus the four region approach, which is Massachusetts and Rhode Island; again, Long Island Sound, New York/New Jersey Bight and Delaware, Maryland and Virginia. These are the kind of two that we're asking the board to consider at this board meeting.

Then I want to review some of the potential actions the board could take. The board could opt to select a management region out of the three region, or the four region at this meeting. It is the preferred approach from the TC and the PDT, because then it would allow the TC to kind of move forward on a specific management area for the stock assessment updates, and it would allow the PDT to review the Catch Reduction Analyses prior to the annual meeting.

Just kind of like a streamline approach, we know exactly what we're going to do next if this option is chosen. However, there are other ways the board could go. I've already done Number 1, so Option Number 2 is the board could select a management region out of the three or four-region management approach at the annual meeting, so after the stock assessment update has been revealed, the results have been presented.

This would recognize that the TC would have to complete five regional stock assessment updates instead of either a three or a four region, so it does add additional work on behalf of the TC. The last option to consider is to include both the three and four region management approaches into Draft Amendment 1.

This would recognize that the TC and PDT would have a significantly higher workload when developing the potential management options. There is a highly likely possibility that Draft Amendment 1 could be delayed if this option were chosen. With that, I will take questions myself, or Jay or Katie can refer to the stock assessment, as well.

CHAIRMAN NOWALSKY: Ashton, I'll ask you to put that last slide up on the board. Just to reiterate with those three options, the first one is we pick three or four region approach today. The assessment update that is going to take place later this year, with the most recent data available, would only apply to that and the status quo coastal update. We would just get that information back at the annual board meeting.

If the board went with Option 2 here, we would essentially be tasking the TC to do an update on all of those regions, and we would then get that information back at the annual board meeting. The third option here would then be further putting that decision off until some point in time, where we would get the update information later this year.

Then once we had that update information, we would then leave the decision point out into the draft amendment for public comment to determine which of those regional approaches we would chose as part of the entire amendment process.

The decision here today would be whether or not we want to narrow down the approach to the three or four region, or we want to allow the TC to go ahead, do the updates, and then get that back; review those at the annual meeting and potentially make a decision at the next board meeting. First, let me ask if there are any questions about those potential processes and options. Okay, question? Jim, go ahead.

MR. GILMORE: Just so I understand, on 2 and 3; they are sort of additive, so you're still, if you do Number 3, you're going to have to go through all the stock assessment updates; so that is going to be included in that. It just makes it a little bit longer.

CHAIRMAN NOWALSKY: Let me add first that yes, we would be making that decision further down the road, and it would be a question of whether the public weighs in on those decisions or not; and Katie wanted to add as well.

DR. DREW: The extra work on top of Number 3 would also be developing management options for all of the potential regions when we go forward with how much of a reduction we're going to take; so things like bag limit, size limit, season analyses, those would have to be done for all of the regions for both potential sets of regions.

In addition, just to point out that this decision or this question also went out to the public already in the form of the public information document. The public has had a chance to weigh in on this initial question, then it would be a matter of weighing in on the regions as well as the management options as part of that whole document. As you can imagine, that adds a tremendous amount of work for the TC, the PDT and staff in developing that third option.

MR. GILMORE: Katie, you're going to do size, season and bag for any one of those options. It is just that on Option 3, you are just going to have to do a lot more iterations on it.

DR. DREW: Right, so we would do a set of management options for all of the regions that the board wants to look at. If the board wants to make a decision on the options here today and say, okay going forward, we're going to break this stock into three regions; then the TC will update all three regional assessments; we'll do the catch reductions for all three regions; we'll do a size, season and bag limit analysis for all of those options; that would then go into the document and be reviewed. But if the board does not make that decision here today or at annual meeting, then the TC would do that for the three-region assessment and the four-region assessment models. Depending on where the board makes that decision, that is the timeline.

CHAIRMAN NOWALSKY: Just so I can clarify, Katie, the size, season, bag limit reductions, if the board does not make a decision today, those are going to be done as part of the assessment update later this year? It was my belief those would not come until the board specifically tasks the TC/PDT to do those in constructing the draft amendment to go out for public comment.

DR. DREW: Right, we were tasked to present, or our understanding is that we were tasked to present overall catch reductions at the annual meeting. Basically saying, with this set of reference points you need to reduce F by this much; therefore, you need to reduce catch in this region by this much.

The options of how those would be handled would be then presented when the PDT is tasked with developing those options, so that would be the next meeting after that. That would be part of the third option, basically. Number 2, we're only doing the assessment update and the overall catch reductions. Option 3, we would be also adding the management options.

CHAIRMAN NOWALSKY: Today I think we're at the 1 or 2 decision point; you would agree?

DR. DREW: Yes.

CHAIRMAN NOWALSKY: Additional questions on the options here. Okay, I see Bill Adler has got his hand up for discussion or a motion, if applicable.

MR. ADLER: You know last time we had the meeting the discussion arose as to whether we could split off Long Island Sound into a separate area, and then the Technical Committee did that. I don't understand why, since we have this already at our fingertips, why we can't go ahead with that; I guess you would say it is the four-area instead of three.

Because it seems like at the last meeting, we were looking for something like this. I don't know what the disadvantage would be, but somebody else may know it, why we can't just proceed on the four region, give them the job of doing the four-region option; unless somebody says no, we want the three or whatever. What do you think?

CHAIRMAN NOWALSKY: The only gain from the board's perspective is that we would then see the latest stock assessment update for both the three and the four-region approach. That would be the reason for not making a decision today; I don't know, does that help you?

MR. ADLER: No, I just thought to move this ahead, if we picked the four region one, and then proceed with whatever they have to do. If we're moving ahead on the four-region approach that we could make that decision today and send the Technical Committee off to do whatever they would do, rather than wait around and say, well should we do the three, should we do the four; and then wait another two months before we make that decision. I just thought why not move it ahead a little.

CHAIRMAN NOWALSKY: Well, that is the will of the board. Tom Fote.

MR. ADLER: Okay, do I make a motion that we pick the four region approach?

CHAIRMAN NOWALSKY: Well, I've got two more hands up. Let me go through those hands, and if there is no other motion at that point then we can come back to that. Go ahead, Tom.

MR. FOTE: I would like to make a motion that we actually go to the four-region. The reason I propose that motion right now is because we're right after the stock assessment. If we think the four-region is the best idea, I don't want to get between when we have three regions or four regions and start cherry picking which is the advantage to one place over another.

If we do this before the stock assessment, we're saying this is the right method of doing this, because we basically are able to sample out of areas that we wanted to do purposefully. I don't want to know whether it is an advantage if I'm in a three regional or four regional. I want to make the decision now, and I'm taking a chance whether it's good or bad; but I think it's the proper thing to do. **With that, I'll make a motion that we go to the four-region approach and only the four-region approach, which I think is Option 1.**

CHAIRMAN NOWALSKY: Do I have a second to that motion, Bill Adler. Okay, discussion on the motion; let me see a show of hands of those people who would like to speak in favor of the motion. I've got Jim, Russ. Bob, do you want to speak in favor, also? Can I get a show of hands who would like to speak against the motion? All right, Tom, do you have anything additional to say in support of your motion before I go to the speaker list?

MR. FOTE: Yes, I'm looking to cut down the load on the Technical Committee. When we require more information, when we require all that, it is tasking people that are overworked, overstressed already; and basically I'm trying to be conservative on their time. I know we have limited amount of personnel in New Jersey that can do this, so we're asking one person to do a lot of the tasks.

If we really think that this is the best approach and we're able to do it, that would actually give us regions. The only reason that will make us wait for the stock assessment is if we wanted to cherry pick. But like I said, well, this way I only have to make this much reduction or that reduction. It is not really planning to do the right thing. That is why I'm saying we should do this now.

CHAIRMAN NOWALSKY: I'll go to Jim Gilmore next, speak against the motion.

MR. GILMORE: I'm not completely against the motion, it is a conditional issue. Maybe to get to Bill Adler's question before. The problem we have is biologically, the assessments are fine, and I understand them. That is why we are in complete agreement; I think the assessments were done right. I think biologically, it makes sense.

Management wise it becomes extremely difficult for the east end of Long Island. It is probably one of the super border areas, because even like separations between Delaware and New Jersey or New York and New Jersey, they are relatively fine areas. You get to the east end of Long Island, and you try to split it; it gets very difficult to enforce it. That really goes to my questions about size limits. The only way this would work is if we have some incredible cooperation about having the same relative size, season and bag limits for that area. But it is a chicken and egg thing right now. If we're going to go with a four-region approach, and we have that commitment that that is what is going to happen, then I have less of a concern about it.

However, if we go with a four-region approach, and then we've got very different limits between Long Island Sound and New England and then the New Jersey Bight Area or whatever, it is going to be a mess and it is going to be unenforceable. I think one of the things we need to get through this is some feedback from the Law Enforcement Committee about, if we go with very disparate measures, are we going to shoot ourselves in the foot?

Because if this looks good on paper but it can't be enforced, we're going to have overharvest; just everyone is going to go out and do what they want to do. That is why it's a conditional opposition to this is that we really need to get a commitment that if we're going to go down this road, we have to have the same measures in the New York and Long Island Sound area, or else this is not going to work.

CHAIRMAN NOWALSKY: Russ, in favor.

MR. RUSS ALLEN: I think this is the right way to move forward at this point. We've tasked the Technical Committee, the PDT, everyone to do a heck of a lot of work; and they've come back and given us what we were looking for. I think this is the best time to move forward this way. I understand Jim's concerns, because we all have those concerns for different areas in all our states.

But I think that can be part of the amendment as it's going forward, and some of the concerns that the PDT can look into and how to manage that area as best as possible. That doesn't alleviate all Jim's concerns that's for sure, but we would be willing to work with New York and trying to make sure we could do the best we can.

I mean, that's all we can put out there for now, until we see exactly what the options are. As I said, they've done a yeoman's job on coming up with the different assessments for the different areas, and done everything we've asked them to do over the last couple years; and I think it's time to move all of this forward as fast as possible.

CHAIRMAN NOWALSKY: Do I have any other speakers against the motion? Emerson Hasbrouck.

MR. HASBROUCK: In addition to the issues that Jim raised, which I agree with, one of the recommendations or one of the comments in the review of the two new assessments was that the new regions are reasonable and acceptable; but not necessarily better than the benchmark regions. The review said yes, they're good, but they're not necessarily any better. Why are we going to go through a process that may not be any better than what we had with the benchmark assessment?

CHAIRMAN NOWALSKY: Bob Ballou, speaking in favor of the motion.

MR. BOB BALLOU: I support the motion. It seems to me, the crux of this is whether we try to fit the management to the region or the region to the management. I think it is the former, and I think that is what this motion would do. Just in response to Jim's comments. As soon as you move down the road of regional management, you're going to inevitably have an issue of disparity, or potential disparity, between the regions.

Whether you take a three-region approach or four, you still have that same issue; maybe it just moves a little bit, but you still have that issue of how you deal with differences between the regions. The fact that we seem to be inevitably moving down the road toward regional management for tautog, I do think the four-region approach makes the most sense; and I support the motion.

CHAIRMAN NOWALSKY: Okay, let me get another show of hands, anyone who would like to speak against the motion; anyone else to speak in favor of the motion, Tom Fote.

MR. FOTE: What I wanted was to do is clarify Emerson's statement. When the stock assessment was done, it was done on one region. What they recommended was that we split up regions, we do different regions; because with the original stock assessment it, was based on one region, not multiple regions.

CHAIRMAN NOWALSKY: Let me let Katie respond to that as well.

DR. DREW: Right, so the most recent benchmark assessment did have the three-region approach, and I think the peer reviewers comments were more to the fact that we don't have strong biological reasons to split the stock at Long Island Sound versus lumping New Jersey in with that region. The evidence is very muddy. There is no clear biological ways to draw the line. In light of that, then management priorities can take over.

If the priority is to keep a consistent region across New Jersey, New York, Connecticut then you would go with a three region. If the management concern is that we want separate information on the Long Island Sound portion versus the New York/New Jersey Bight area, then you would go with the four-region. There isn't strong scientific or biological evidence as it is now, as the data stand now to support one regional breakdown over the other; and thus management concerns can take priority in this case.

CHAIRMAN NOWALSKY: Okay, let me make one last call for anyone to speak for or against the motion. Seeing no one else wishing to speak, **the motion before the board is move to approve the four-region-management approach for Tautog Draft Amendment 1. Motion by Mr. Fote, seconded by Mr. Adler**, we'll take a moment to caucus.

Okay, we'll now put the question before the board. All those in favor of the motion, please raise your right hand, one vote per state, please. Put your hands down, please. All those opposed. **One opposed; any abstentions, two abstentions, any null votes? Motion carries.** Okay, that concludes that agenda item.

We'll now move on to a brief update on the Commercial Harvest Tagging Program, and we'll also have a question for the board about how that may interact with the amendment; before we go on to that, Dave.

MR. SIMPSON: One question for the next step is when or have we already made a decision about reference points, whether we use MSY in some areas or SPR in some areas? When do we revisit that, or do we revisit that? I just want to make sure I know where we are with that.

CHAIRMAN NOWALSKY: Is it the intention of the TC, PDT to do the update with both of those, right now?

DR. DREW: Yes, it is very simple to present the SPR versus the MSY reference points when we come back with the updated information, so we can make that decision then.

CHAIRMAN NOWALSKY: Dave, a follow up?

MR. SIMPSON: Yes, just follow up to that. It would be great to see more elaboration on the stock recruitment relationship. I'm skeptical that there is one. I would like to see better evidence. When I look at a time series that I have confidence in, I see a period over time rather than relationship to the stock.

One of those is a parallel with the Millstone Environmental Data they've been sampling for forty years, and we see a lot of consistency between tautog larval abundance and cunner larval abundance. One is fished and one is not. But I think they're both responding to similar environmental conditions, so I'm really interested in that.

CHAIRMAN NOWALSKY: Okay, we're good with that. We'll move on to Ashton's presentation on the Tank Trial.

UPDATE ON THE COMMERCIAL HARVEST TAGGING PROGRAM, THE TAUTOG TANK TRIAL

MS. HARP: I'm going to present a bit of an update on the Commercial Harvest Tagging Program, the Tautog Tank Trial. An overview, the Law Enforcement Subcommittee was developed by the Tautog Board in 2015. This subcommittee has met numerous times via conference call to develop program objectives; the goal is to see if our commercial harvest tagging program is viable. To do that, first the subcommittee developed program objectives, which I'll review.

That has been done; the board approved those at the February, 2016 meeting. Then staff procured potential tags to include in this program. These were reviewed with the subcommittee, and law enforcement tested these tags in person as well, and gave feedback via conference call. Then next the staff did commercial harvester interviews to kind of get a better idea of the handling practices that were used to capture tautog and how long they had tautog, and these were all used to then develop the tank trial or the parameters of the tank trial.

Now the next step is the tank trial, which is underway; which I will review now. But first, I wanted to go over the objectives that the board approved; this is a paraphrased version of them. It was to implement a tagging program to reduce illegal, unreported and unregulated fishing that we know has been prevalent in this fishery for quite some time. To standardize tags across states, instead of having different tags across states, we wanted one simple tag.

It is also a little bit harder to find a tag that works on a live fish, so it is easier just to find one tag and use it across all states in general. The tag needed to be a single use tag. It needed to be -- if one were to take it off they couldn't reuse it on another fish and therefore perpetuate illegal fishing. It needed to be easy to put on but hard to take off. As the last goal, it also needed to accommodate the live market fishery, so it needed to have an applicator, for ease of use for fishermen.

It also needed to not affect fish quality for its resale. With that in mind, staff presented about 12 to 15 different tags that could be used in a tank trial and eventually in a commercial harvest tagging program. The Law Enforcement Subcommittee reviewed these tags and selected three tags to move forward with in a tank trial. The three tags are up here and I also have some on me; so if you want to see some after this meeting I can show you them.

There is a button tag, which is commonly used actually in live stock, so we're testing this on a fish to see if it is actually even possible. The metal one is a strap tag, which one is used on fish. It comes with an applicator. The bottom one is a Rototag, and this one is used on fish in aquaculture purposes.

These will all be then applied to live fish. We're first applying these dead fish to see exactly where we would put them on the fish, and then they will be applied to live fish; and I'll go over that. Next for the harvester feedback, I talked to a couple of fishermen over the phone about the potential for this program.

I just wanted their feedback on how they fish for tautog, what the market is like, what their handling practices are like. They said the tautog fishery was very much linked to the black sea bass fishery. They target tautog when the black sea bass fishery closes, and when the black sea bass fishery is open, they usually catch tautog as incidental catch; I mean, catch they still retain and will sell, but it is not the main fish that they are going out for.

They generally fish out to ten miles, but will go further if targeting black sea bass. They noted that tautog is not as resilient in warm water or during spawning, so tags could increase mortality during this time. After reviewing to them, okay, when you come back to the dock, who are you selling to? Who then sells to that person, we realized that it is a very decentralized market, with lots of small scale dealers and buyers; and a couple of wholesalers.

It is not just, you go to one dealer and then that dealer goes to the end market to the restaurant, it's you know it goes to one dealer then it could go to another dealer before ending up at a buyer and then go to a restaurant. We realized the next point is that live tautog is held by buyers and dealers for weeks, it could even be months at a time.

When I asked how long do you generally keep these fish, or do you know that they're in captivity, they said, well, you can keep a tautog alive as long as you want. They are very hardy fish. We know what to do; we know how to keep them alive. It is not like this fish is coming out of the water, hitting the dock and then going on to someone's plate. There is quite some time that passes in between catching the fish and then eating the fish.
There is a full list of harvester comments that is in the May Law Enforcement Subcommittee meeting summary. I also have a different presentation, a longer presentation I presented to the Law Enforcement Subcommittee on this issue as well. Now, I'm going to go over the parameters of the tank trial. This is being led by the New York Division of Marine Resources and Stony Brook University. Currently fish traps are collecting tautog and New York DMR modified lobster traps to become fish traps to collect tautog. They actually created a huge pen to then hold the tautog at the dock until we have the number of fish needed to then move them to the wet lab, and overall they plan to collect 80 tautogs to then transfer to the wet lab; and it will be in two different batches.

We're going to do 40 fish and then 40 fish. Each tag will be applied to 20 fish; so 60 fish in total. There are going to be 20 fish that will serve as the control group; thereby equaling 80 fish. Each fish will be tagged and monitored for four weeks. We went back and forth on the length of time that the tags should be on the fish and determined that four weeks is long enough to see if it would affect the fish, if there would be any kind of infections with the fish from the tag; and to make sure to see if there is any mortality as a result of the tag on the fish.

The trial is expected to begin this month. It is going to be underway shortly. Looking ahead, I just kind of wanted to give an update on next steps. At the annual meeting the results of the tagging tank trial will be presented. I'll also have a Law Enforcement Subcommittee meeting before the annual meeting as well, so they can review the results and they can give recommendations and feedback that will also be presented at the annual meeting.

Then at the annual meeting the board can opt to task the PDT with developing Draft Amendment 1 options for a commercial harvest tagging program; because the goal of the Law Enforcement Subcommittee was really to investigate the feasibility of such a program. If the board thinks it is a viable program, the tags are working, the fish are not dying. Then the board could task the PDT with developing options for Draft Amendment 1. With that, I'll take questions.

CHAIRMAN NOWALSKY: With reference to Ashton's last slide, there is no decision point here today; but the public information document that went out included as an item, the unreported harvest; and it has certainly been an issue before this board for some time. When we first looked at the timeline it seemed that the two actions would need to be decoupled, to keep the draft amendment moving forward.

When the decision was made to do the Long Island Sound Assessment, basically at this point we're looking at a decision next year and implementation likely in 2018. That would potentially present the opportunity to include the commercial harvest tagging program now, as part of the draft amendment, if we chose to task the PDT to develop options at the annual meeting.

That is where we're at. There is no decision that needs to be made today, but I wanted to bring that to the attention of the board that where it had previously looked like it was going in a decoupled manner, there may be the opportunity to bring the two back together again. With that, any questions for Ashton on her presentation?

MR. JOHN CLARK: Ashton, I was curious as to why the trial is only for four weeks. If I recall, they said that a lot of times these fish are kept for up to six months, even longer in tanks. If we're going to get an idea what the shedding rate of these tags might be, that seems kind of short; considering how long they're kept.

MS. HARP: Like I said, there was a bit of discussion on the length of the trial, and just from talking to people there was such a variability in how these fish were kept and the length that they were kept; that it was really hard to mimic exactly the conditions that the fish would be going through if it was actually going through the supply chain. When I talked to them about, what are the different tanks sizes, what is the water flow size? It was so different across the different fishermen; that you couldn't exactly have a trial that would replicate any one way that this fish went through the supply chain. Four weeks was seen as a compromise.

CHAIRMAN NOWALSKY: Any additional questions? Bob Ballou.

MR. BALLOU: Ashton, you may have already covered this, but it just occurs to me. Why the need to explore tags other than those that have traditionally been used to track fish for migratory purposes. I mean, clearly those have demonstrated their efficacy. Is there any thought given to just using the same tags that have always been used; maybe a different color, to see how they compare with these new styles?

MS. HARP: Yes, there was and that would be definitely the easiest option and would be preferred, although it didn't meet one of the objectives put forth by the Law Enforcement Subcommittee, which was that it needed to be a one-time-use tag. When looking at those tags, those tags could just be easily ripped out of the fish and then reused again; therefore defeating the purpose.

MR. ROY MILLER: Many years ago I recall using those particular metal jaw tags in tagging Salmonids, and if memory serves, those particular tags caused the decrease in the growth rate of the animal when it was released back into the wild; thus providing a competitive disadvantage for tag fish violating one of the tagging assumptions. But I assume, since these are tanks and these fish will be fed ad libitum, or in other words as much as they'll eat, that won't be a consideration in these particular trials.

MS. HARP: The growth rate of the fish after it's captured was not a consideration for this trial.

CHAIRMAN NOWALSKY: Follow up, Roy.

MR. MILLER: Yes, I was not so concerned about the growth rate, it is just about the condition of the fish that would be a factor in its marketability.

CHAIRMAN NOWALSKY: That was definitely the major concern of the harvesters; and we hope to get some information from the trials on that. Ashton.

MS. HARP: Just when talking to the harvesters about this program, there were only two, I mean there weren't a lot of people, there were like ten people that I was talking to; but only two people were dramatically opposed to such a program. They did see that there is a problem in this fishery with the black market and with illegal and unreported fishing going on.

They were happy that I had called them and happy to kind of get feedback on them. They hoped that such a program would work for them. I mean, they clearly don't want to have any more -- they don't want this to affect the amount of time that they put into this fishery, but if it could help them, then they were for it.

ADJOURNMENT

CHAIRMAN NOWALSKY: Okay, is there any other business to come before the board today? Okay seeing none; and having covered the business on the agenda, the board is hereby adjourned. Thank you everyone.

(Whereupon the meeting ended at 2:27 p.m. on August 2, 2016)

Atlantic States Marine Fisheries Commission

2016 Tautog Stock Assessment Update

October 2016

Vision: Sustainably Managing Atlantic Coastal Fisheries

Prepared by the Tautog Technical Committee and Stock Assessment Subcommittee

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Executive Summary

The regions accepted for management use are defined as:

- Massachusetts - Rhode Island (MARI)
- Long Island Sound (LIS), which consists of Connecticut and New York waters north of Long Island
- New Jersey – New York Bight (NJ-NYB), which consists of New Jersey and New York waters south of Long Island
- Delaware, Maryland and Virginia (DelMarVa)

Although the TC considers the coastwide stock unit inappropriate for the management of tautog, the coastwide model was updated in this assessment to provide the appropriate status quo options for management consideration.

All regions were updated with landings and index data through 2015 using the statistical catch-at-age model ASAP. Short-term projections to determine the level of harvest required to have a 50% and 70% probability of achieving the F target for each region, as well as the probability of being at or above the SSB threshold, in 2020 were conducted with AGEPRO.

All regions were overfished in 2015.

Overfishing was not occurring in the MARI or DelMarVa regions, although F was still above the target in the MARI region. F was at the target in the DelMarVa region.

Overfishing was occurring in the LIS and NJ-NYB regions in 2015.

The coast was overfished and experiencing overfishing in 2015.

Region	F_{target}	$F_{threshold}$	F_{3yravg}	SSB_{target}	$SSB_{threshold}$	SSB_{2015}	Status
MARI	0.14	0.28	0.23	3,631 mt	2,723 mt	2,196mt	Overfished, overfishing not occurring
LIS	0.28	0.49	0.51	2,865 mt	2,148 mt	1,603 mt	Overfished, overfishing
NJ-NYB	0.20	0.34	0.54	3,154 mt	2,351 mt	1,809 mt	Overfished, overfishing
DMV	0.16	0.24	0.16	1,919 mt	1,447 mt	621 mt	Overfished, overfishing not occurring
Coast	0.17	0.24	0.38	14,944 mt	11,208 mt	6,014 mt	Overfished, overfishing

The MARI, LIS, and coast need to take harvest reductions in order to have a 50% or 70% probability of being at the F_{target} in 2020. These range from a 55-56% reduction from 2015 levels in MARI and a 47-53% reduction from 2015 levels in LIS, to an 18-24% reduction from 2015 levels for the coast. Harvest levels for the NJ-NYB and DMV region that are at or slightly above 2015 levels will result in a 50-70% probability of F being at or below F_{target} for those regions.

Even at the target F levels, the probability of SSB being above the $SSB_{threshold}$ in 2020 is small for all regions.

1 Stock Identification

Historically, tautog has been assessed as a coastwide stock, consistent with the management unit, which includes all states from Massachusetts through Virginia. In the 2015 benchmark stock assessment (ASMFC 2015), the Tautog TC investigated new stock unit definitions based on life history data, fishery and habitat characteristics, and available data sources. A subsequent 2016 regional assessment analyzes two additional regions to comprise a four-region management scenario (ASMFC 2016). The regions used in this assessment update are defined as:

- Massachusetts - Rhode Island (MARI)
- Long Island Sound (LIS), which consists of Connecticut and New York waters north of Long Island
- New Jersey – New York Bight (NJ-NYB), which consists of New Jersey and New York waters south of Long Island
- Delaware, Maryland and Virginia (DelMarVa)

Although the TC considers the coastwide stock unit inappropriate for the management of tautog, the coastwide model was updated in this assessment to provide the appropriate status quo options for management consideration.

2 Life History

Tautog are a relatively slow growing, long-lived fish. Individuals over 30 years have been recorded in Rhode Island, Connecticut, and Virginia. Tautog also grow to large sizes, up to 11.36 kg (25 lbs). They mature at 3 to 4 years of age, and spawn from April – September.

They undergo seasonal inshore-offshore migration in some parts of their range, but tagging data indicate they return to the same reefs year after year and do not make extensive north-south migrations.

The 2015 benchmark assessment explored a number of different ways of estimating natural mortality (M). Maximum age based methods gave a result of M=0.15 for most regions and M=0.16 for the DelMarVa region, consistent with what has been used in previous assessments.

3 Data

The MARI, DelMarVa, and coastwide update assessments use the same data sources as the 2015 benchmark stock assessment. The LIS and NJ-NYB update assessments use the same data sources as the 2016 regional assessment. All regions incorporate data through 2015. The recreational discard mortality rate of 2.5% was used for all regions.

3.1 Massachusetts-Rhode Island

3.1.1 Landings

Recreational anglers account for upwards of 90% of landings in this region. In the MARI region, recreational landings peaked in 1986 at nearly 2.7 million fish and fell sharply to about 13% of its peak by the mid-1990s. Since then landings have remained low and have varied in the range of 200,000 to 50,000 fish. The 2013-2015 average recreational landings are 167,085 fish (Table 3.1.1, Figure 3.1.1). The majority (nearly 75%) of tautog recreational harvest in the MARI region comes from the private/rental boat mode. The remaining 25% is split relatively evenly among the shore and for-hire (party/charter boat) modes.

Commercial landings in the MARI region peaked in 1991 at approximately 725,300 lbs (329 mt), declined to 97,000 lbs (44 mt) in 1996, and since then has varied in the range of 110,000 – 200,000 lbs (50 to 90 mt) (Table 3.1.1, Figure 3.1.1). The 2013-2015 average landings in the MARI region were approximately 121,250 lbs (55 mt).

Total removals in the MARI region, including recreation harvest, recreational release mortality, and commercial landings averaged 390 mt, with 337 mt taken in 2015.

3.1.2 Indices

The set of indices available in the MARI region consists of two trawl survey indices, one seine survey which aliases the young of the year segment of the population, and a fishery dependent index using MRIP information (Table 3.1.2, Figures 3.3.2-5). For all indices, statistical model-based standardization of the survey data was conducted to account for factors that affect tautog catchability.

The Massachusetts Division of Marine Fisheries (MADMF) runs a synoptic coastal trawl survey performed in the spring and autumn utilizing a stratified random design.

The Rhode Island Division of Fish and Wildlife (RIDFW) research trawl survey has two components, a seasonal survey with a random stratified design which began in 1979, and a monthly fixed station survey which began in 1990 that is conducted monthly throughout the year. For the tautog stock assessment only the fall segment of the RI trawl survey was used, consistent with the benchmark assessment.

The RI Seine Survey has operated from 1986 to the present, with a consistent standardized consistent methodology starting in 1988. It is a fixed site survey that takes place throughout the extent of Narragansett Bay Rhode Island.

The Tautog TC developed a fishery dependent index of abundance from MRIP recreational survey data, using “logical guilds” to identify tautog trips.

3.1.3 Biosampling and Age-Length Keys

For the MARI region, age-length samples are collected from a combination of recreational fishermen and fishery independent surveys. There was a total of 756 length-age samples collected in the MARI region from 2013-2015 (approximately 250 per year) to characterize the age structure in the region.

3.2 Long Island Sound

3.2.1 Landings

The update assessment estimates of commercial and recreational landings and recreational discards (Table 3.2.1, Figure 3.2.1) have been revised in all years from those used in the previous LIS regional assessment (ASMFC 2015). Total removals in LIS (recreational harvest, recreational dead discards and commercial harvest) peaked in 1987 at 1,386 mt. In recent years landings have been a fraction of that; for example, the 2015 landings were 430 mt or 21% of the peak. Commercial harvest accounts for approximately 12% of total catch, recreational harvest accounts for 86% and recreational discards for about 2%.

3.1.1 *Indices*

The model was fit to both the total standardized index (catch per tow or catch per trip) and index-at-age of the Connecticut Long Island Sound Trawl Survey and MRIP CPUE (Table 3.2.2, Figure 3.2.2-3). The New York Peconic Bay Trawl Survey (Table 3.2.2. Figure 3.2.4) was used as a year one index. The New York Western Long Island Seine Survey (Table 3.2.2, Figure 3.2.5) was treated as a young-of-year index and was lagged forward one year (e.g., the observed 1984 YOY index value was represented as the predicted 1985 age-1 index value).

3.1.2 *Biosampling and Age-Length Keys*

The update assessment uses an ALK that has been updated from the previous LIS regional assessment (ASMFC 2015) upon incorporation of 2015 fishery independent indices. Data used in the LIS ALKs include LISTS, the Rhode Island Trawl Survey (RI) and New York Port Sampling (NY-N) (Table 3.2.3). An average of 415 samples were used per year with a minimum sample size of 109 and a max of 859. Rhode Island age-length data were included as needed to a fill size gaps in the key. New York data included only fish that were collected from the North Shore of Long Island. Size gaps that remained were filled using age distributions estimated from a key that pooled all years of data. The length range of the ALK is narrower than the estimated catch (ALK: 15 to 60 cm; estimated catch: 8 to 83 cm). Lengths below 16 cm and above 60 cm were accordingly binned into single groups.

3.3 New Jersey – New York Bight

3.3.1 Landings

Tautog is predominantly a recreationally caught species, with anglers accounting for about 90% of landings within the NJ-NYB region. Between 2013 and 2015, annual recreational landings have shown high interannual variability without a trend, ranging from approximately 150,000 to

400,000 fish, with an average of 242,000 fish (Table 3.3.1, Figure 3.3.1). For this assessment update, a change was made to how New York recreational harvest was split between LIS and south shore for the years 2004+. The June 2016 regional assessment used a post-stratification SAS code to separate harvest from the two regions, but this method does not weight sites based on activity. For this update, harvest by region was estimated using MRIP data which does account for site activity. Seven of eleven years are within 10% of the value used in the benchmark assessment, but four years (2007, 2009, 2010, and 2013) resulted in increases of 13% to 45% using the new methodology.

In the NJ-NYB region, commercial harvest during 2013 to 2015 has shown a declining trend falling from 99,207 lbs (45 mt) in 2013 to nearly 86,000 lbs (39 mt) in 2015 with an average harvest of 90,389 lbs (41 mt) for this time period (Table 3.3.2, Figure 3.3.1).

Trends in harvest can be obscured by high interannual variability in catch and relatively high harvest measurement error. An unquantified illegal live fish market contributes to uncertainty in harvest estimates.

3.3.2 Indices

The Western Long Island (WLI) Seine Survey, New Jersey (NJ) Ocean Trawl Survey, and recreational survey were used in the assessment update.

The NJ-NYB portion (Jamaica Bay) of the WLI seine survey encompasses 19 different stations. As not all stations were sampled continuously, only the eight stations sampled annually in at least 20 years were included in the model. An abundance index for tautog was created using a negative binomial generalized linear model (GLM) including station and water temperature. The WLI seine index captures mainly age-0 fish, so was lagged forward one year and treated as an age-1 index. (This is an improvement over the 2016 regional assessment that did not lag the index appropriately.) The index identifies three periods of recruitment separated by 3-5 years of near zero recruitment with successively higher peaks. There was a time series high of 2.7 fish per tow in 2012, and an average catch of 1.5 fish for the period 2012-2015 (Table 3.2.2, Figure 3.3.2).

An abundance index for tautog was developed for the NJ Ocean Trawl survey using a negative binomial generalized linear model (GLM) including year, bottom temperature, depth, and bottom salinity as factors. The index was variable, but indicated a period of high abundance at the beginning of the time series, declined through the late 1990s, then recovered to moderate abundance between 2000 and 2010 (Table 3.3.2, Figure 3.3.3). CPUE dropped by more than 50% in 2011-2012, but recovered to previous levels around 0.5 fish per tow in recent years.

A fishery dependent index of abundance from the MRFSS/MRIP recreational survey data was developed using the logical guild methodology described in the regional benchmark assessment. Abundance was estimated using a negative binomial GLM, with the final model specified as

$$\text{Total catch} \sim \text{Year} + \text{State} + \text{Wave} + \text{Mode},\ \text{offset} = \ln(\text{Angler\_Hours}).$$

During development of this assessment update, it was determined that the recreational CPUE index used in the 2016 regional assessment for the NJ-NYB region was incorrect. This error has been corrected for this assessment update. Generally, the two indices follow a similar pattern, but the corrected index exhibits slightly greater interannual variability.

Results of the NJ-NYB recreational CPUE index are shown in Table 3.3.2 and Figure 3.3.4.

All three indices were used in the assessment model. The WLI seine index captures mainly age-0 fish, so was lagged forward one year and treated as an age-1 index. (This is an improvement over the 2016 regional assessment that did not lag the index appropriately.) The NJ ocean trawl and MRFSS indices were treated as adult indices (ages 1-12+), with survey age distribution estimated using survey specific length frequency data and the NYNJ ALKs, assuming a plus group of ages 12+.

3.3.3 Biosampling and Age-Length Keys

For the NJ-NYB region, recreational harvest length frequency was evaluated separately for NJ and NY south shore. Unweighted lengths from MRFSS/MRIP intercepts from NJ were the only source of information used to characterize recreational harvest length distributions in New Jersey, while the south shore harvest was characterized using combined region specific data from MRFSS/MRIP and the New York Headboat Survey (NYHBS) sampling program. The sum of the recreational harvest at length for NJ and NY south shore was used to estimate total regional harvest at length. As the tautog fishery is predominantly recreational, the length frequency distributions obtained from this sector were applied to the commercial harvest.

Numerous sources contributed to estimate the length frequency of discarded fish in the NJ-NYB region. Region specific discard length data from the American Littoral Society Volunteer Angler Program (ALS) (1982-present) and MRIP Type 9 sampling of fish released alive from headboats (2004-present) were available for both NJ and south shore of NY. In addition, fishery dependent samples were also available for NY south from the NYHBS sampling program (1995-present).

Prior to 1995, raw age data by state were not consistently available. As a result, ALKs for the NJ-NYB region could only be created for 1995 forward. This still required pooling across regional boundaries to ensure the full range of sizes were covered by each regional key. As a result, the NJ-NYB key includes some data from Long Island Sound and Delaware. The distribution of the NJ-NYB harvest for the years 1989-1994 was assumed to follow the same distribution as the age distribution of the NJ Ocean Trawl survey.

3.4 DelMarVa

3.4.1 Landings

Recreational landings were obtained from the NMFS MRIP data collection program. Recreation harvest (A+B1) of tautog in DelMarVa has declined from 241,064 fish in 2010 to 22,215 in 2015 (Table 3.4.1, Figure 3.4.1). The decline coincided with the protective regulatory measures (minimum size increase and seasonal closures) instituted in 2012 to reduce fishing mortality. Recreational landings in 2015 were the lowest in time series.

Recreational discards have also declined from 686,392 released fish in 2010 to 125,258 fish in 2015 (Table 3.4.1). Due to low number of intercepted fishing trips that had tautog, annual estimates of recreational landings and discards in MD and VA had low precision (Proportional Standard Error (PSE) values exceeded 50% in three out four of the most recent years).

Commercial landings reported by each state (DE, MD, VA) in annual compliance reports were combined to derive region specific landings for the 2013-2015 period and added to the time series compiled for the DelMarVa region in 2013 benchmark assessment. Commercial landings in DelMarVa region were declining in recent years, primarily due to a decline in Virginia (Table 3.4.1. and Figure 3.4.1). Average commercial landings for 2013-2015 were 10,740 pounds (4.9 mt), with 2015 being much lower at 6,233 lbs (2.8 mt). Data on commercial discards were not available, but discards are believed to be minimal.

3.4.2 Indices

There are no fishery independent indices available for the DelMarVa region. The only index of relative abundance used in the 2013 benchmark assessment was catch per trip derived from MRFSS / MRIP data. Total catch per trip was modeled with GLM method using a suite of potentially important covariates (year, state, wave, mode) with an effort offset based on angler hours for the trip. The MRIP based index was updated through 2015. The MRIP index suggested a continuing decline in the relative abundance of tautog in DelMarVa region (Table 3.4.2, Figure 3.4.2).

3.4.3 Biosampling and Age-Length Keys

Biological sampling for tautog is conducted by each state on annual basis with the goal to collect at least 200 samples per year for each state. Samples for length, weight, sex and age are taken mostly by intercepting the catch of recreational fishermen. However, some samples were taken from commercial fishery as well. Annual age length keys were constructed by combining paired length - age samples from all three states. Total number of age and size samples used to construct annual ALK for 2013 -2015 ranged from 677 to 840, covering 23-76 cm size range and ages 1-29.

Length frequency of the recreational harvest was characterized using length frequency of the data collected by MRIP for each state. State specific MRIP annual harvest estimates were applied to state specific length frequency of the recreational harvest (A+B1) to obtain harvest in numbers by size group. Size frequency of discards (B2) was characterized by combining the MRIP Type 9 and ALS raw data on the size of released fish by state. State specific data were pooled to obtain regional estimate of total harvest (A+B1) and discards.

Due to low or absent commercial fishery size sampling, size frequency of recreational harvest was used to describe commercial catch at size. State specific recreational harvest, dead discards and commercial harvest in numbers of fish by size were combined into regional estimate and converted into catch at age using regional year specific age length keys.

3.5 Coastwide

3.5.1 Landings

Coastwide recreational harvest peaked in 1986 at over 7 million fish and has declined since then (Table 3.5.1, Figure 3.5.1). Average recreational harvest from 2013-2015 was 708,136 fish, with 2014 nearly double the harvest of 2013 and 2015: over 1 million fish compared to approximately 545,282 fish in 2015. The 2014 estimate was also more uncertain than the 2013 and 2015 estimates, with a PSE of 24.7% compared to 16-17% in 2013 and 2015.

The proportion of tautog released alive on the coast has increased over time. From 1982-1986, an average of 17.7% of the catch was released alive, while from 2013-2015, 81% of the catch was released alive (Figure 3.5.2). Tautog are very hardy; it is estimated that 2.5% of the fish that are released alive die as a result of being caught. This translates into an average of 73,551 tautog from 2013-2015. Although the proportion of fish released alive was not significantly different in 2014, the total numbers of fish released alive was also nearly double the levels of 2013 and 2015.

Commercial harvest showed a similar pattern to recreational harvest, although the magnitude is smaller, representing approximately 9% of the total harvest over the entire time series (Figure 3.5.3). It peaked in the late 1980s at 1.2 million lbs (525 mt), and declined to an average of 0.27 million lbs (124 mt) in 2013-2015. Commercial harvest in 2014 was 0.28 million lbs (129 mt), not significantly different from the 2015 harvest of 0.26 million pounds.

Total removals have declined in all regions across the coast (Figure 5.4.4). The proportion of harvest from each region has fluctuated somewhat over the years, with the DMV's proportion declining in recent years and the LIS region's proportion growing (Figure 5.4.4). From 2013-2015, MARI accounted for 27% of coastwide removals, LIS accounted for 35%, NJ-NYB accounted for 32%, and DMV accounted for 5%.

3.5.2 Indices

The coastwide assessment used the same indices as used in the regional assessments. This results in a total of seven fishery independent indices (three recruitment indices and four age-1+ surveys) and one fishery dependent index (age 1+).

A single MRIP CPUE for the coast was developed using the same technique as for the regional assessment; a comparison of the coastwide and regional trends is shown in Figure 5.3.5. Additionally, the New York seine survey for the coast was developed from all bays sampled instead of split north and south of Long Island.

The age-1+ indices showed similar trends over all, higher in the 1980s and lower through the 1990s to the present (Table 3.5.2, Figure 3.5.6). The recruitment indices were variable and also showed similar patterns, alternating periods of high and low recruitment (Table 5.3.3, Figure 5.3.7). Recruitment indices in 2013-2015 were near their long term average.

3.5.3 Biosampling and Age-Length Keys

Two regional age-length keys were developed for the coast, with samples from MA – NY forming a northern key and samples from NJ – VA forming a southern key. MRIP catch-at-length was pooled by region for the recreational harvest and also applied to the commercial harvest. MRIP Type 9 lengths and ALS lengths were pooled by region and applied to the recreational releases.

4 Model

All regions used ASAP (Age Structured Assessment Program v. 3.0.17, part of the NOAA Fisheries Toolbox) as the base model. ASAP is a forward-projecting, statistical catch-at-age model that uses a maximum likelihood framework to estimate annual fishing mortality, recruitment, population abundance and biomass, and other parameters from catch-at-age data and indices of abundance.

ASAP provides estimates of the asymptotic standard error for estimated and calculated parameters from the Hessian. In addition, MCMC calculations provide more robust characterization of uncertainty for F, SSB, biomass, and reference points.

4.1 Massachusetts-Rhode Island

The time series used for the MARI region was from 1982 through 2015, and uses a 12 plus age group as the final age class estimated by the model. There were no significant departures from the benchmark stock assessment for this regional model. The model was fit to both the total standardized index (catch per tow or catch per trip) and index-at-age data for the MADMF and RIDFW trawl surveys, and the MRIP CPUE indices. The RIDFW seine survey data was treated as a young-of-year index and was lagged forward one year (e.g., the 1983 age-1 predicted index value was fit to the observed 1982 YOY index value). The MARI region used three selectivity blocks which were selected based on periods of large regulatory changes: 1982-1996, 1997-2006, and 2007-2015. Unlike other regions, the MARI region has not undertaken any significant regulatory changes since 2007, therefore only three selectivity blocks are used for this region.

4.2 Long Island Sound

The ASAP model used a single fleet representing total removals in weight and removals-at-age from the recreational harvest, recreational release mortality, and commercial catch. Selectivity of the fleet was described by a logistic curve with a 12 year plus group. Data from 1984-2015 were divided into four selectivity blocks (1984-1986, 1987-1994, 1995-2011, and 2012-2015) based on the schedule of Connecticut regulatory changes.

Adult indices were fit to index-at-age data assuming a single logistic selectivity curve and constant catchability. YOY indices had a fixed selectivity pattern of 1 for age-1 and 0 for all other ages, and also assumed constant catchability.

Recruitment was estimated as deviations from a Beverton-Holt stock recruitment curve, with parameters estimated internally.

4.3 New Jersey-New York Bight

The NJ-NYB base model included years 1989-2015. Harvest at age was estimated from NJ and NY south commercial and recreational harvest, 2.5% of recreational discards, and available length frequency data. The coefficient of variation (CVs) on harvest were estimated as a weighted average of NY and NJ PSE and the respective state proportion of total NJ-NYB harvest. PSEs calculated in this fashion during MRFSS years (1989-2003) were corrected for underestimation by increasing them 30% as in the benchmark assessment.

Four single logistic selectivity blocks were established based on major regulatory and data collection changes that would be expected to alter the size distribution of the catch (pre-FMP = 1989-1997, FMP implementation 1998-2003, collection of Type 9 data 2004-2012, Addendum 6 regulations 2012-2015).

Following completion of a base model run, index CVs were adjusted upwards to bring RMSEs of the indices close to 1.0. Subsequently, effective sample size for the catch and aged indices were adjusted using ASAP's estimates of stage 2 multipliers for multinomials.

4.4 DelMarVa

The ASAP model was run from 1990 to 2015 for DelMarVa region based on the catch at age and MRIP index data covering ages 1-12, where age 12 was treated as a plus group. Removals were modeled as a single fleet that included total removals in weight and numbers-at-age from recreational harvest, recreational release mortality, and commercial catch. Selectivity of the fleet was described by a single logistic curve. Four selectivity blocks were used: 1982-1996, 1997-2006, 2007-2011 and 20013-2015. Breaks were chosen based on implementation of new regulations. Adult indices were fit to index-at-age data assuming a single logistic selectivity curve and constant catchability. No YOY indices are available for DelMarVa region.

All likelihood components weightings (lambda values) were retained from the 2013 benchmark assessment. CVs on total catch for the 2013 2015 were set equal to the last five years (2008-2012) average MRIP PSE values inflated for missing catch that were used in the 2013 benchmark assessment. The input ESS were adjusted using ASAP's estimates of stage 2 multipliers for multinomials.

A limited number of sensitivity runs were conducted to examine the effects of input data and model configuration on model performance and results. These included: addition of the NJ trawl index to examine the influence of individual data streams on model results; use of catch at age developed with size frequency of recreational catch based on the state biological sampling; different starting values for estimated parameters; use of 3 selectivity blocks for the catch instead of 4; fixing steepness at 1 (i.e., no relationship to SSB and fitting deviations to an average recruitment value; and truncating the time-series.

4.5 Coastwide

For the coast, ASAP was configured similarly to the regional models with a single fleet, four selectivity blocks (1982-1994; 1995-2006; 2007-2012; 2013-205), including a new 2013-2015 block, and age 12+ as the plus group. The model was run from 1982 – 2015. MRIP PSEs were used as the CV on catch, while index CVs were based on the GLM-standardized CVs and adjusted to bring their RMSE values close to one.

5 Results

5.1 Massachusetts – Rhode Island

5.1.1 Fishing Mortality and Selectivity Patterns

In general, fishery selectivity patterns shifted as expected with each block, with younger ages being less vulnerable to the fishery in the later two blocks compared to the earliest block pre-FMP implementation (Figure 5.1.1.). There was not a significant shift in selectivity between the 1997-2006 block and the 2007-2015 block.

In the MARI region, total F was highly variable, driven by large swings in estimated recreational harvest from year to year (Table 5.1.1, Figure 5.1.2). Since the terminal year of the benchmark assessment (2013), total F has been slowly declining to a point estimate of 0.22 in 2015. The terminal three year average total F was 0.23.

5.1.2 Spawning Stock Biomass and Abundance

Total abundance and spawning stock biomass declined rapidly from 1982 until 2000 (Table 5.1.2, Figures 5.1.3 and 5.1.4). Despite a period of slightly increased abundance in the early to mid-2000s, the overall trend has been flat from 2000 until 2015. Total abundance declined from a high of 10.9 million fish to the current estimate of 2.8 million fish in 2015. Spawning stock biomass decreased from 8,994 mt in 1985 to the current estimate of 2,196 mt in 2015.

5.1.3 Recruitment

Recruitment was generally highest in the early years of the time-series, with a couple of average recruitment years in the mid-2000s (Table 5.1.2, Figure 5.1.5). Observed recruitment has increased from time series lows during the 2013 – 2015 period, but remain below average in general.

5.1.4 Retrospective Analysis

Retrospective analyses were performed by ending the model in earlier and earlier years and comparing the results to the output of the model that terminated in 2015. As the most recent selectivity block began in 2007, a 7 year peel retrospective analyses was performed.

In the retrospective analysis, the MARI region showed a retrospective pattern of overestimating F (Mohn's rho = 0.36) and underestimating SSB (Mohn's rho =-0.08) (Figure 5.1.7). Recruitment tended to be more variable, was also underestimated on average, and was stable in the final 4 years (Mohn's rho = -0.27) (Figure 5.1.7). This overestimation of F and underestimation of SSB and recruitment are generally considered conservative estimates with regard to stock status.

5.1.5 Model Sensitivity and Uncertainty

The main sensitivity testing done in the MARI region was to run the model with one of the fishery independent indices dropped from the analysis. This was done for each of the four indices used in the assessment. It was found that there were some minor changes to the magnitude of the outputs, but the trend in the information was the same, and the stock status and terminal estimates were fairly close to the base model estimates. The one notable change occurred when the MRIP index was dropped from the analysis, the terminal year F was much higher than in the other model formulations, though trends and reference points were all similar to the other formulations. In general, the model was found to be robust to these changes.

5.2 Long Island Sound

5.2.1 Fishing Mortality and Selectivity Patterns

Estimated fishery selectivity patterns shifted in the expected direction between the all selectivity block (Figure 5.2.1).

In LIS, fishing mortality (F) calculated from the average of the currently fully recruited ages ranged between about 0.07 and 0.61 over the full time series which peaked in the early to mid-1990s at 0.61 and then declined until the mid-2000s (Table 5.2.1 and Figure 5.2.2). F is currently near its historic maximum (F_{2015}=0.58, F_{3yr} = 0.51).

5.2.2 Spawning Stock Biomass and Abundance

Total abundance and spawning stock biomass declined rapidly from 1984 until the mid to late 1990s. Despite a period of slightly increased abundance in the early to mid-2000s, the overall trend has been a slower but consistent decline since 1995 (Table 5.2.2, Figure 5.2.3). Total estimated abundance declined by more than half, from 8 million fish (1984) to 3.5 million fish (2015). Spawning stock biomass decreased by more than 75%, from over 6,350 mt at the beginning of the time-series to the current estimate of 1,551 mt.

Abundance at age in the stock of the terminal year shows a dominance of fish aged 1 and 3, fewer age 2 fish and declining abundance from age 4 through age 12 (Figure 5.2.4).

5.2.3 Recruitment

Recruitment was highest in the early years of the time series and again in 2013 and 2015 (Table 5.2.2, Figure 5.2.5. The two recent peaks in recruitment bracketed the lowest recruitment year on record.

The stock-recruitment relationship is shown in Figure 5.3.6. Steepness was estimated at 0.71. Estimates of steepness in the benchmark assessment were relatively robust to model configuration and there was good contrast in the stock size and recruitment levels over the time-series, suggesting the relationship was reliable for BRP calculations.

5.2.4 Retrospective Analysis

Retrospective analyses were performed by ending the model in progressively earlier years and comparing the results to the output of the model that terminated in 2015. In the retrospective analysis starting in 2012, F (Mohn's rho = 0.303, Figure 5.2.7A) was underestimated in the last five years while SSB (Mohn's rho = - 0.147, Figure 5.2.7B) and recruitment (Mohn's rho = -0.237, Figure 5.2.7C) were overestimated for the LIS region over the time series.

5.2.5. Model Sensitivity and Uncertainty

For the LIS region, the LIS portion of the NY recreational harvest was revised for the years 2005-2015 which resulted in a decrease of up to 45% of the total recreational harvest. Additionally, the LIS portion of the NY commercial harvest was revised for the years 2008-2015, which resulted in a decrease harvest estimate of 20%. These estimates as based on numerous data streams and are a source of uncertainty. As the data is updated annually the model will be updated to reflect the most up-to-date estimates. Additionally, unquantified illegal live fish harvest from the region is not accounted for in the stock assessment, and this may be an influential mortality source.

5.3 New Jersey – New York Bight

5.3.1 Fishing Mortality and Selectivity Patterns

Estimated fishery selectivity patterns shifted in the expected direction between the first and second selectivity blocks, but the model estimated an increase in selectivity at age for the third time block despite increased regulation. The reason for this is unknown but may be due to changes in data availability or sampling design. The 2012 size limit increase (via Addendum VI) shifted selectivity to the right as expected, with 50% selectivity between ages 5 and 6 (Figure 5.3.1).

Consistent with previous assessments, including the 2015 benchmark, a three year moving average F was used to smooth the time series of fishing mortality (F). Fully exploited fishing mortality (F-mult) shows high interannual variability, but suggests a cyclical pattern in exploitation over time, with ranges generally between 0.2 and 0.6 (Table 5.3.1, Figure 5.3.2). The declines in F are generally consistent with changes in regulations which often included increases in minimum size. F would then increase over the next few years as the fish grew into the new size limit. Terminal year fishing mortality is estimated as F_{2015} = 0.45 (90% confidence interval 0.23 - 0.88; Figure 5.3.3) with the three-year average F_{avg} = 0.54.

5.3.2 Spawning Stock Biomass and Abundance

SSB shows a general decline from approximately 6,000 mt in 1989 to around 1,900 mt by 1996 (Table 5.3.2, Figure 5.3.3). Regulations in 1997 and 2003 allowed slight increases in SSB in subsequent years, but these gains were short lived as F rebounded. From 2006 to 2011, SSB declined from around 2,000 mt to 1,000 mt, but has since recovered to 1,835 mt (90% confidence intervals 1,352 - 2,489 mt).

Abundance at age in the stock of the terminal year shows a dominance of fish aged 1 through 3 with declining numbers from age 4 through age 12 (Figure 5.3.4).

5.3.3 Recruitment

During the early 1990s, recruitment (age 1) follows a similar pattern as SSB (Table 5.3.3, Figure 5.3.5), declining from 1.5 million in 1989 to less than 1 million by 1993. From 1993 to 2011, recruitment varied without trend between approximately 560,000 and 1,010,000 fish annually. Estimates of recruitment in the last four years of the model were all over 950,000 fish, with an apparent strong year class in 2014, estimated at 2.26 million.

5.3.4 Retrospective Analysis

The NJ-NYB region retrospective analysis spanned from 2015 to 2009, which extended into the previous selectivity block. SSB is overestimated relative to the base model in every year of the model but shows a stabilization close to the final estimates within the last selectivity block from 2012 to 2015 (Mohn's rho = 0.42; Figure 5.3.6). The retrospective pattern in fishing mortality switches at the change in selectivity (Figure 5.3.7), from overestimated F in recent years to underestimating F during the third selectivity block (Mohn's rho=0.079). The earliest estimate is underestimated by over 100% while the first year in the final selectivity block is overestimated by nearly 100%. The pattern in recruitment shows an overestimate of recruits in 2009, but the values for the following years fall below the final base run estimates (Mohn's rho=-0.094; Figure 5.3.8).

5.3.5 Model Sensitivity and Uncertainty

Two sensitivity runs were conducted for the NJ-NYB region to evaluate model sensitivity to data inputs and assumptions. During development of the update assessment, two errors were found in the indices used in the regional benchmark (NY seine and MRFSS; see appropriate section for details). Both errors were corrected for the update, but a sensitivity run was conducted using the incorrect indices to evaluate model performance. Similarly, the Tautog TC questioned the validity of the third selectivity block estimate for the NJ-NYB region, so a sensitivity run was conducted fixing the third selectivity as the average of the 2nd and 4th time periods. Neither of the runs had a significant impact on the results. Most notable, the incorrect indices resulted in a slightly lower fishing mortality rate in recent years ($F_{3year\text{-}avg}$ = 0.47 for sensitivity vs 0.54 for preferred model) and slightly higher SSB and recruitment trends in the last five years. For the run using a fixed 3rd selectivity block, terminal and recent year estimates were nearly identical to the preferred run, but fishing mortality for the years of that selectivity block (2004-2011) increased over the preferred run. This is consistent with the retrospective pattern which indicates F was underestimated in those years. F reference points were consistent among the runs, as was stock status with respect to F.

5.4 DelMarVa

5.4.1 Fishing Mortality and Selectivity Patterns

Fishing mortality has declined in 2013 - 2015 relative to the earlier period (Table 5.4.2, Figure 5.4.2). The terminal year (2015) F was estimated at 0.08, while the three year average for 2013 – 2015 was estimated as 0.16.

5.4.2 Spawning Stock Biomass and Abundance

Both total abundance and spawning stock biomass have declined steadily in the DelMarVa region since 2009, and SSB reached historically low level of 609 mt in 2015 (Table 5.4.3, Figure 5.4.3). Total abundance declined from a stable level of about 2.5 million fish in 2002-2009 period to the current low of 0.86 million fish in 2015.

5.4.3 Recruitment

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

5.4.4 Retrospective Analysis

Retrospective analyses were performed by shortening the data time series by one year at a time and comparing the results to the output of the model with full time series (1990-2015). The analysis was completed for time series ending in 2015, 2014, 2013, 2012, and 2011 (a five year peel).

As in the 2013 benchmark assessment, the DelMarVa region showed a strong retrospective pattern, consistently underestimating F (Mohn's rho = -0.65; Figure 5.4.5) and overestimating SSB (Mohn's rho=0.83; Figure 5.4.5). Retrospective bias in F and SSB in this assessment update appears to be larger than estimated before in 2013. Recruitment has the largest positive bias being overestimated (Mohn's rho=2.2; Figure 5.4.5); this may be due in part to the lack of a YOY index in this region. The estimates of R, F and, in particular, SSB do not converge when going back in time.

5.4.5 Model Sensitivity and Uncertainty

A limited number of sensitivity runs were conducted to examine the effects of input data and model configuration on model performance and results.

The base model results were insensitive to changes in starting values of model parameters (initial numbers at age, steepness, selectivity, catchability, etc). The model was converging on the same parameters estimates, within a range of initial starting values, indicating stability of model solution. Fixing steepness parameter at 1, thus assuming no stock recruitment relationship, had very little effect on the final model results. The model was also insensitive to the introduction of the additional, 4th selectivity block covering 2012-2015 period. Estimates of F and SSB were nearly identical to those from the model run with three selectivity blocks, where the third block covered the period of 2007 -2012.

Forcing the model to fit the catch information exactly (by reducing catch CVs to a very small value) is one of the few outcomes where the results are rather different – the SSB estimates appear to be significantly larger, particularly in the most recent period (SSB in 2015 is 57% higher than the base run), while the fishing mortality is significantly lower (55% of the base run estimate in 2015. Truncation of the time series (starting the model in 1995 rather than in 1990) leads to a slightly lower SSB and higher F estimates relative to the base run. Addition of NJ trawl index as the geographically nearest fishery independent survey resulted in very small changes in SSB estimates, but slightly higher F relative to the base run.

Overall, the model estimates appear to be stable and not sensitive to changes explored in various sensitivity runs.

5.5 Coastwide

5.5.1 Fishing Mortality and Selectivity Patterns

On the coast, the selectivity pattern of the fishery has shifted towards the right over time, with tautog fully selected by age 7 in the earliest time block, prior to implementation of the ASMFC FMP, and fully selected by age 9 in the most recent block, from 2013-2015 (Figure 5.5.1). However, the model estimated an increase in selectivity at age for the third time block, 2007-2012, despite increased regulation. This was also seen in other regions, and may indicate issues with the length and age sampling data for this time block.

Fishing mortality has been variable from year to year, but overall shows cyclical patterns of increasing and decreasing F (Table 5.5.1, Figure 5.5.2). The variability is somewhat smoothed out by the three year moving average of F. Full F peaked in the late 1980s, the mid-1990s and around 2010. F declined sharply from 2010 to 2011, but has been increasing again since then. In the terminal year, F_{2015} was 0.33, while the three-year average of 2013-2015 was 0.38.

5.5.2 Spawning Stock Biomass and Abundance

Spawning stock biomass peaked at the beginning of the time series, at around 26,000 mt before declining to a low of 5,138 mt in 2011 (Table 5.5.2, Figure 5.5.3). SSB has increased somewhat since then, with SSB in 2015 estimated at 6,014 mt.

Abundance has declined over this time period as well, from a high in the early 1980s of approximately 28 million fish to a low in 2011 of 8.4 million fish, with a slight increase since then (Figure 5.5.4). Total abundance in 2015 was 9.9 million fish. The age structure of the population has contracted over this time period as well, with older fish (ages 8-12+) making up a smaller proportion of the population in the most recent years (Figure 5.5.4).

5.5.3 Recruitment

Recruitment has declined since the beginning of the time series, from approximately 5.9 million age-1 fish in 1982 to a low of 1.75 million fish in 1996 (Table 5.5.2, Figure 5.5.5). Recruitment has fluctuated around a mean of 2.2 million fish since then. Recruitment in 2015 was estimated at 2.1 million fish, slightly below the time-series mean of 2.75 million fish.

The spawner-recruit relationship is shown in Figure 5.5.6. Steepness was estimated at 0.55, indicating a moderately productive species.

5.5.4 Retrospective Analysis

A retrospective analysis was conducted by iteratively removing one year of data, from 2015 – 2009. It should be noted that this analysis crosses the 2013-2015 selectivity block, meaning removing data from the terminal selectivity block, as well as the 2007-2012 block, will hinder the model's ability to estimate F and selectivity in those years.

In general, the model overestimated F (Mohn's rho=0.37) and underestimated SSB (Mohn's rho = -0.088) and recruitment (Mohn's rho = -0.30), although for some years of the analysis, this pattern was reversed (Figure 5.5.7).

5.5.5 Model Sensitivity and Uncertainty

The use of the ASAP model is an improvement over previous coastwide assessments' use of the VPA model because of ASAP's ability to handle uncertainty in catch and indices. However, the TC does not recommend the coastwide model for management use, given the biology and life history of tautog. The coastwide model averages the trends over a number of discrete population units and increases the risk of overfishing individual regions. Although the precision of MRIP estimates is best at the largest spatial scale, the coastwide model is also sensitive to the same data uncertainties as the other regions, including the lack of dedicated fishery independent indices for tautog, especially in the southernmost part of the range and low sample size for age data.

6 Biological Reference Points and Stock Status

Overfishing status is evaluated based on average F from 2013-2015. Annual estimates of F are highly variable due to the annual variability in catch, which is more likely due to the imprecision of the MRIP estimates. Therefore, the TC recommends the use of the three-year running average to evaluate overfishing status to smooth out the somewhat artificial inter-annual variability in F and allow management to respond to genuine trends. Overfished status is determined by SSB in 2015. Estimates of SSB are more stable, so the TC finds the terminal year estimate appropriate to determine overfished status.

Regions with adequately estimated stock-recruitment relationships used MSY-based reference points to determine stock status. Regions without stock-recruitment curves used SPR-based reference points for F, and used the projection model AGEPRO to project the population forward in time under constant fishing mortality ($F_{30\%SPR}$ and $F_{40\%SPR}$) with recruitment drawn from the model estimated time-series of observed recruitment to develop an estimate of the long-term equilibrium SSB associated with those fishing mortality reference points.

6.1 Massachusetts-Rhode Island

Estimated steepness of the MARI regional model was deemed credible by the TC during the benchmark assessment, and the TC therefore recommends MSY-based benchmarks for this region. The steepness parameter was similar to that estimated during the benchmark (steepness = 0.45), therefore MSY reference points were used for this update to be consistent with the benchmark recommendations. Because there was considerable discussion by the TC regarding the utility of the different reference point models, SPR-based reference points are also provided for the MARI region.

6.1.1 Overfishing Status

F_{target} was defined as F_{MSY} with $F_{threshold}$ set at the F value necessary to achieve the SSB threshold, 75%SSB_{MSY}, in the long term. These two reference points are F_{target} = 0.14 and $F_{threshold}$ = 0.28. The three year average of F for 2013-2015 is 0.23. This value is below the threshold, indicating overfishing is not occurring, but it is still above the target (Figure 6.1.1).

For SPR estimates, the 3-year average value of F_{3yr} = 0.23 was below both F_{Target} = 0.28 and $F_{threshold}$ = 0.49 (Figure 6.1.3), thus indicating by the SPR reference points that this stock is not experiencing overfishing and is at a fishing mortality rate that is below the target.

6.1.2 Overfished Status

For the MARI region, SSB_{target} was defined as SSB_{MSY} = 3,631 mt and $SSB_{threshold}$ was defined as 75% of SSB_{MSY} = 2,723 mt. SSB_{2015} was estimated at 2,196 mt, below both the target and the threshold, indicating the stock is overfished (Figure 6.1.2).

For SPR estimates, the point estimate of SSB_{2015} = 2,196 mt is below the SSB_{Target} = 2,684 mt but is above the $SSB_{threshold}$ = 2,004 mt (Figure 6.1.4), thus indicating that the stock is not overfished but is not yet rebuilt to the SSB target.

6.2 Long Island Sound

6.2.1 Overfishing Status

F_{target} was defined as F_{MSY} and $F_{threshold}$ was defined as the F rate that would maintain the population at 75%SSB_{MSY}. F_{target} for Long Island Sound was 0.28 and $F_{threshold}$ was 0.49.

For comparison with other regions, both MSY and SPR values are reported. Both methods indicated that overfishing is occurring in Long Island Sound. In 2013-2015, F ranged from 0.35 to 0.59. The 3 year-average estimates of F (F_{3yr} = 0.51) exceeded both the MSY target and threshold (Table 6.2.1, Figure 6.2.1) and the SPR target and threshold ($F_{40\%SPR}$=0.27 and $F_{30\%SPR}$=0.46; Table 6.2.1, Figure 6.2.2).

6.2.2 Overfished Status

The ASAP model runs using both MSY and SPR methods indicated that the tautog stock is overfished in Long Island Sound. SSB_{2015} (1,603 mt, Table 6.2.1, Figure 6.2.1) is below MSY target and threshold (SSB_{MSY} = 2,865 mt and $SSB_{75\%MSY}$ = 2,148 mt) as well as SPR target and threshold ($SSB_{40\%}$ = 2,980 mt and $SSB_{30\%SPR}$ = 2,238 mt; Table 6.2.1, Figure 6.2.2).

6.3 New Jersey – New York Bight

6.3.1 Overfishing Status

In the NJ-NYB regional model, data were not sufficient to allow credible estimation of the stock-recruit relationship, so the TC considered the MSY-based reference points unreliable. Consistent with the regional assessment, fishing mortality target and threshold reference points in the NJ-NYB region are defined as $F_{40\%SPR}$ and $F_{30\%SPR}$, respectively. ASAP model estimated values for the target and threshold are $F_{40\%}$ = 0.20 and $F_{30\%}$ = 0.34. The ASAP model runs indicated overfishing was occurring in the NJ-NYB region in 2015. Both the point estimate of F_{2015} = 0.45 and the 3-year average value of F_{3yr} = 0.54 were above the fishing mortality threshold (Figure 6.3.1).

6.3.2 Overfished Status

Long term equilibrium projections conducted in AgePro estimate that spawning stock biomass reference points for the NJ-NYB region as SSB_{target} = 3,154 mt and $SSB_{threshold}$ = 2,351 mt. The ASAP model run indicates that the NJ-NYB tautog population is overfished in 2015. SSB_{2015} was estimated at 1,809 mt, approximately 23% below the SSB threshold and 43% below the target (Figure 6.3.1).

6.4 DelMarVa

6.4.1 Overfishing Status

For DelMarVa, F_{target} is defined as $F_{40\%SPR}$ = 0.16, and $F_{threshold}$ is defined as $F_{30\%SPR}$ = 0.24. The three year average F from 2013-2015 was 0.16, equal to the target and below the threshold, indicating overfishing is not occurring (Figure 6.4.1).

6.4.2 Overfished Status

The SSB target for DelMarVa is the long-term equilibrium SSB associated with $F_{40\%SPR}$, equal to 1,919 mt. The SSB threshold is the SSB associated with $F_{30\%SPR}$ = 1,447 mt. Terminal year SSB 2015 estimate is 620.9 mt, below both the target and the threshold (Figure 6.4.1). According to the probability distribution of SSB estimates based on the MCMC analysis, there is 100% chance that SSB in 2015 was below $SSB_{threshold}$ (Figure 6.4.2), indicating the stock is overfished.

6.5 Coastwide

6.5.1 Overfishing Status

For the coast, F_{target} was defined as F_{MSY} and $F_{threshold}$ was defined as the F rate that would maintain the population at 75%SSB_{MSY}. F_{MSY} for the coastwide population was 0.17 and $F_{75\%SSB}$ was 0.24. The 2013-2015 average F was 0.38, above both the MSY-based target and the threshold, indicating overfishing was occurring (Figure 6.5.1).

For comparison, $F_{30\%SPR}$ was 0.43 and $F_{40\%}$ was 0.25. The 2013-2015 average F was between those two values (Figure 6.5.2).

6.5.2 Overfished Status

SSB_{target} was defined as SSB_{MSY}, estimated at 14,944 mt, and $SSB_{threshold}$ was 75% of SSB_{MSY}, or 11,208 mt. In 2015, SSB was 6,014 mt, below both the target and the threshold, indicating the stock was overfished (Figure 6.5.1).

For comparison, the $SSB_{30\%}$ associated with $F_{30\%SPR}$ was 7,091 mt and the $SSB_{40\%}$ associated with $F_{40\%SPR}$ was 9,448 mt. SSB in 2015 was below both of these values as well (Figure 6.5.2).

7 Projections

AgePro (v. 4.2, NOAA Fisheries Toolbox), was used to conduct short term (2016-2020) projection scenarios to determine constant harvest levels that would result in 50% chance and 70% chance of achieving the regional F targets in 2020, as well as to project trends under status quo removals. Biological parameters (maturity, M, weights at age) for the projection model were the same used in the ASAP population model, with the exception that projection catch weights at age were set equal to the average catch weight at age in the most recent selectivity block. The model assumed empirical recruitment drawn from the ASAP estimated observed recruitment vector for SPR reference points, and Beverton and Holt recruitment with lognormal error using parameter estimated by ASAP for MSY-based reference points. Fishery selectivity was input as that estimated by ASAP in the most recent selectivity period. Harvest for 2016 and 2017 were assumed equal to the most recent three year average harvest. An iterative process was used to determine a constant harvest rate in 2018-2020 that resulted in 50% and 70% probabilities of achieving $F_{target.}$

7.1 Massachusetts – Rhode Island

Probability estimates of achieving MSY reference points ($F_{MSYTarget}$ and $SSB_{75\%MSY}$) and SPR reference points ($F_{40\%SPR}$ and $SSB_{30\%}$) in 3 years from short term projections (2017 through 2020) are shown in Table 7.1.1 and Figures 7.1.1 and 7.1.2. Under status quo conditions (2013-2015 average landings of 390 mt), using MSY reference points there is 0% probability of achieving F_{Target} and 0% probability of reaching $SSB_{Threshold}$ (Table 7.1.1, Figure 7.1.1). Similarly, under status quo conditions, using SPR reference points there is 0% probability of achieving $F_{40\%}$ but a 4.1% probability of reaching $SSB_{30\%SPR}$ (Table 7.1.1, Figure 7.1.2).

Reducing landings to 151 mt (approximately 55% of 2015 landings) and using MSY reference points results in a 50% probability of achieving F_{target} and 2.2% probability of achieving $SSB_{Threshold}$ (Table 7.1.1, Figure 7.1.3). With MSY reference points, landings of 148 mt (a 56% reduction from 2015 landings) results in a 70% probability of achieving F_{target} and 2.3% probability of achieving $SSB_{Threshold}$ by 2020 (Table 7.1.1, Figure 7.1.4).

Using SPR reference points, a harvest reduction of 24% from 2015 landings to 257 mt results in a 50% probability of achieving $F_{40\%SPR}$ and 23.2% probability of achieving $SSB_{30\%SPR}$ (Table 7.1.1, Figure 7.1.5). Annual landings of 253 mt (a 25% reduction from 2015 levels) results in a 70%

probability of achieving $F_{40\%SPR}$ and 24.3% probability of achieving $SSB_{30\%SPR}$ (Table 7.1.1, Figure 7.1.6).

7.2. Long Island Sound

Under status quo conditions (2013-2015 average landings of 500 mt), using MSY reference points, there is 1.7% probability of achieving F_{Target} and 0.6% probability of reaching $SSB_{Threshold}$ (Table 7.2.1, Figure 7.2.1). Similarly, under status quo conditions, using SPR reference points there is 0% probability of achieving F_{Target} and 0.6% probability of reaching $SSB_{Threshold}$ (Table 7.2.1).

Reducing landings to 264 mt (a 39% reduction from 2015 levels) and using MSY reference points results in a 50% probability of achieving F_{target} and 34% probability of achieving $SSB_{Threshold}$ (Table 7.2.1, Figure 7.2.2). With MSY reference points, landings of 229 mt (a 47% reduction from 2015 levels) results in a 70% probability of achieving F_{target} and 40% probability of achieving $SSB_{Threshold}$ by 2020 (Table 7.2.1, Figure 7.2.3).

Using SPR reference points, a harvest reduction of 41% (to 255 mt) results in a 50% probability of achieving $F_{40\%SPR}$ and 28% probability of achieving $SSB_{30\%SPR}$ (Table 7.2.1, Figure 7.2.4). Annual landings of 229 mt (47% reduction from 2015) results in a 70% probability of achieving the SPR $F_{40\%SPR}$ and 33% probability of achieving $SSB_{30\%SPR}$ (Table 7.2.1, Figure 7.2.5).

7.3 New Jersey – New York Bight

Probability estimates of achieving F_{Target} and $SSB_{Threshold}$ in 2020 years from short term projections (2016 through 2020) are shown in Table 7.3.1 and Figures 7.3.1 – 7.3.3. Under status quo conditions (2013-2015 average landings of 461 mt), there is a 45% probability of achieving F_{Target} and an 85% probability of being at or above $SSB_{threshold}$ in 2020 (Table 7.3.1, Figure 7.3.1).

Constant harvest of 450 mt (a 2.3% reduction from the 2013-2015 average but a 35% increase from 2015 levels) results in a 50% probability of achieving F_{target} and 86% probability of being at or above $SSB_{threshold}$ (Table 7.3.1, Figure 7.3.2). Annual landings of 410 mt (an 11% reduction from the 3-year average and a 23% increase from 2015 levels), provides a 70% probability of achieving F_{target} and an 88% probability of being at or above $SSB_{threshold}$ (Table 7.3.1, Figure 7.3.3).

7.4 DelMarVa

If the constant catch of 77.0 mt was maintained during 2016-2020 (status quo scenario), the probability of the fully-recruited F being at or below the F target by the year 2020 is expected to be 99.64%, while the probability of SSB being at or above SSB threshold is 18.15 % (Table 7.4.1, Figure 7.4.1). Fishing mortality will rise to 0.13 in 2016 and will decline thereafter to F=0.076 by 2020 (Figure 7.4.1). SSB is projected to grow but the median will reach only 1320.5 mt (Figure 7.4.1).

A 50% probability for F being at or below $F_{threshold}$ by year 2020 can be achieved by maintaining total annual removals at 136 mt, an increase from both the 3 year average and 2015 levels;

however, this results in a very low chance (9.9%) of SSB reaching the SSB threshold (Table 7.4.1; Figure 7.4.2).

A 70% chance of F being at or below $F_{threshold}$ by year 2020 requires to maintain annual removals in 2018-2020 at 125 mt, but the chance for SSB reaching SSB target is only 11.9% (Table 7.4.1; Figure 7.4.3).

7.5 Coastwide

Under status quo harvest (the average of the last three years, 1,270 mt), there is zero probability of attaining the F_{target} in 2020, and less than 1% probability of being at or above the SSB threshold (Table 7.5.1, Figure 7.5.1).

To have a 50% chance of being at or below the F target in 2020, harvest for 2018-2020 needs to be reduced to 737 mt, an 18.5% reduction from 2015 harvest (Table 7.5.1, Figure 7.5.2). This results in a 0.9% chance that SSB will be at or above the threshold in 2020 (Figure 7.5.2).

To have a 70% chance of being at or below the F target in 2020, harvest for 2017-2020 needs to be reduced to 682 mt, a 24.6% reduction from 2015 harvest (Table 7.5.1, Figure 7.5.3). This results in a 1% chance that SSB will be at or above the threshold in 2020 (Figure 7.5.3).

These calculations were done using the MSY-based target and threshold reference points.

Status quo harvest results in a 2.7% chance that F will be at or below $F_{40\%SPR}$ in 2020, and a 29.4% chance that SSB will be at or above $SSB_{30\%}$ (Table 7.5.1, Figure 7.5.4).

To have a 50% chance of achieving $F_{40\%SPR}$, harvest in 2018-2020 needs to be 968 mt, a 23.8% reduction from the 2013-2015 average harvest, but a 7% increase from 2015 harvest (Table 7.5.1, Figure 7.5.5). This results in a 50.2% probability of SSB being at or above $SSB_{30\%}$ (Figure 7.5.5).

To have a 70% chance of being at or below $F_{40\%SPR}$, harvest in 2018-2020 needs to be reduced to 895 mt, a reduction of 1% from 2015 harvest levels and a reduction of 29.5% from the 2013-2015 average harvest (Table 7.5.1, Figure 7.5.6). This results in a 55.3% probability of SSB being above $SSB_{30\%}$ (Figure 7.5.5).

8 Research Recommendations

For all regions, the TC recommends expanding the biological sampling of catch and discards, both commercial and recreational, as well as increased MRIP sampling levels to improve estimates of total catch, as high priorities to improve the assessment. In addition, establishing standardized multi-state fishery independent surveys using gear appropriate for structure-oriented species (e.g., fish pots or traps) is a high priority to improve the quality of fishery independent abundance information for the assessment. Genetic analyses with up-to-date methodologies could also help refine regional boundaries. Better monitoring of illegal harvest to develop more accurate estimates of these removals and improve compliance would also be useful to both the assessment and management of this species.

9 Literature Cited

Atlantic States Marine Fisheries Commission. 1996. Fisheries Management Plan for Tautog. ASMFC, Washington, DC.

Atlantic States Marine Fisheries Commission. 2015. Tautog benchmark stock assessment. Arlington, VA.

Atlantic States Marine Fisheries Commission. 2016. Tautog regional stock assessment: Long Island Sound and New Jersey-New York Bight. Arlington, VA.

10 Tables

Table 3.1.1. Total removals by sector for the MARI region.

	Recreational (#s of fish)		Commercial	Total
	Harvest	Released Alive		Harvest
Year	(A+B1)	(B2)	(lbs)	(mt)
1982	1,265,960	36,347	155,600	1,888
1983	916,304	160,239	200,200	1,206
1984	748,384	264,958	402,800	1,341
1985	216,345	48,304	466,500	487
1986	2,652,311	436,693	528,900	4,739
1987	747,797	204,966	670,500	1,334
1988	829,478	261,695	606,000	1,579
1989	366,583	76,860	566,900	882
1990	386,877	117,368	500,158	812
1991	468,851	179,847	725,943	1,152
1992	551,735	101,425	652,058	1,354
1993	335,328	118,493	361,929	684
1994	160,787	282,698	167,781	401
1995	127,031	270,111	130,287	313
1996	135,326	249,188	97,396	344
1997	109,703	179,952	103,841	265
1998	81,118	172,650	111,623	242
1999	143,612	305,683	101,709	318
2000	126,239	203,737	139,720	361
2001	155,651	278,909	140,395	372
2002	165,085	419,193	198,080	460
2003	166,869	386,438	140,855	392
2004	146,235	288,030	124,757	420
2005	232,562	445,497	142,186	615
2006	161,250	530,434	194,238	410
2007	216,537	680,682	159,253	534
2008	137,997	264,226	121,896	333
2009	110,295	283,101	105,600	233
2010	242,805	304,734	119,373	551
2011	52,132	348,649	105,217	150
2012	129,221	310,096	117,998	345
2013	193,926	512,749	123,597	436
2014	169,065	544,881	116,581	398
2015	138,264	476,747	108,892	337

Table 3.1.2. Indices of relative abundance for the MARI region.

Year	MA Trawl Survey	RI Fall Trawl Survey	MRIP CPUE	RI Seine Survey (YOY)
1982	0.83	0.302	0.694	
1983	0.423	1.026	1.926	
1984	0.912	1.729	1.707	
1985	0.643	0.949	0.712	
1986	2.159	3.030	3.105	
1987	0.894	1.227	0.903	
1988	0.582	0.053	0.878	
1989	2.351	0.478	1.257	7.567
1990	0.224	0.269	0.916	13.758
1991	0.079	0.203	1.104	5.391
1992	0.594	0.137	1.662	7.353
1993	0.105	0.040	1.269	9.007
1994	0.371	0.111	0.990	3.507
1995	0.060	0.103	0.736	0.968
1996	0.173	0.670	0.892	0.877
1997	0.207	0.041	0.459	7.065
1998	0.158	0.071	0.428	2.658
1999	0.034	0.109	0.335	4.764
2000	0.019	0.526	0.272	5.313
2001	0.153	0.150	0.304	15.026
2002	0.170	0.392	0.350	8.700
2003	0.117	0.231	0.465	9.291
2004	0.041	0.510	0.300	15.669
2005	0.263	0.137	0.554	7.656
2006	0.290	0.021	0.489	13.442
2007	0.129	0.035	0.348	2.595
2008	0.200	0.198	0.334	8.851
2009	0.237	0.127	0.934	2.408
2010	0.022	0.158	0.498	2.339
2011	0.146	0.195	0.654	3.042
2012	0.077	0.071	0.514	1.340
2013	0.043	0.178	0.480	4.115
2014	0.130	0.148	0.414	4.149
2015	0.090	0.079	0.456	5.194

Table 3.2.1. Total catch by sector for the LIS region.

	Recreational (#s of fish)		Commercial	Total Harvest
Year	Harvest (A+B1)	Released Alive (B2)	(lbs)	(mt)
1982				
1983				
1984				825
1985				805
1986			285,285	1,071
1987			350,842	1,386
1988	664,341	382,998	257,615	1,103
1989	515,322	340,698	309,486	907
1990	459,765	428,202	171,706	792
1991	565,449	605,198	168,070	898
1992	466,681	501,359	164,039	788
1993	383,309	360,578	132,385	624
1994	224,172	270,393	78,186	339
1995	172,826	302,923	53,087	306
1996	84,582	125,904	116,817	186
1997	68,375	149,719	74,831	150
1998	123,043	413,306	66,734	255
1999	150,639	261,363	33,700	332
2000	29,464	53,732	34,067	75
2001	29,425	147,165	60,019	93
2002	514,233	734,039	65,833	995
2003	229,112	385,144	86,447	443
2004	260,173	532,607	89,922	578
2005	110,291	261,960	79,281	246
2006	324,274	579,285	86,640	642
2007	505,230	997,400	120,319	1,007
2008	393,542	634,734	82,226	807
2009	270,515	457,807	52,732	523
2010	217,978	426,213	71,036	433
2011	76,506	265,894	88,481	179
2012	220,194	880,195	65,710	523
2013	122,376	629,212	85,312	326
2014	342,430	2,420,049	99,944	743
2015	199,800	1,031,494	76,525	431

Table 3.2.2. Indices of abundance for the LIS region.

Year	CT Long Island Sound Trawl Survey	MRIP CPUE	NY Peconic Bay Trawl (Age-1)	NY WLI Seine Survey (YOY)
1982		1.225		
1983		1.091		
1984	1.697	1.546		0.369
1985	0.956	1.453		
1986	1.033	1.258		0.052
1987	0.829	1.367	0.207	0.033
1988	0.617	3.379	0.218	1.244
1989	0.771	2.668	0.900	0.026
1990	0.787	1.229	0.354	0.187
1991	1.039	1.608	0.286	2.932
1992	0.465	1.804	0.132	0.450
1993	0.257	1.471	0.227	0.009
1994	0.277	1.279	0.076	
1995	0.142	0.692	0.089	0.065
1996	0.206	1.046	0.233	0.043
1997	0.278	0.577	0.177	0.281
1998	0.365	0.395	0.250	0.215
1999	0.505	0.342	0.170	1.004
2000	0.454	0.222	0.085	1.772
2001	0.543	0.229	0.326	0.034
2002	0.955	0.687	0.137	0.548
2003	0.393	0.782	0.208	0.935
2004	0.349	0.626	0.145	0.045
2005	0.294	0.683		0.331
2006	0.396	1.072		0.172
2007	0.366	0.781	0.219	0.064
2008	0.379	0.676		0.040
2009	0.264	0.599	0.924	
2010	0.170	0.750	0.424	0.010
2011	0.177	0.550	0.103	0.008
2012	0.285	0.452	0.161	0.402
2013	0.286	0.364	1.133	0.025
2014	0.328	0.772	0.407	0.448
2015	0.354	0.327	0.477	1.296

Table 3.3.1. Total catch by sector for the NJ-NYB region.

Year	Recreational (#s of fish) Harvest (A+B1)	Released Alive (B2)	Commercial (lbs)	Total Harvest (mt)
1982	910,502	151,180		
1983	654,074	231,774		
1984	660,719	153,337	130,073	
1985	1,399,406	315,718	125,663	
1986	2,968,005	324,116	121,254	
1987	1,485,251	691,974	127,868	
1988	962,326	485,103	198,416	
1989	1,061,967	486,647	105,822	927
1990	1,411,498	556,687	154,323	1,183
1991	1,564,192	1,270,467	176,370	1,696
1992	1,283,981	800,674	147,710	1,554
1993	1,075,591	1,002,991	169,756	1,195
1994	330,877	450,591	216,053	419
1995	773,402	1,079,342	156,528	935
1996	541,233	625,146	112,436	641
1997	253,456	503,556	68,343	319
1998	24,308	536,624	50,706	62
1999	227,131	1,264,625	44,092	351
2000	522,799	1,003,171	55,116	944
2001	500,795	1,232,142	85,980	790
2002	563,610	1,274,528	57,320	948
2003	170,085	588,524	92,594	250
2004	125,255	571,272	110,231	237
2005	52,744	286,363	103,617	130
2006	324,041	956,020	114,640	556
2007	371,566	1,385,999	127,868	646
2008	265,054	1,228,194	125,663	447
2009	289,079	1,102,538	74,957	450
2010	418,343	1,452,652	114,640	602
2011	197,397	975,357	114,640	329
2012	73,025	580,820	70,548	165
2013	170,248	700,017	99,208	331
2014	409,612	832,050	85,980	716
2015	180,343	910,732	85,980	334

Table 3.3.2 Indices of relative of abundance for the NJ-NYB region

Year	NY Jamaica Bay Seine Survey (YOY)	NJ Ocean Trawl	MRIP CPUE
1982			0.363
1983			0.244
1984			0.209
1985			0.312
1986			0.631
1987	0.083		0.499
1988	0.234		0.525
1989	1.280	1.269	0.714
1990	0.994	1.565	0.767
1991	0.407	0.988	0.660
1992	0.421	1.324	0.782
1993	0.013	0.692	0.399
1994	0.121	0.434	0.194
1995	0.090	0.601	0.523
1996	0.052	0.203	0.370
1997	0.000	0.112	0.315
1998	0.052	0.296	0.087
1999	0.853	0.618	0.169
2000	0.634	0.334	0.205
2001	1.112	0.287	0.383
2002	0.135	1.482	0.531
2003	0.240	0.605	0.148
2004	1.859	0.353	0.250
2005	1.477	0.662	0.164
2006	0.622	0.760	0.257
2007	1.041	0.357	0.369
2008	0.423	0.897	0.268
2009	0.042	0.572	0.524
2010	0.000	0.435	0.228
2011	0.066	0.140	0.247
2012	2.745	0.248	0.204
2013	0.706	0.424	0.157
2014	0.922	0.724	0.178
2015	1.829	0.456	0.305

Table 3.4.1. Total catch by sector for the DMV region.

	Recreational (#s of fish)		Commercial	Total Harvest
Year	Harvest (A+B1)	Released Alive (B2)	(lbs)	(mt)
1982	244,032	20,010		
1983	586,271	67,004		
1984	278,415	34,292		
1985	154,444	37,016	4,334	
1986	469,671	108,559	5,162	
1987	317,012	93,003	7,610	
1988	570,381	110,900	9,511	
1989	569,114	160,508	12,016	
1990	218,991	135,294	6,655	203
1991	323,823	201,118	9,468	497
1992	275,976	203,969	6,195	280
1993	443,190	489,045	5,562	504
1994	454,837	475,896	12,046	662
1995	566,031	450,207	27,746	713
1996	291,893	157,455	29,560	454
1997	257,493	246,349	26,810	374
1998	120,019	275,906	20,681	267
1999	158,369	450,855	26,179	296
2000	168,540	465,256	17,503	298
2001	103,241	374,054	16,330	180
2002	253,709	744,271	26,892	426
2003	152,972	318,839	16,505	270
2004	230,001	345,543	26,445	390
2005	149,444	457,085	10,326	269
2006	231,059	579,466	14,503	424
2007	203,905	525,183	14,378	338
2008	177,247	349,010	15,951	319
2009	218,374	390,535	14,469	379
2010	241,064	686,392	8,969	399
2011	103,777	200,094	17,968	181
2012	65,846	234,530	15,940	121
2013	48,195	168,605	15,070	74
2014	76,878	135,106	10,917	117
2015	22,215	125,258	6,233	41

Table 3.4.2. Indices of relative abundance for the DMV region.

Year	MRIP CPUE
1982	0.166
1983	0.159
1984	0.145
1985	0.049
1986	0.250
1987	0.099
1988	0.204
1989	0.237
1990	0.079
1991	0.114
1992	0.122
1993	0.221
1994	0.185
1995	0.166
1996	0.181
1997	0.105
1998	0.049
1999	0.082
2000	0.052
2001	0.064
2002	0.104
2003	0.084
2004	0.137
2005	0.108
2006	0.123
2007	0.084
2008	0.149
2009	0.096
2010	0.137
2011	0.078
2012	0.064
2013	0.069
2014	0.039
2015	0.027

Table 3.5.1. Total catch by sector for the coast.

Year	Recreational (#s of fish) Harvest (A+B1)	Released Alive (B2)	Commercial (lbs)	Total Harvest (mt)
1982	2,986,485	292,887	419,656	3,969
1983	2,698,478	676,332	427,919	2,800
1984	2,116,432	647,964	677,615	2,754
1985	2,507,219	717,194	734,370	2,292
1986	7,021,004	1,105,043	941,012	8,107
1987	3,325,947	1,406,300	1,157,280	4,574
1988	3,030,988	1,240,696	1,071,017	4,721
1989	2,524,897	1,068,964	1,016,631	3,355
1990	2,480,559	1,241,464	873,510	2,751
1991	2,930,104	2,256,855	1,110,344	4,200
1992	2,583,622	1,611,027	1,012,176	3,957
1993	2,242,205	1,972,309	698,493	3,028
1994	1,172,943	1,479,937	459,529	1,800
1995	1,642,468	2,103,424	375,567	2,271
1996	1,059,640	1,158,675	357,434	1,618
1997	700,458	1,080,041	280,912	1,121
1998	357,976	1,409,850	254,186	801
1999	688,186	2,283,012	208,825	1,283
2000	852,597	1,730,087	247,456	1,686
2001	791,531	2,038,259	305,487	1,426
2002	1,501,151	3,173,716	351,451	2,704
2003	731,222	1,684,236	340,552	1,263
2004	770,885	1,737,957	300,749	1,497
2005	558,644	1,454,562	292,194	1,229
2006	1,041,858	2,649,092	350,580	1,991
2007	1,312,420	3,629,994	340,925	2,493
2008	974,529	2,495,252	310,940	1,827
2009	891,158	2,309,219	243,644	1,696
2010	1,123,910	2,881,613	287,851	1,950
2011	430,793	1,915,440	266,387	837
2012	498,225	2,026,298	238,013	1,155
2013	540,708	2,187,380	278,148	964
2014	1,038,418	4,065,321	284,842	1,942
2015	545,282	2,573,361	255,481	905

Table 3.5.2. Indices of relative abundance for the coast (Age-1+).

Year	MA Trawl Survey	RI Fall Trawl Survey	CT LISTS	NJ Ocean Trawl
1982	0.830	0.302		
1983	0.423	1.026		
1984	0.912	1.729	3.469	
1985	0.643	0.949	1.797	
1986	2.159	3.030	1.720	
1987	0.894	1.227	1.213	
1988	0.582	0.053	0.901	
1989	2.351	0.478	1.259	1.269
1990	0.224	0.269	1.162	1.565
1991	0.079	0.203	1.147	0.988
1992	0.594	0.137	1.025	1.324
1993	0.105	0.040	0.570	0.692
1994	0.371	0.111	0.584	0.434
1995	0.060	0.103	0.253	0.601
1996	0.173	0.670	0.563	0.203
1997	0.207	0.041	0.508	0.112
1998	0.158	0.071	0.644	0.296
1999	0.034	0.109	0.761	0.618
2000	0.019	0.526	0.800	0.334
2001	0.153	0.150	0.895	0.287
2002	0.170	0.392	1.167	1.482
2003	0.117	0.231	0.898	0.605
2004	0.041	0.510	0.694	0.353
2005	0.263	0.137	0.760	0.662
2006	0.290	0.021	0.841	0.760
2007	0.129	0.035	0.614	0.357
2008	0.200	0.198	0.727	0.897
2009	0.237	0.127	0.482	0.572
2010	0.022	0.158	0.247	0.435
2011	0.146	0.195	0.446	0.140
2012	0.077	0.071	0.581	0.248
2013	0.043	0.178	0.578	0.424
2014	0.130	0.148	0.696	0.724
2015	0.090	0.079	0.616	0.456

Table 3.5.3. Recruitment indices for the coast.

Year	RI Seine Survey	NY Peconic Bay Trawl Survey	NY WLI Seine Survey
1982			
1983			
1984			
1985			0.259
1986			0.024
1987		0.207	0.348
1988		0.218	0.088
1989	7.567	0.900	1.206
1990	13.758	0.354	0.304
1991	5.391	0.286	0.345
1992	7.353	0.132	2.429
1993	9.007	0.227	0.587
1994	3.507	0.076	0.014
1995	0.968	0.089	0.053
1996	0.877	0.233	0.135
1997	7.065	0.177	0.102
1998	2.658	0.250	0.204
1999	4.764	0.170	0.170
2000	5.313	0.085	1.193
2001	15.026	0.326	1.577
2002	8.700	0.137	0.249
2003	9.291	0.208	0.548
2004	15.669	0.145	0.880
2005	7.656		0.291
2006	13.442		0.782
2007	2.595	0.219	0.357
2008	8.851		0.301
2009	2.408	0.924	0.081
2010	2.339	0.424	0.017
2011	3.042	0.103	0.007
2012	1.340	0.161	0.167
2013	4.115	1.133	1.055
2014	4.149	0.407	0.244
2015	5.194	0.477	0.527

Table 5.1.1. Fishing mortality estimates for the MARI region

Year	Annual F	3-year Average F
1982	0.19	
1983	0.13	
1984	0.12	0.15
1985	0.07	0.11
1986	0.35	0.18
1987	0.22	0.21
1988	0.21	0.26
1989	0.17	0.20
1990	0.16	0.18
1991	0.21	0.18
1992	0.32	0.23
1993	0.20	0.25
1994	0.18	0.24
1995	0.48	0.29
1996	0.51	0.39
1997	0.31	0.43
1998	0.40	0.41
1999	0.33	0.35
2000	0.27	0.33
2001	0.27	0.29
2002	0.27	0.27
2003	0.30	0.28
2004	0.17	0.25
2005	0.23	0.23
2006	0.27	0.22
2007	0.34	0.28
2008	0.26	0.29
2009	0.21	0.27
2010	0.36	0.28
2011	0.14	0.24
2012	0.20	0.23
2013	0.24	0.19
2014	0.24	0.22
2015	0.22	0.23

Table 5.1.2 Spawning stock biomass and recruitment estimates for the MARI region

Year	SSB (mt)	Recruitment (numbers of fish)
1982	8,528	1,997,640
1983	8,592	1,382,280
1984	8,813	961,360
1985	8,994	890,150
1986	8,285	1,150,630
1987	6,978	1,234,600
1988	6,249	1,611,130
1989	5,775	1,454,970
1990	5,646	1,219,490
1991	5,560	1,072,770
1992	5,197	900,490
1993	4,849	687,180
1994	4,693	546,600
1995	4,072	470,120
1996	3,105	403,810
1997	2,549	494,110
1998	2,235	574,970
1999	1,978	642,590
2000	1,885	613,540
2001	1,889	560,550
2002	1,926	580,420
2003	1,951	626,540
2004	2,021	739,200
2005	2,123	697,760
2006	2,187	708,500
2007	2,195	610,950
2008	2,215	879,990
2009	2,290	670,720
2010	2,345	478,040
2011	2,413	505,250
2012	2,502	340,830
2013	2,461	492,040
2014	2,321	581,390
2015	2,196	541,250

Table 5.2.1. Fishing mortality estimates for the LIS region.

Year	Annual F	3-year Average F
1984	0.18	
1985	0.17	
1986	0.19	0.18
1987	0.24	0.20
1988	0.27	0.24
1989	0.32	0.28
1990	0.25	0.28
1991	0.22	0.27
1992	0.32	0.26
1993	0.57	0.37
1994	0.51	0.47
1995	0.46	0.51
1996	0.50	0.49
1997	0.28	0.41
1998	0.27	0.35
1999	0.21	0.25
2000	0.07	0.18
2001	0.07	0.12
2002	0.24	0.13
2003	0.17	0.16
2004	0.16	0.19
2005	0.11	0.15
2006	0.20	0.16
2007	0.42	0.24
2008	0.61	0.41
2009	0.58	0.53
2010	0.52	0.57
2011	0.31	0.47
2012	0.49	0.44
2013	0.34	0.38
2014	0.59	0.48
2015	0.58	0.50

Table 5.2.2. Spawning stock biomass and recruitment estimates for the LIS region.

Year	SSB (mt)	Recruitment (Numbers of age-1 fish)
1984	6,351	1,239,780
1985	6,201	1,012,980
1986	5,928	1,483,620
1987	5,433	1,252,980
1988	4,934	1,176,970
1989	4,425	1,116,580
1990	4,050	669,600
1991	3,894	834,930
1992	3,576	872,760
1993	2,871	642,600
1994	2,204	586,920
1995	1,878	679,730
1996	1,695	556,290
1997	1,653	602,590
1998	1,718	834,760
1999	1,798	948,390
2000	2,032	851,300
2001	2,416	936,260
2002	2,666	573,760
2003	2,805	792,940
2004	2,925	782,850
2005	3,065	467,610
2006	3,155	507,820
2007	2,834	458,790
2008	2,181	519,690
2009	1,624	530,370
2010	1,331	622,420
2011	1,261	461,660
2012	1,314	583,840
2013	1,388	1,114,870
2014	1,439	458,710
2015	1,551	1,131,070

Table 5.3.1. Fishing mortality estimates for the NJ-NYB region.

Year	Annual F	3-Year Average F
1989	0.23	
1990	0.30	
1991	0.49	0.34
1992	0.61	0.47
1993	0.65	0.59
1994	0.32	0.53
1995	0.58	0.52
1996	0.45	0.45
1997	0.25	0.43
1998	0.09	0.26
1999	0.19	0.18
2000	0.32	0.20
2001	0.41	0.31
2002	0.50	0.41
2003	0.23	0.38
2004	0.18	0.30
2005	0.11	0.17
2006	0.31	0.20
2007	0.45	0.29
2008	0.41	0.39
2009	0.45	0.43
2010	0.87	0.58
2011	0.58	0.63
2012	0.39	0.61
2013	0.52	0.50
2014	0.64	0.52
2015	0.45	0.54

Table 5.3.2. Spawning stock biomass and recruitment estimates for the NJ-NYB region.

Year	SSB (mt)	Recruitment (Numbers of age-1 fish)
1989	6,053	1,457,890
1990	5,807	1,266,380
1991	4,978	1,345,660
1992	3,802	1,050,720
1993	2,898	874,380
1994	2,521	708,030
1995	2,242	736,110
1996	1,865	625,610
1997	1,769	765,210
1998	1,869	1,010,370
1999	2,048	755,120
2000	2,144	650,820
2001	2,038	635,230
2002	1,801	680,660
2003	1,685	717,240
2004	1,762	769,020
2005	1,901	827,810
2006	1,967	711,530
2007	1,816	723,020
2008	1,625	784,000
2009	1,494	557,000
2010	1,237	680,910
2011	992	898,200
2012	1,031	950,390
2013	1,231	1,682,490
2014	1,395	2,263,150
2015	1,809	976,150

Table 5.4.1. Fishing mortality estimates for the DMV region.

Year	Annual F	3-Year Average F
1990	0.18	
1991	0.33	
1992	0.19	0.23
1993	0.29	0.27
1994	0.26	0.25
1995	0.42	0.32
1996	0.33	0.34
1997	0.50	0.42
1998	0.31	0.38
1999	0.33	0.38
2000	0.35	0.33
2001	0.21	0.30
2002	0.46	0.34
2003	0.29	0.32
2004	0.35	0.37
2005	0.29	0.31
2006	0.46	0.37
2007	0.34	0.36
2008	0.32	0.37
2009	0.45	0.37
2010	0.69	0.49
2011	0.75	0.63
2012	0.39	0.61
2013	0.16	0.44
2014	0.26	0.27
2015	0.08	0.17

Table 5.4.2. Spawning stock biomass and recruitment estimates for the DMV region.

Year	SSB (mt)	Recruitment (Numbers of age-1 fish)
1990	1,692	894,740
1991	1,821	1,225,120
1992	1,997	893,280
1993	2,347	605,820
1994	2,509	344,000
1995	2,382	233,200
1996	2,023	200,010
1997	1,587	362,550
1998	1,216	434,520
1999	1,088	452,890
2000	1,044	617,210
2001	1,092	682,840
2002	1,179	707,980
2003	1,275	496,380
2004	1,427	609,230
2005	1,459	663,570
2006	1,438	613,070
2007	1,416	621,720
2008	1,445	574,720
2009	1,424	379,640
2010	1,228	339,840
2011	926	194,940
2012	775	119,980
2013	742	110,620
2014	653	162,630
2015	614	240,090

Table 5.5.1. Fishing mortality estimates for the coast.

Year	Annual F	3-year Average F
1982	0.18	
1983	0.13	
1984	0.12	0.14
1985	0.12	0.12
1986	0.36	0.20
1987	0.30	0.26
1988	0.34	0.33
1989	0.28	0.31
1990	0.21	0.28
1991	0.33	0.27
1992	0.42	0.32
1993	0.42	0.39
1994	0.34	0.39
1995	0.45	0.40
1996	0.30	0.36
1997	0.21	0.32
1998	0.15	0.22
1999	0.24	0.20
2000	0.24	0.21
2001	0.25	0.24
2002	0.32	0.27
2003	0.23	0.27
2004	0.24	0.26
2005	0.21	0.23
2006	0.33	0.26
2007	0.45	0.33
2008	0.42	0.40
2009	0.47	0.45
2010	0.53	0.47
2011	0.26	0.42
2012	0.32	0.37
2013	0.34	0.31
2014	0.47	0.38
2015	0.33	0.38

Table 5.5.2. Spawning stock biomass and recruitment estimates for the coast.

	SSB (mt)	Recruitment (numbers of age-1 fish)
1982	25,607	5,917,750
1983	25,332	4,819,550
1984	26,835	4,166,080
1985	26,378	3,686,250
1986	25,907	4,175,220
1987	19,830	4,095,620
1988	17,720	4,092,240
1989	14,508	3,521,710
1990	15,769	2,930,290
1991	15,519	2,927,600
1992	13,285	2,356,060
1993	10,807	1,934,090
1994	9,229	1,734,280
1995	8,813	1,905,420
1996	8,921	1,745,130
1997	8,631	2,290,090
1998	9,290	2,918,670
1999	6,609	3,062,530
2000	7,575	2,666,160
2001	8,009	2,558,730
2002	7,931	2,354,610
2003	8,424	2,379,110
2004	8,593	2,514,320
2005	8,728	2,237,200
2006	8,667	1,863,210
2007	7,864	1,869,730
2008	6,790	2,172,410
2009	5,931	1,924,410
2010	5,289	2,042,000
2011	5,138	1,790,050
2012	5,386	1,949,270
2013	5,509	2,601,020
2014	5,618	2,236,500
2015	6,014	2,106,580

Table 7.1.1. Short-term projection results for the MARI region.

MSY Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (390 mt)	0%	0.00%
151 mt	50%	2.20%
148 mt	70%	2.30%

SPR Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (390 mt)	0%	4.10%
257 mt	50%	23.2%
253 mt	70%	24.3%

Table 7.2.1. Short-term projection results for the LIS region.

MSY Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (500 mt)	1.70%	0.60%
264 mt	50%	34%
237 mt	70%	40%

SPR Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (500 mt)	0%	0.60%
255 mt	50%	28%
229 mt	70%	33%

Table 7.3.1. Short-term projection results for the NJ-NYB region.

SPR Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (461 mt)	45%	85%
450 mt	50%	86%
410 mt	70%	88%

Table 7.4.1. Short-term projection results for the DMV region.

SPR Reference Points		
Landings (mt) for 2018 -2020	Probability of being at or below F Target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (77 mt)	100%	18%
139 mt	50%	10%
125 mt	70%	12%

Table 7.5.1. Short-term projection results for the coast.

MSY Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (1270 mt)	0%	0.6%
737 mt	50%	0.9%
682 mt	70%	1.0%

SPR Reference Points		
2018-2020 Landings Scenario	Probability of being at or below F target in 3 years	Probability of being at or above SSB threshold in 3 years
Status quo (1270 mt)	3%	29.4%
968 mt	50%	50.2%
895 mt	70%	55.3%

11 Figures

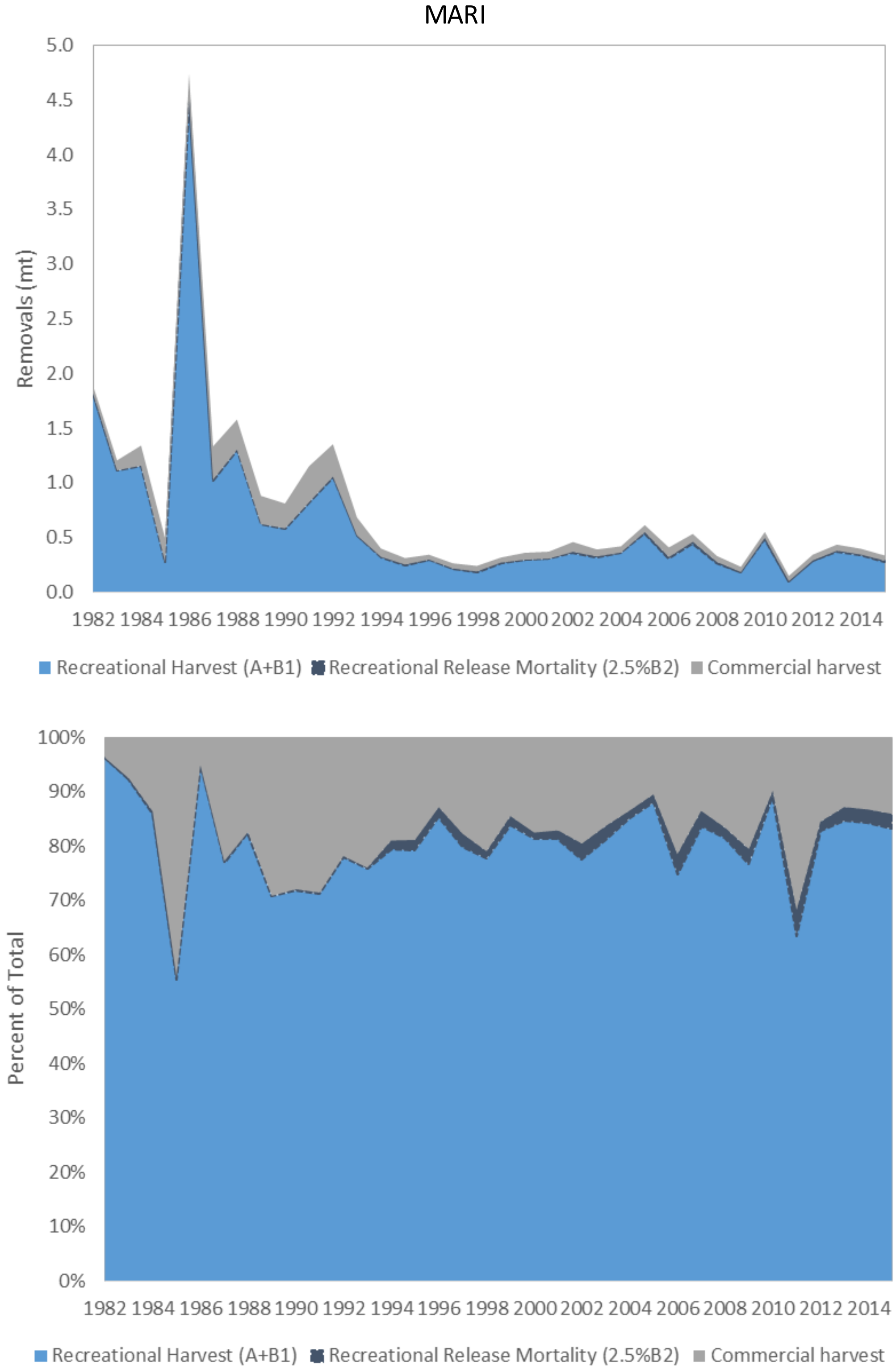


Figure 3.1.1. Total removals by sector for the MARI region.

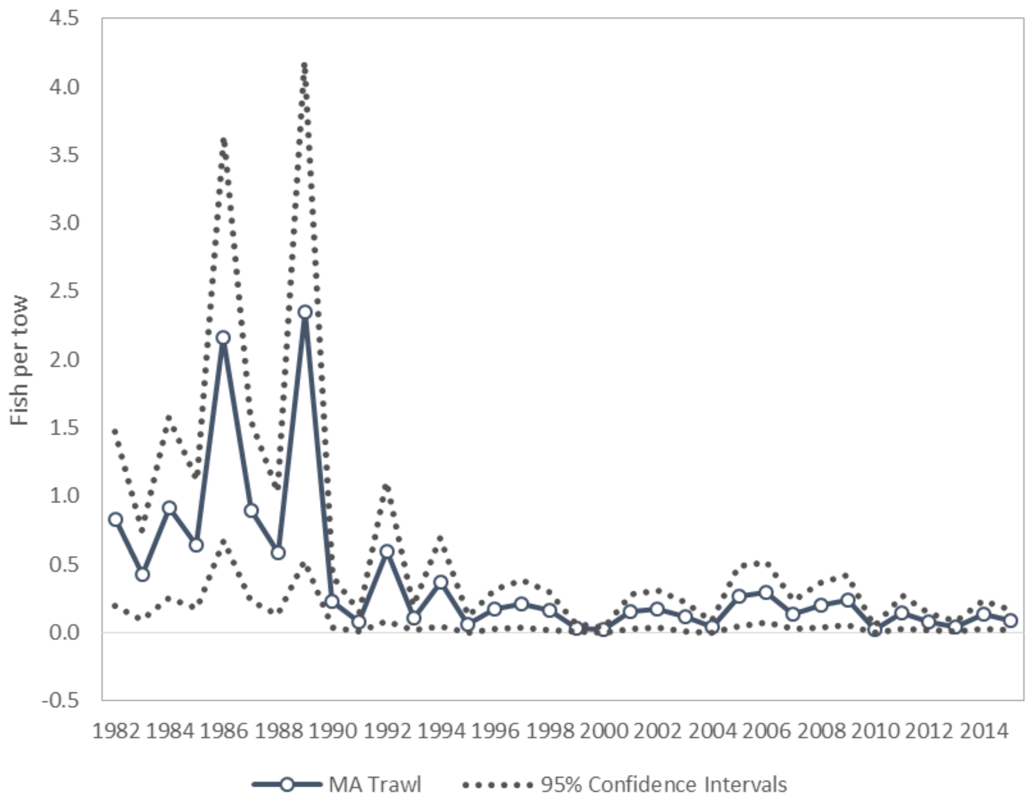


Figure 3.1.2. MA Spring Ocean Trawl index of abundance.

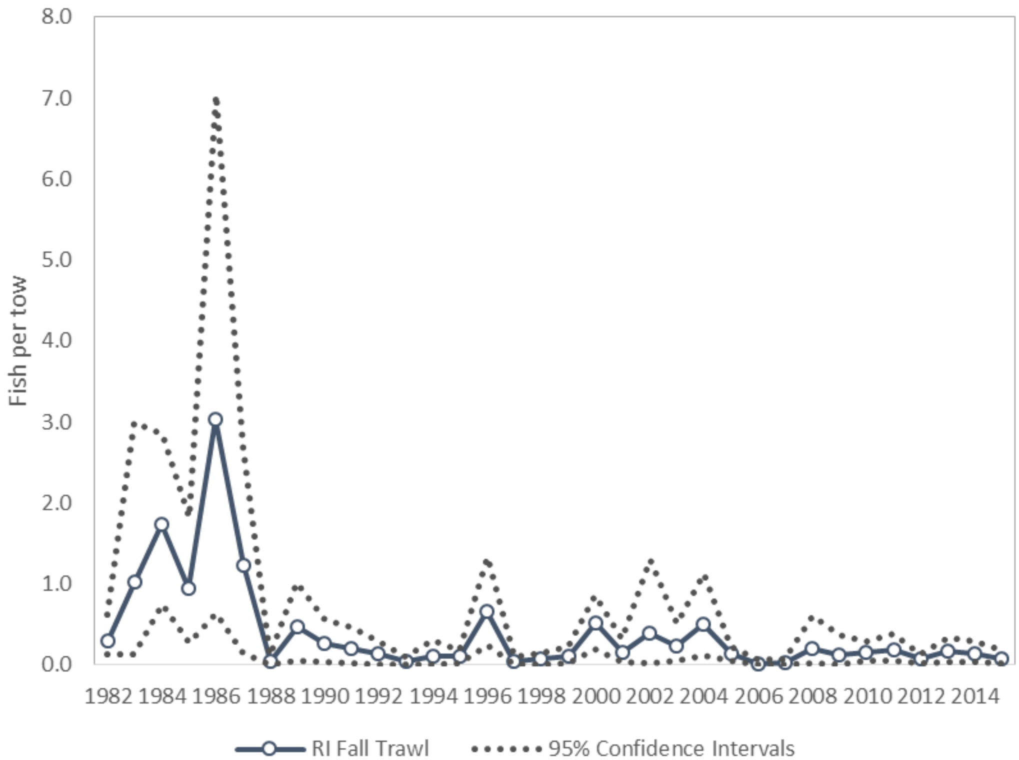


Figure 3.1.3. RI Fall Trawl Survey index of abundance.

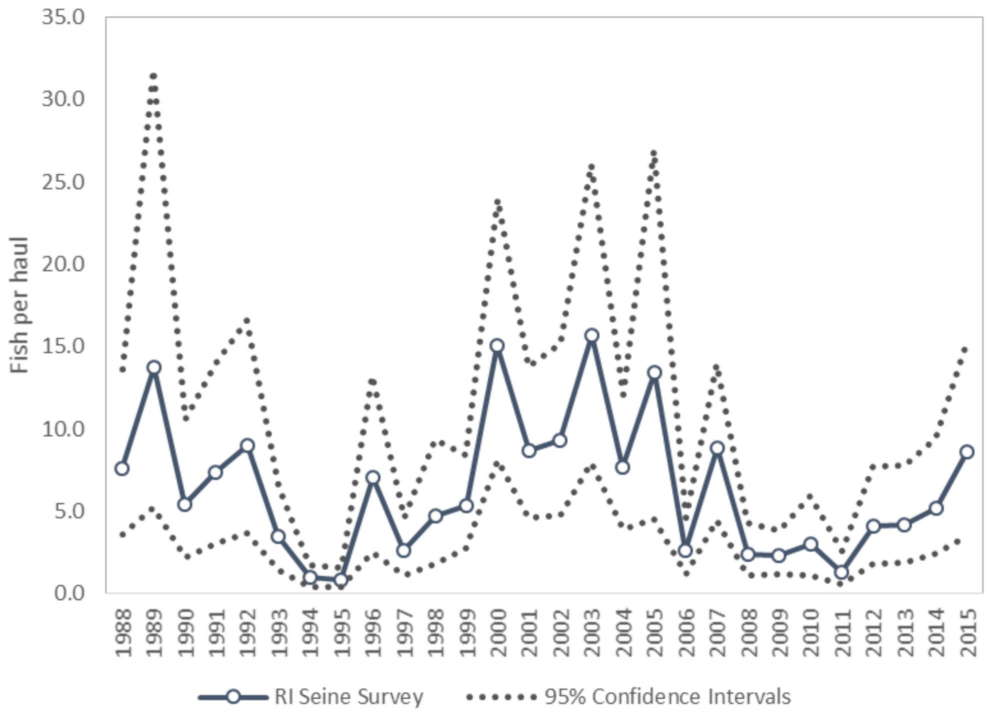


Figure 3.1.4. RI Seine Survey young-of-year index of abundance.

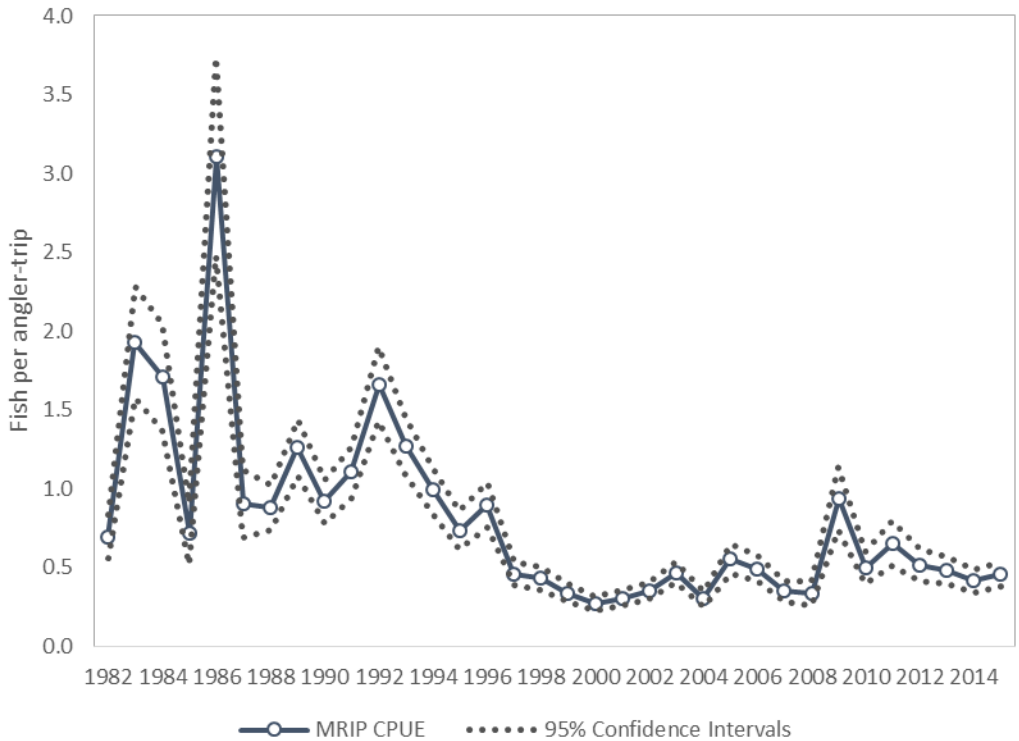


Figure 3.1.5. MRIP CPUE for the MARI region.

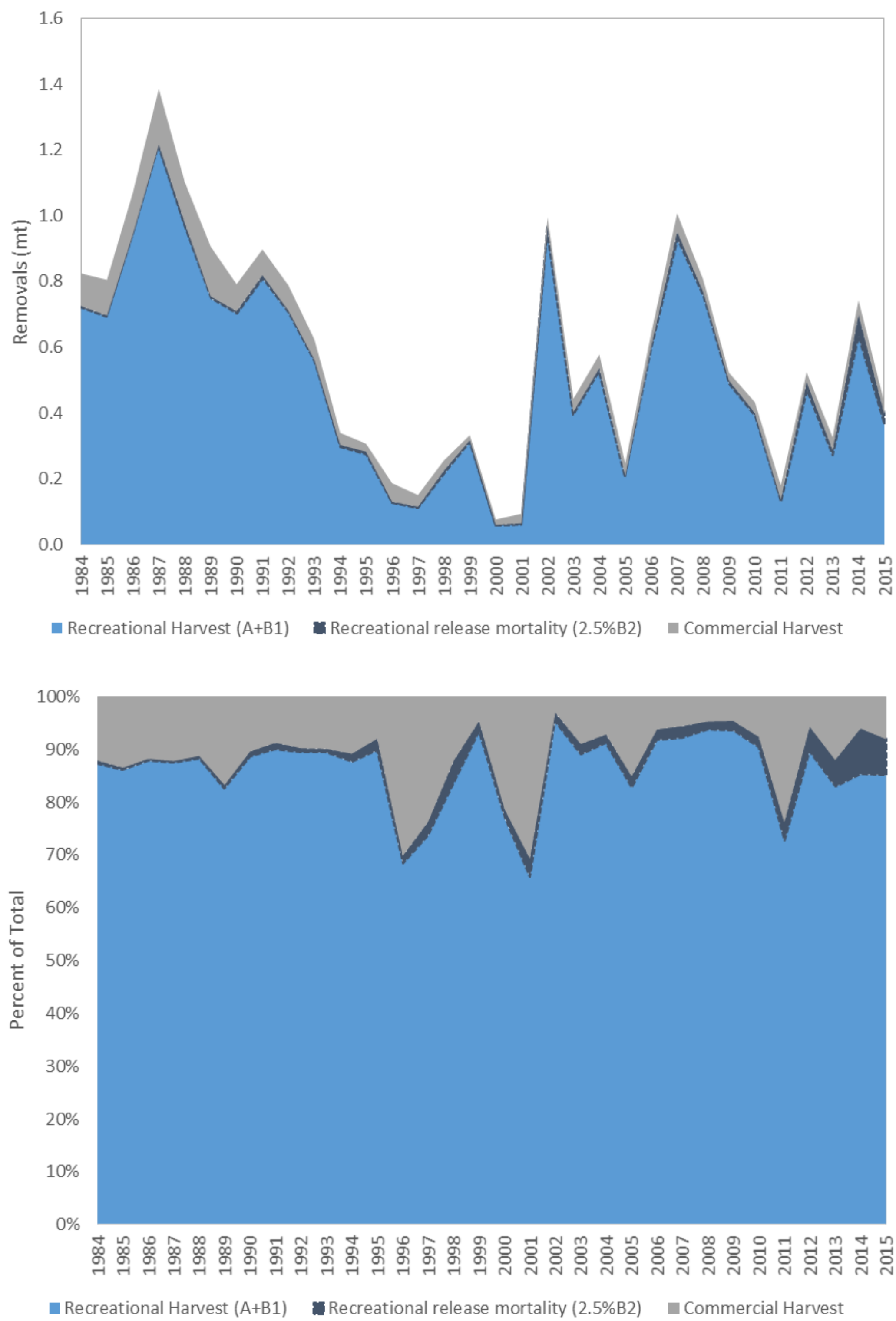


Figure 3.2.1 Removals by sector in metric tons (top) and percent of total (bottom) for the LIS region.

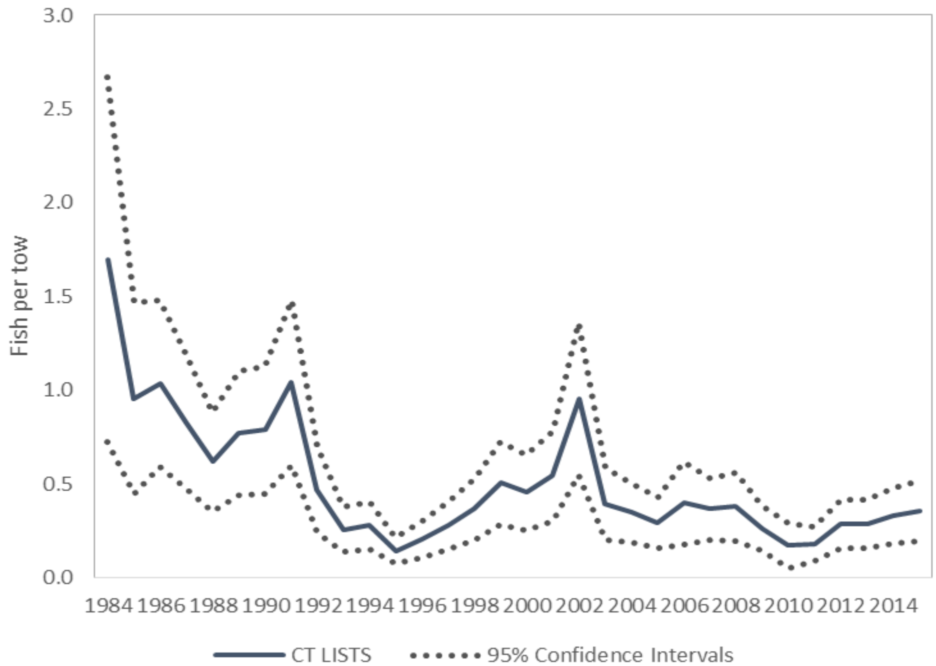


Figure 3.2.2. CT Long Island Sound Trawl Survey index of abundance.

LIS

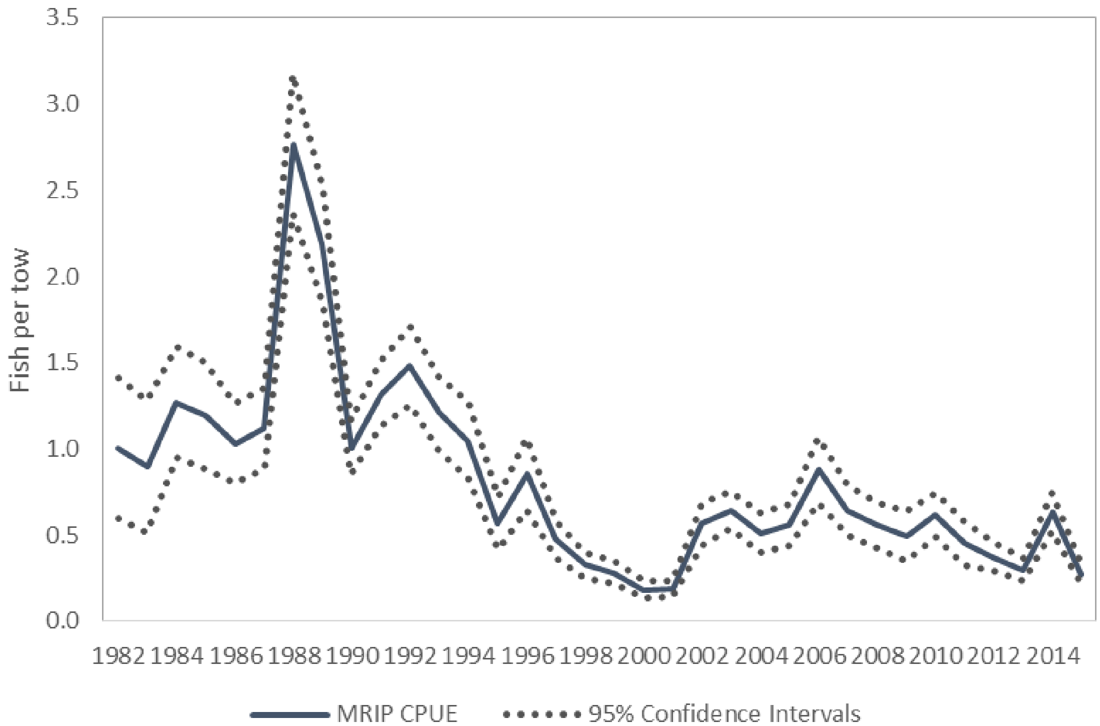


Figure 3.2.3. MRIP CPUE for the LIS region.

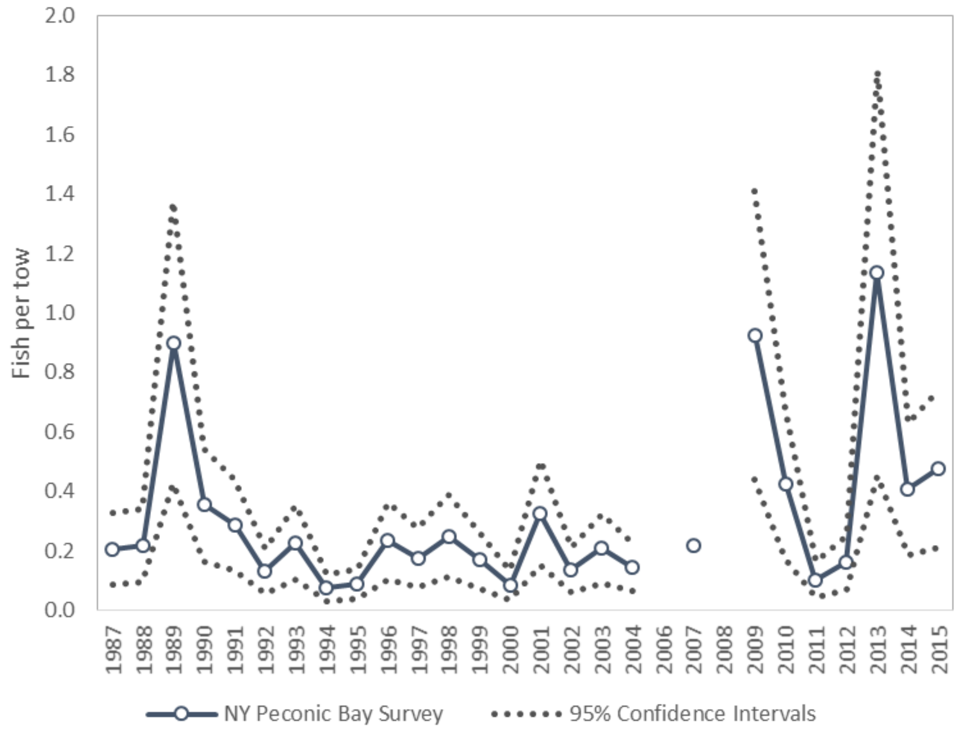


Figure 3.2.4. NY Peconic Bay Trawl Survey YOY index.

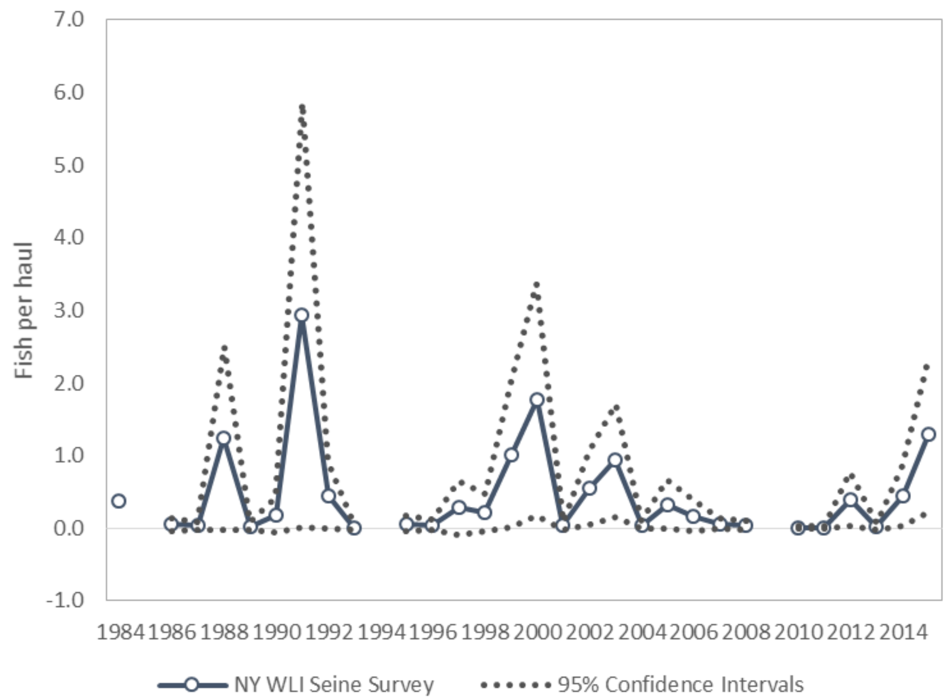


Figure 3.2.5. NY Western Long Island Seine Survey YOY index for the LIS region.

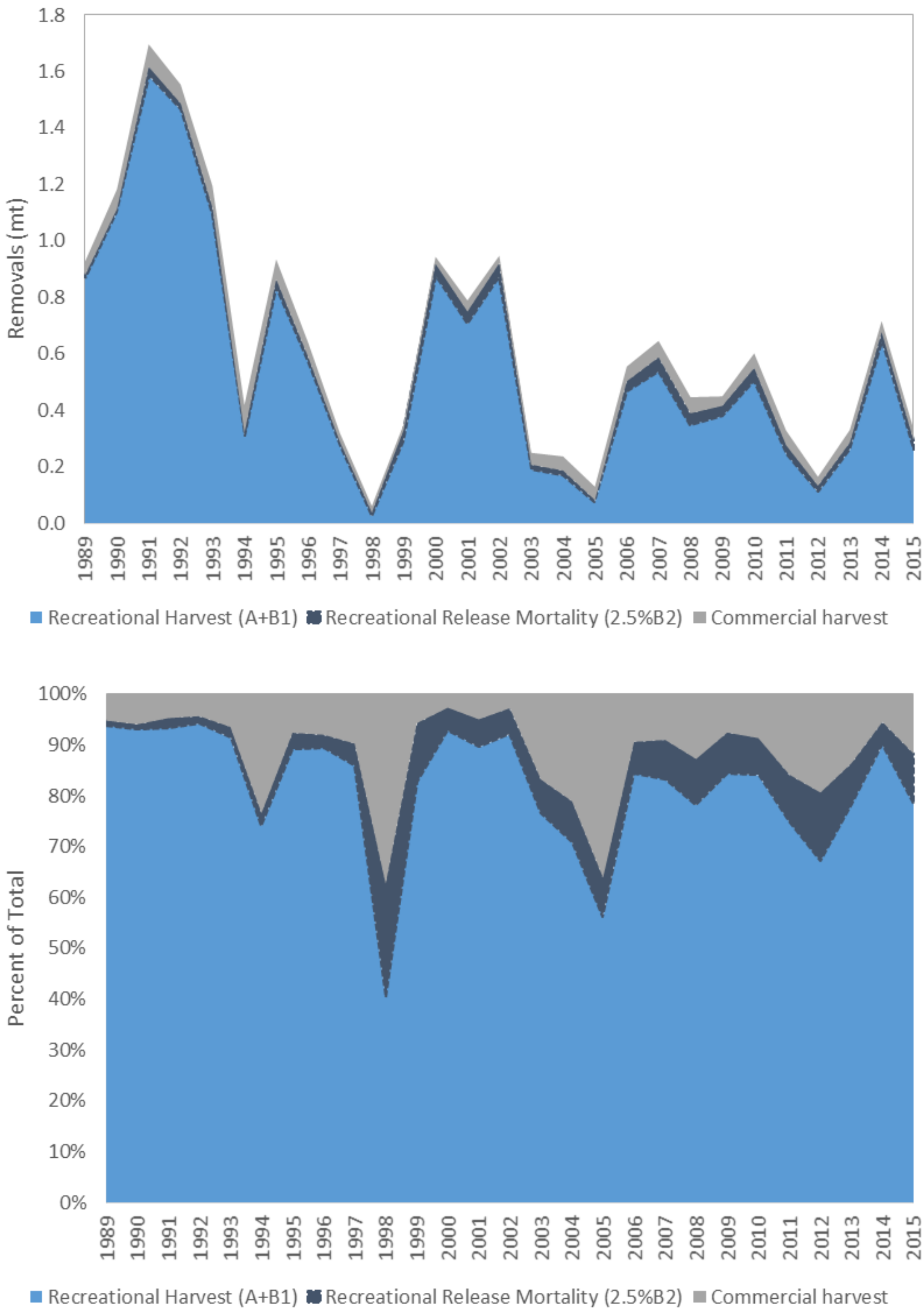


Figure 3.3.1. Total removals by sector for the NJ-NYB region.

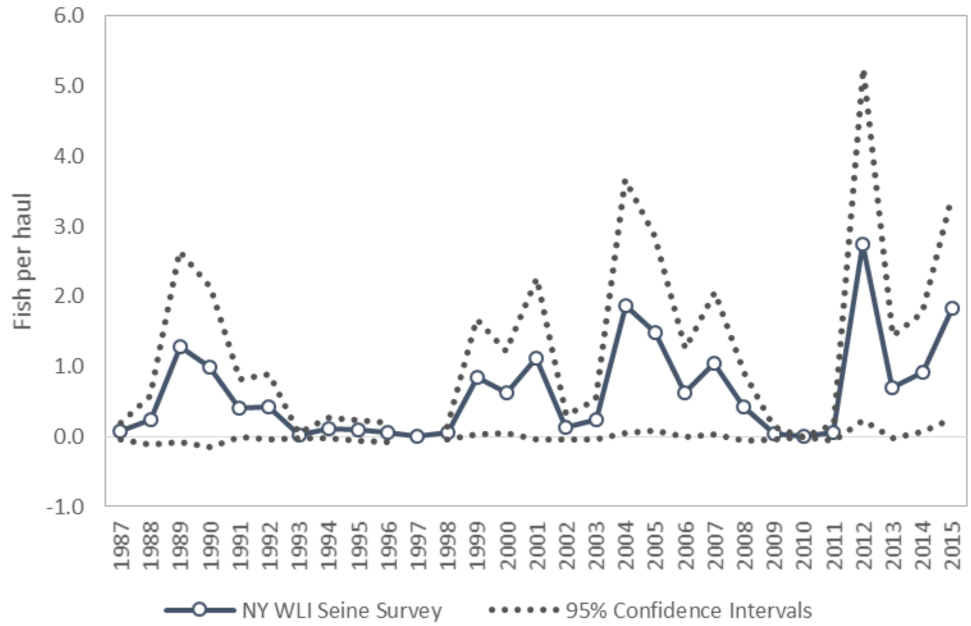


Figure 3.3.2. NY Western Long Island Seine Survey YOY index for the NJ-NYB region.

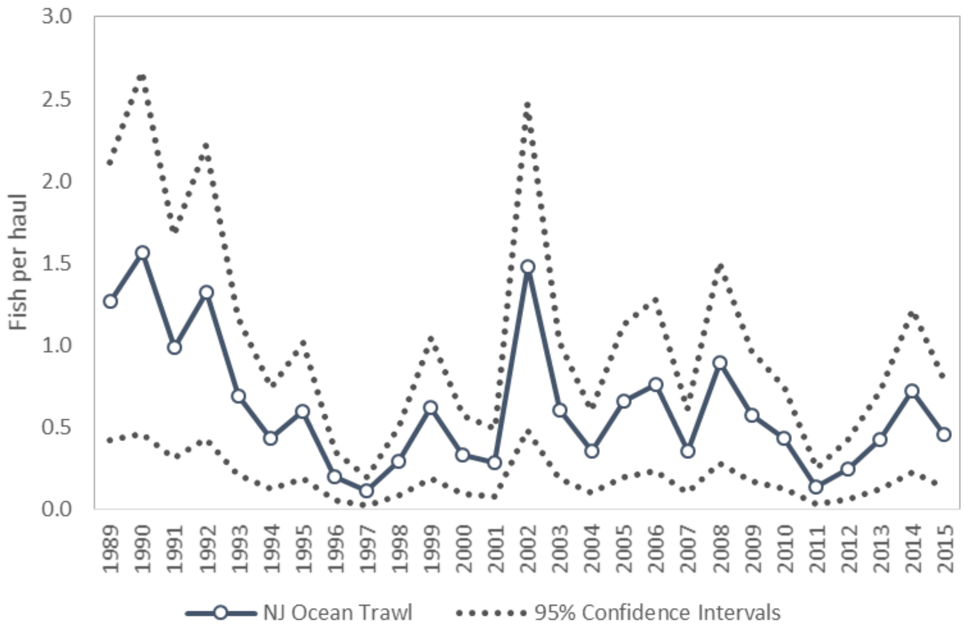


Figure 3.3.3. NJ Ocean Trawl index of abundance.

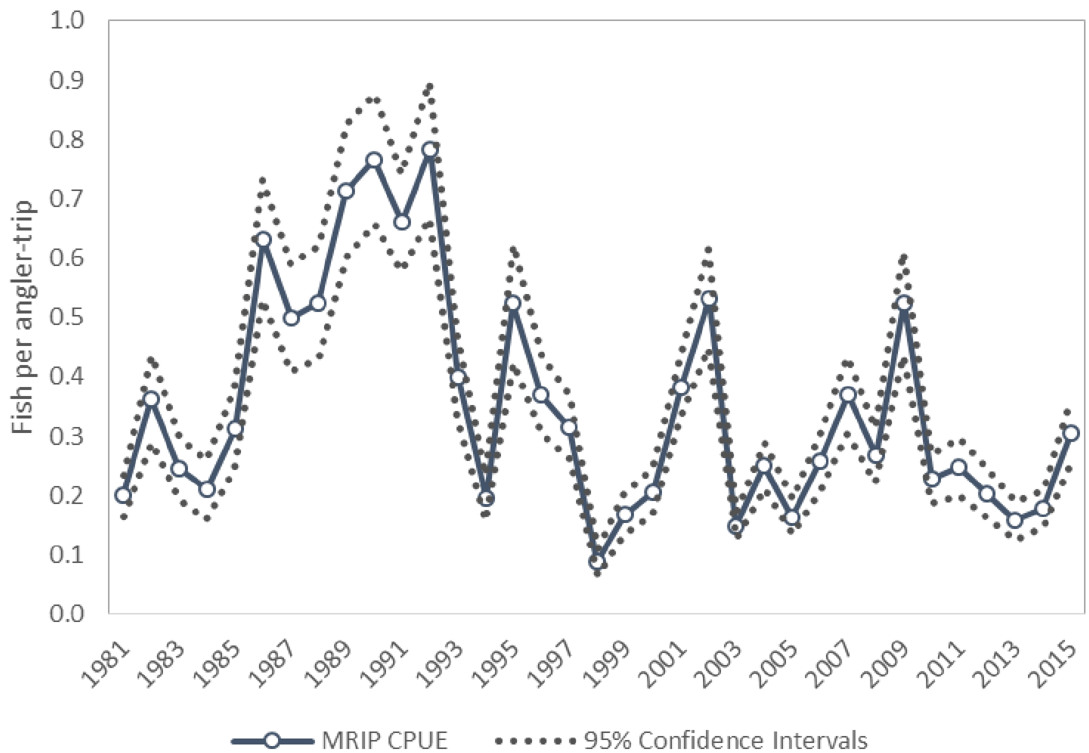
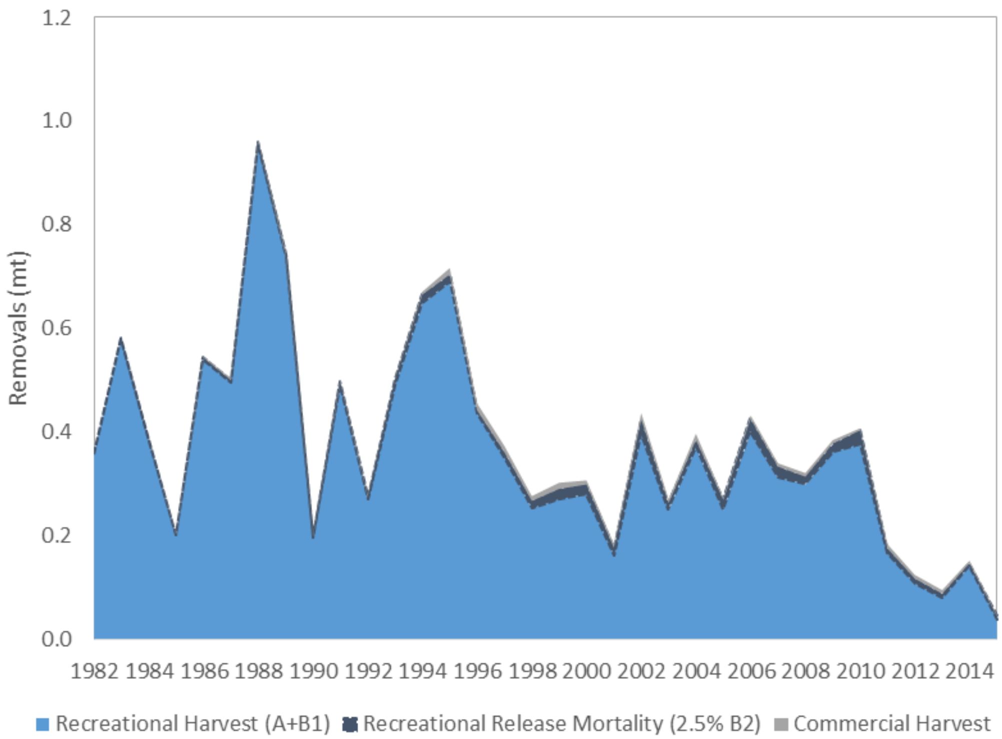


Figure 3.3.4. MRIP CPUE for the NJ-NYB region.

DMV



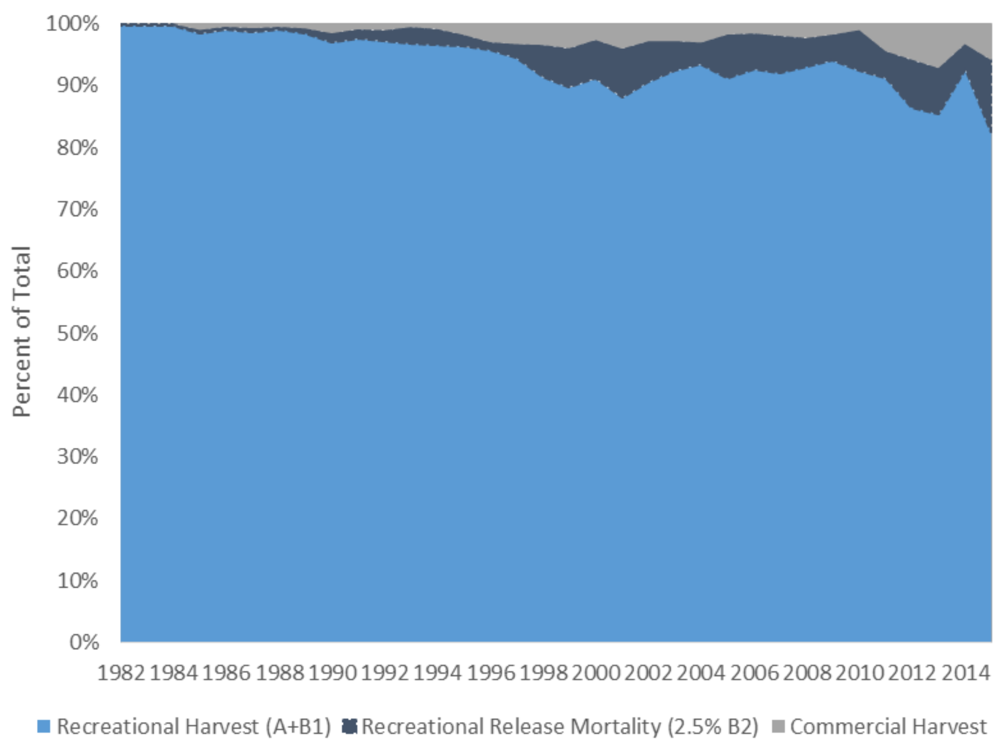


Figure 3.4.1. Removals by sector in metric tons (top) and percent of total (bottom) for the DMV region.

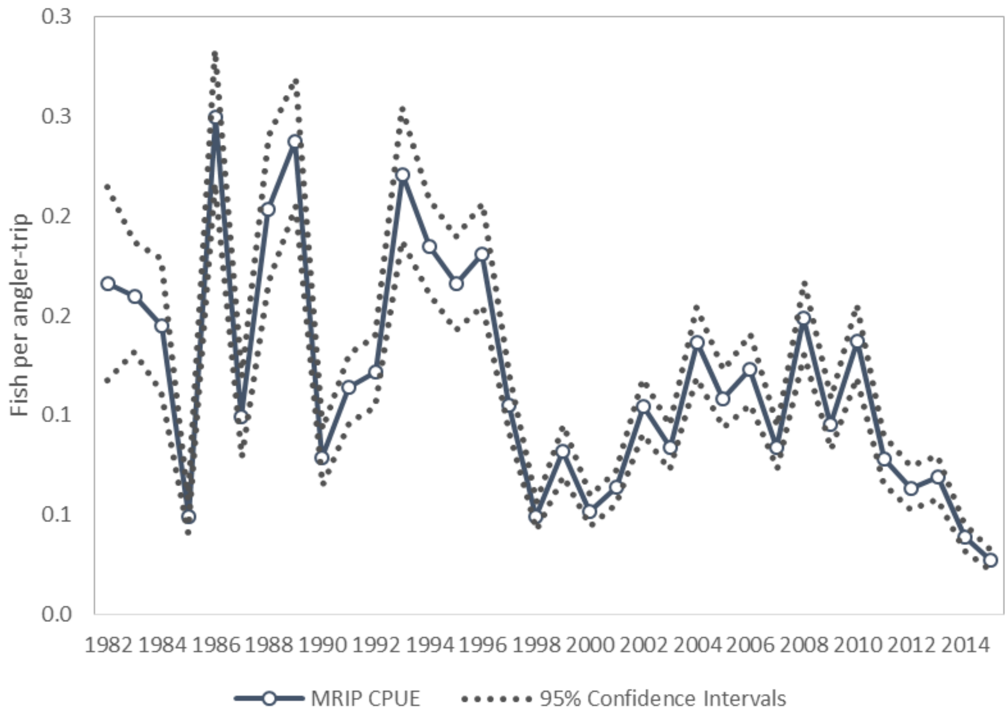


Figure 3.4.2. MRIP CPUE for the DMV region.

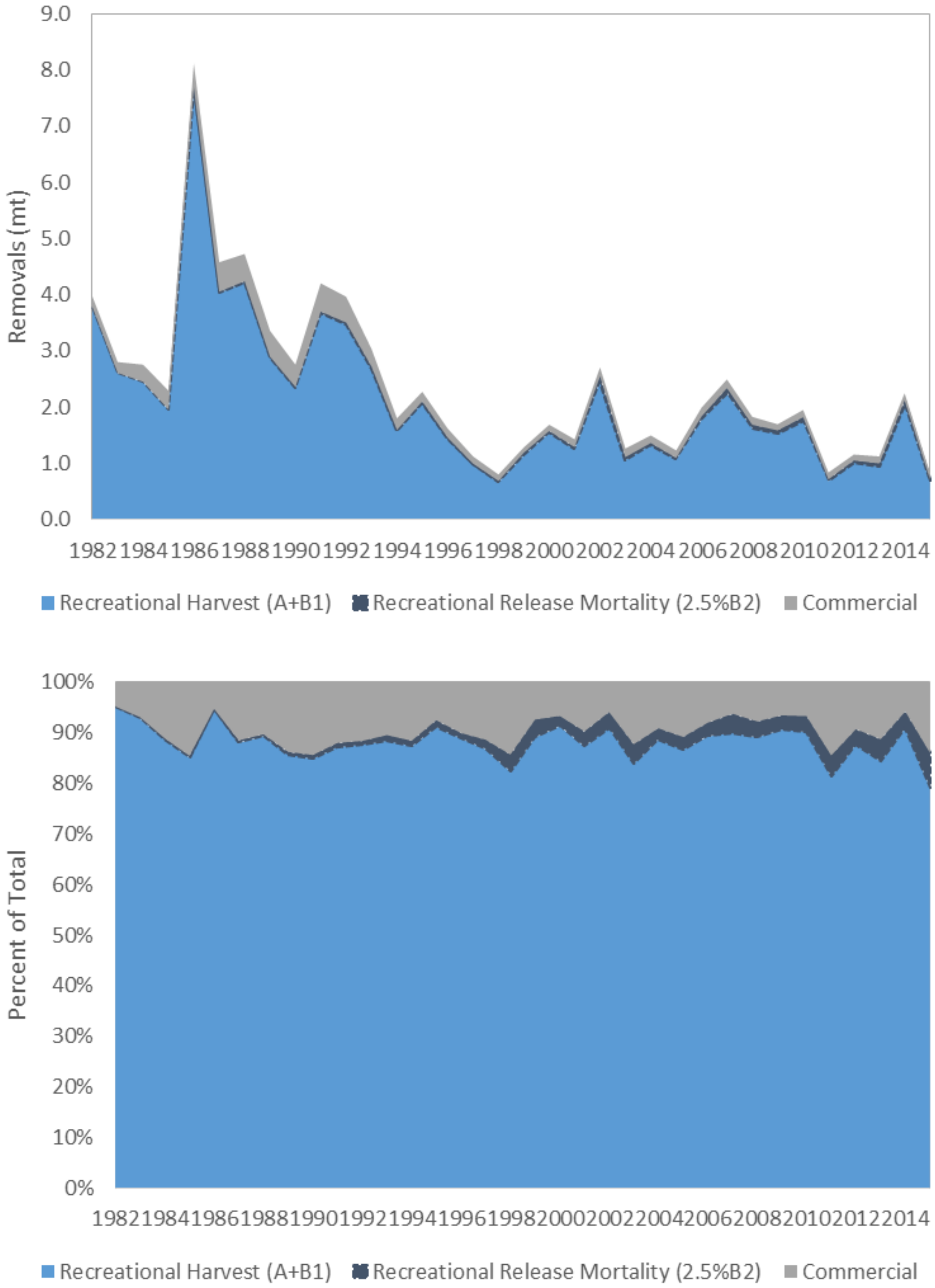


Figure 3.5.1. Total removals by sector for the coast.

Coast

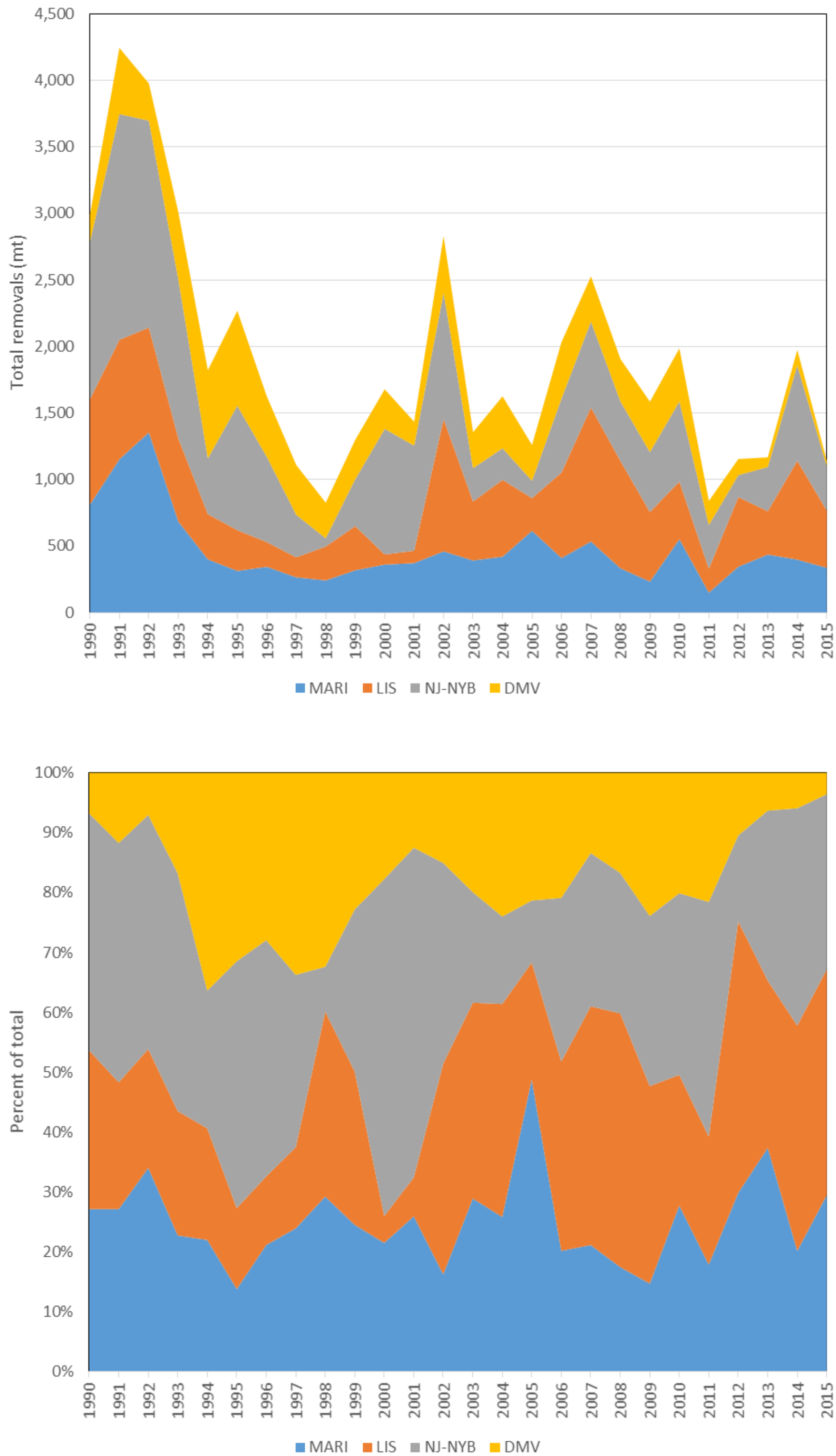


Figure 3.5.2. Coastwide removals by region in metric tons (top) and percent of total (bottom)

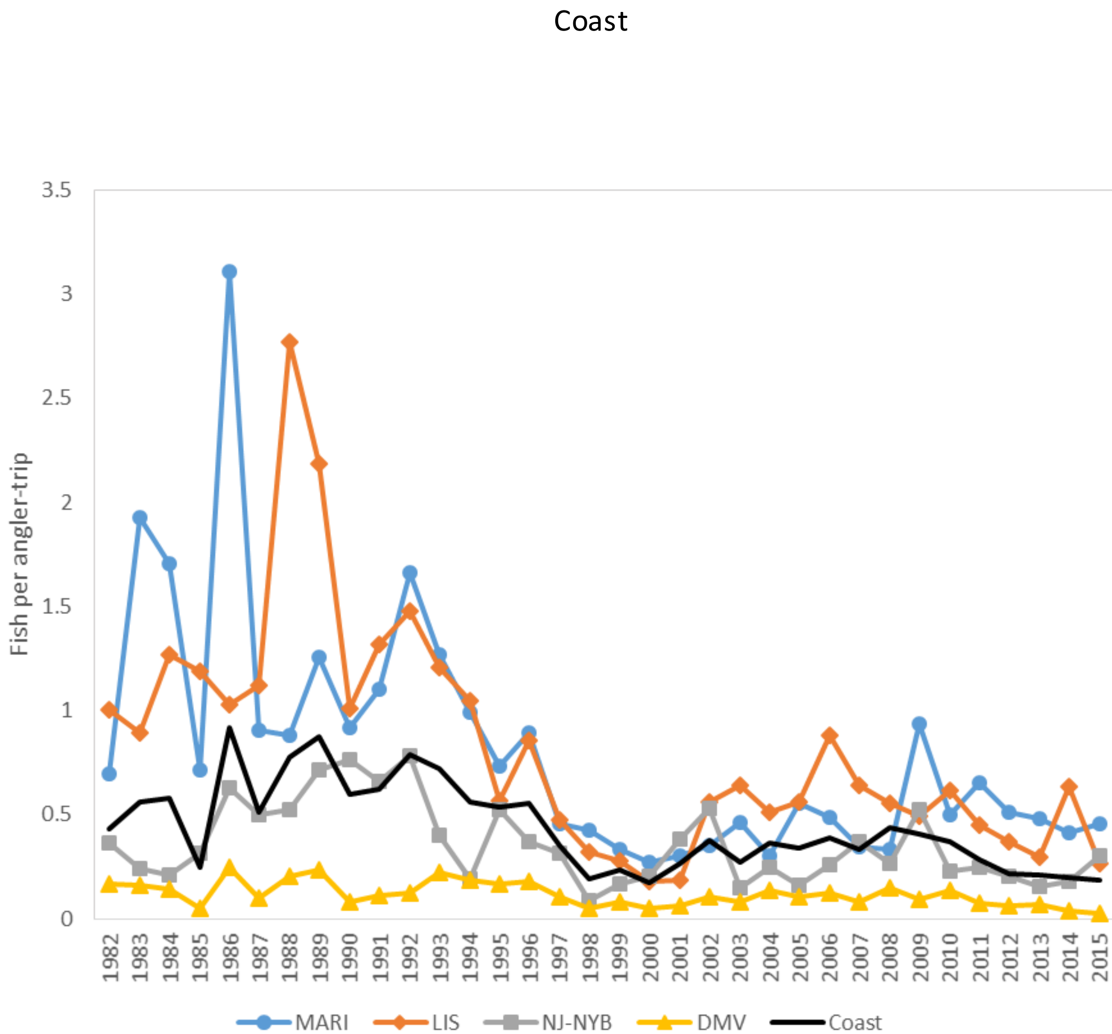


Figure 3.5.3. Comparison of regional and coastwide MRIP CPUE trends.

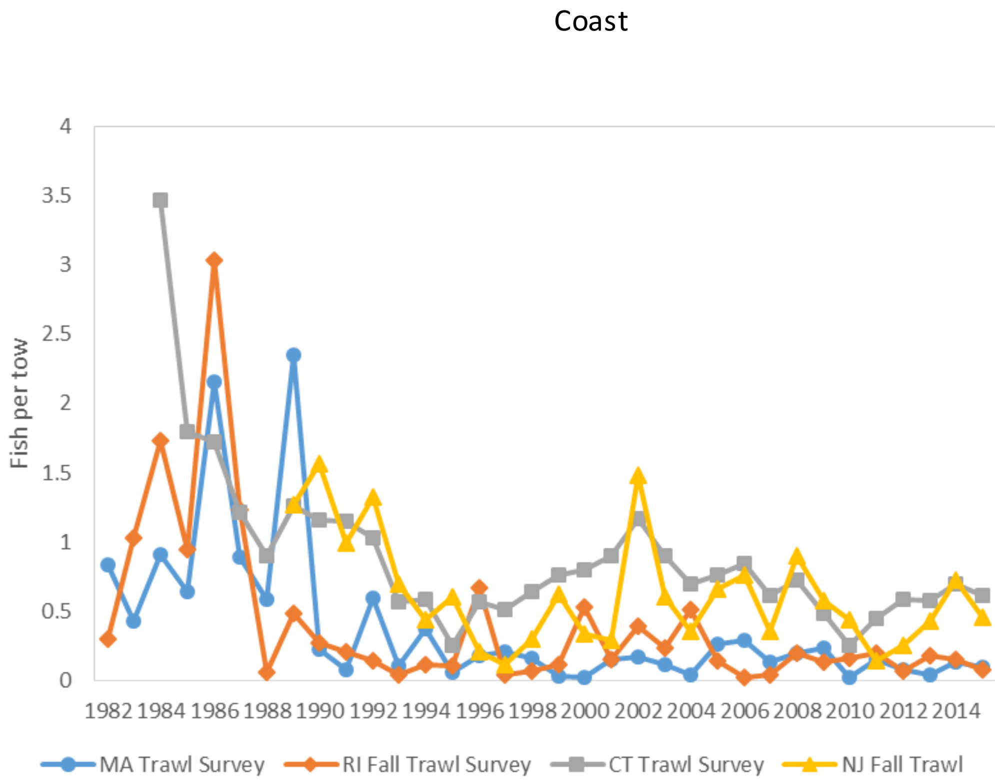


Figure 3.5.4. Comparison of fishery independent age-1+ index trends for the coast.

Coast

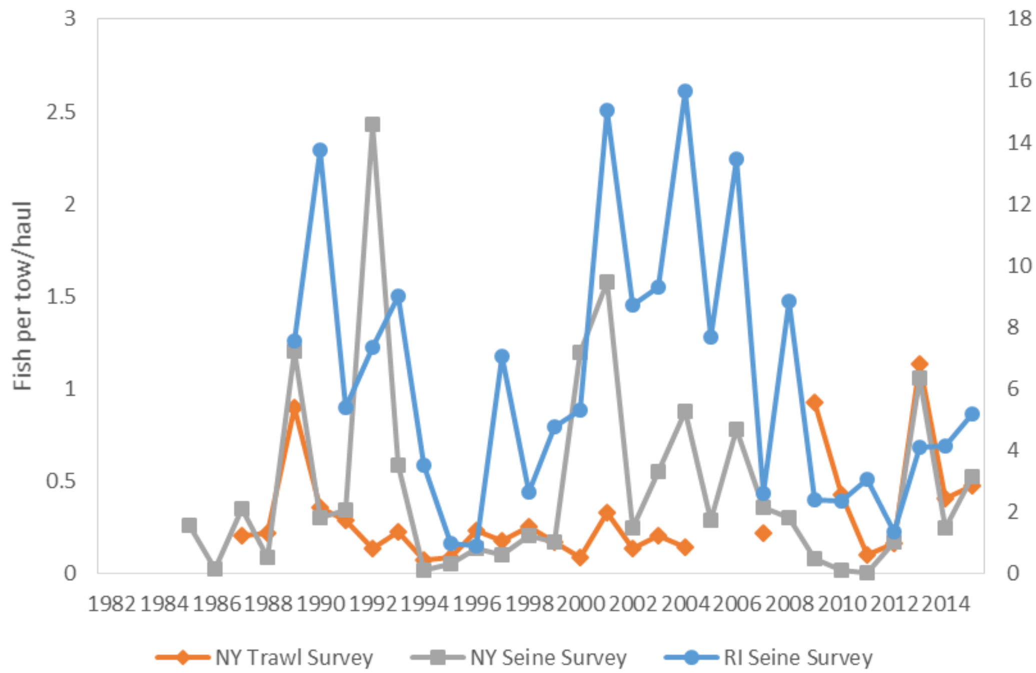


Figure 3.5.5. Comparison of fishery independent recruitment index trends for the coast.

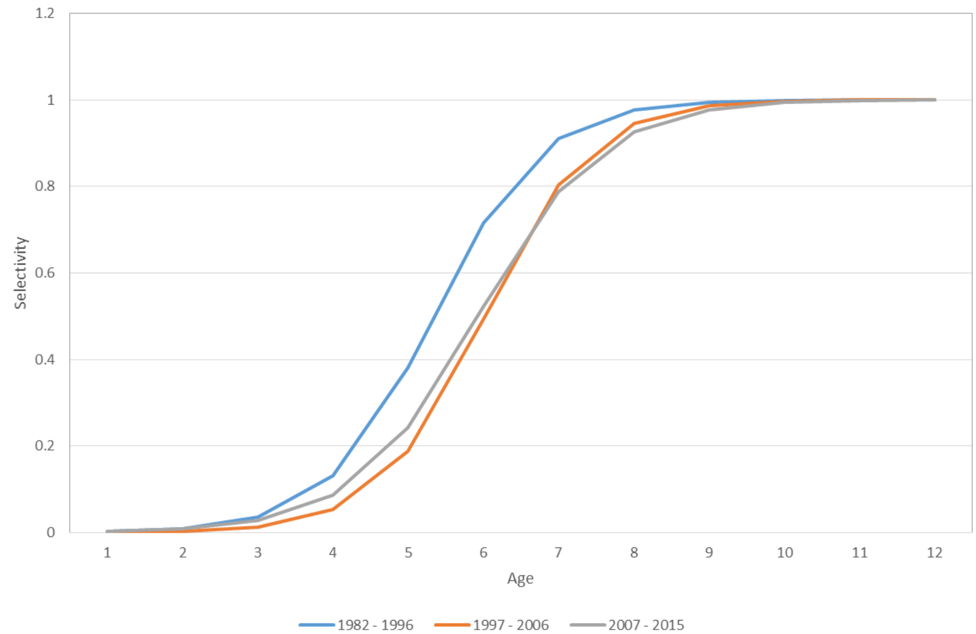


Figure 5.1.1. Estimated selectivity patterns for the fishery in the MARI region.

Figure 5.1.2. Fishing mortality estimates for the MARI region.

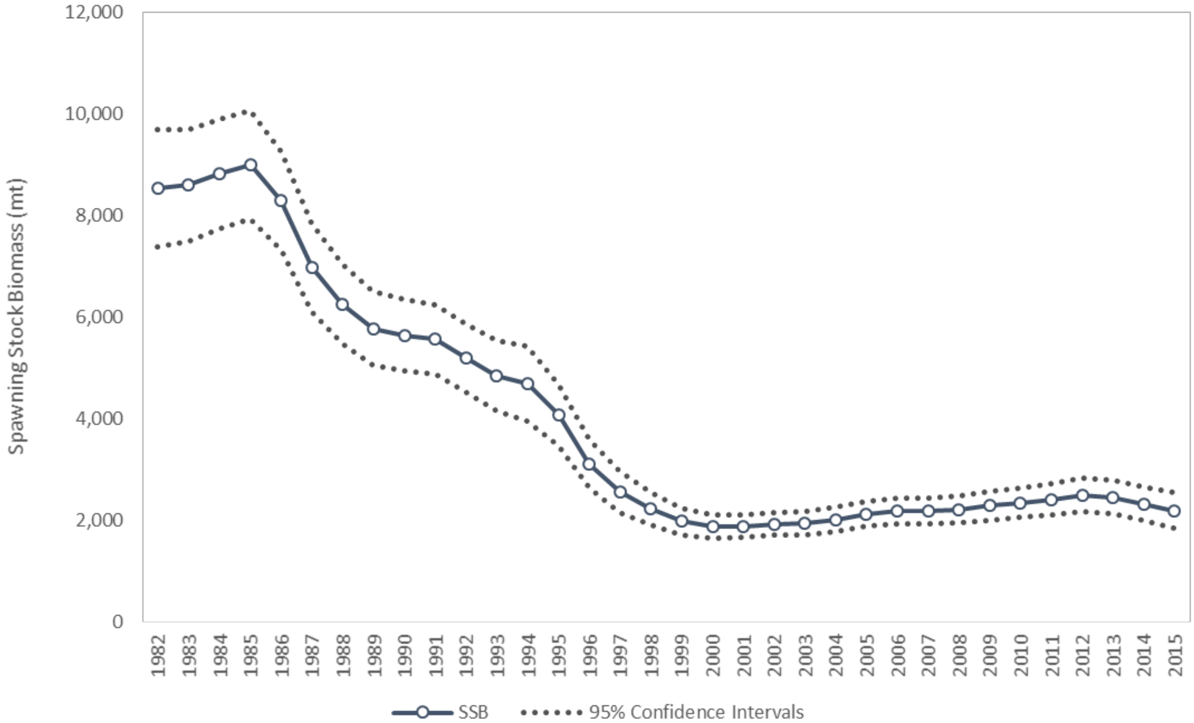
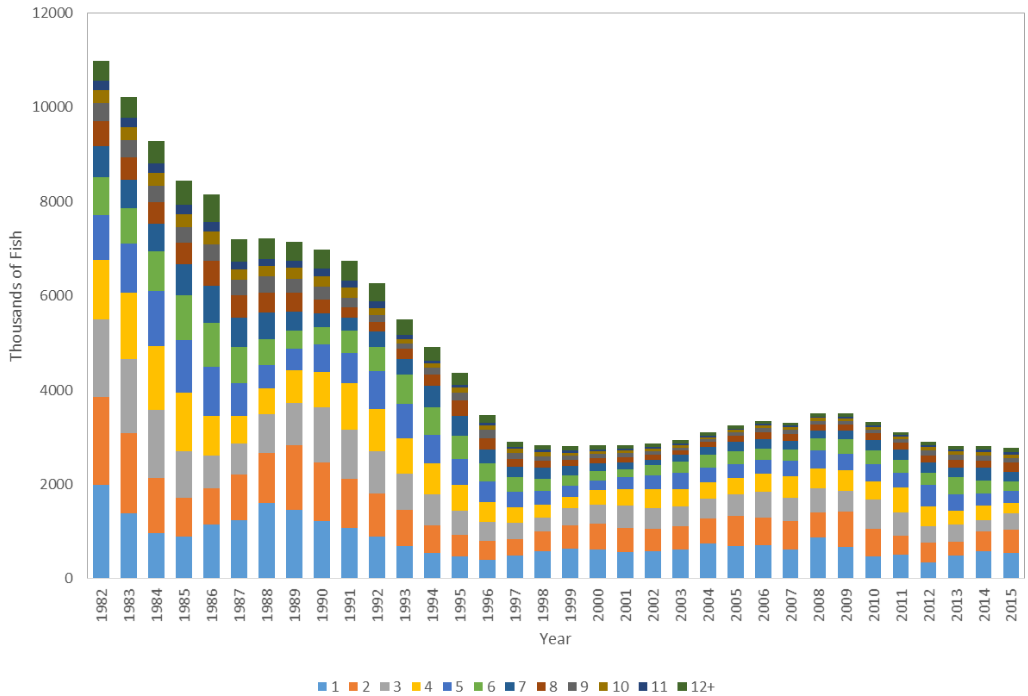


Figure 5.1.3. Spawning stock biomass estimates for the MARI region.



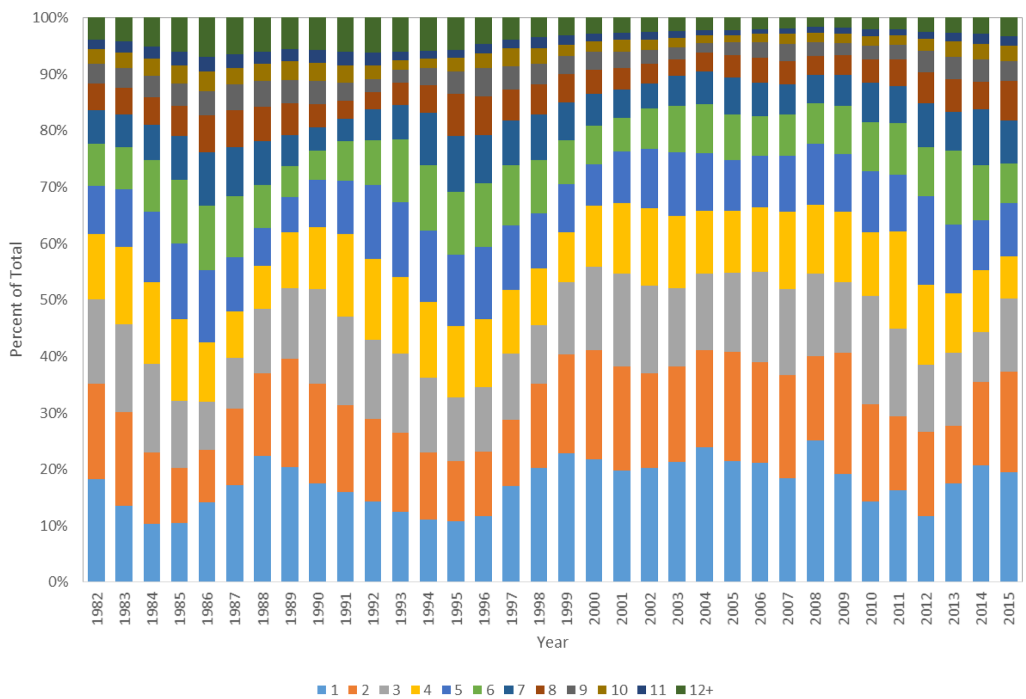


Figure 5.1.4. Abundance at age for the MARI region in total numbers of fish (top) and percent of population (bottom).

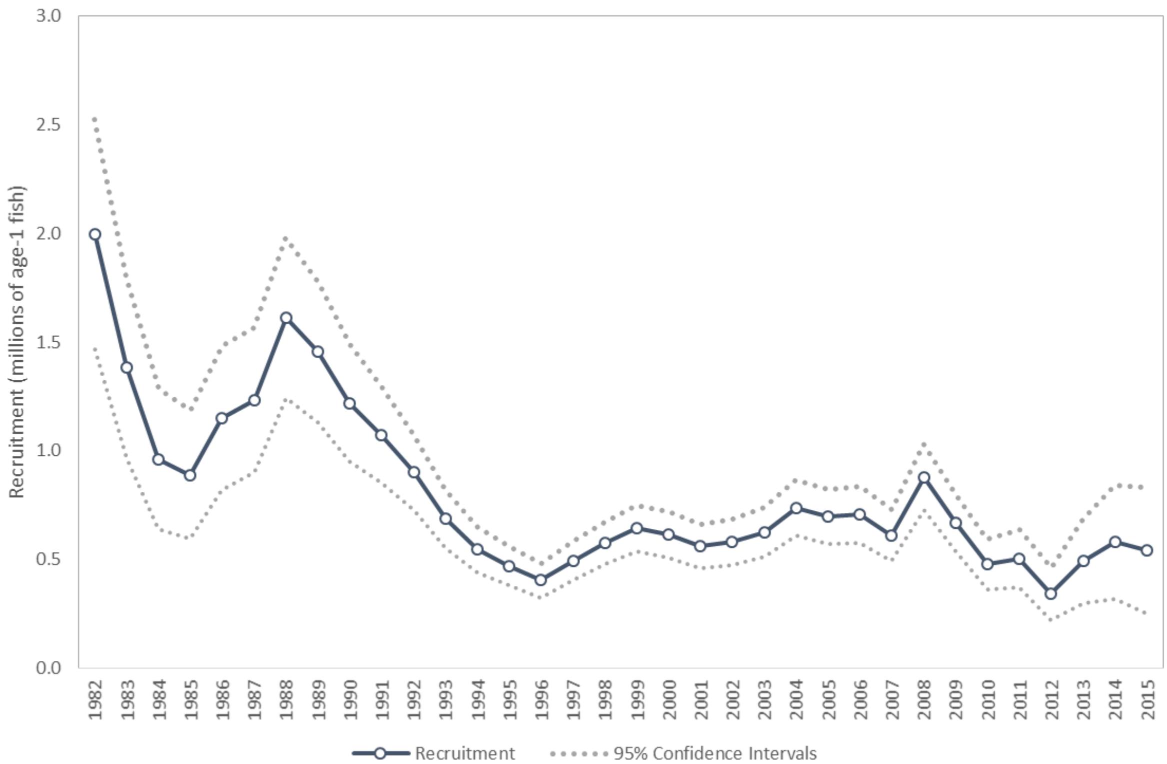


Figure 5.1.5. Recruitment estimates for the MARI region.

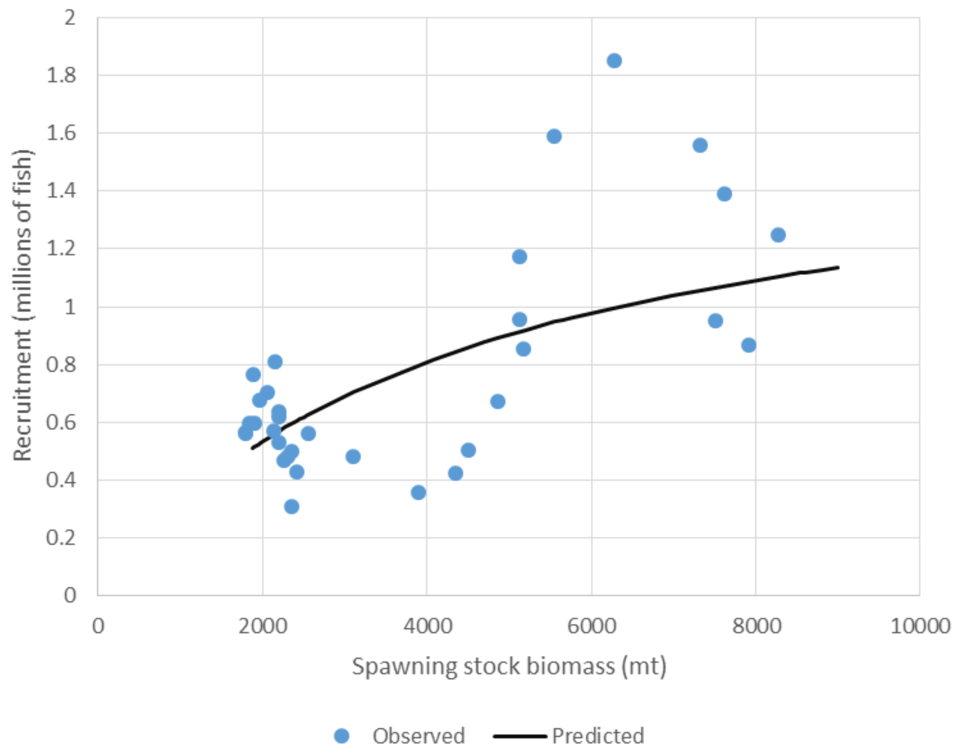


Figure 5.1.6. Stock-recruitment relationship for the MARI region.

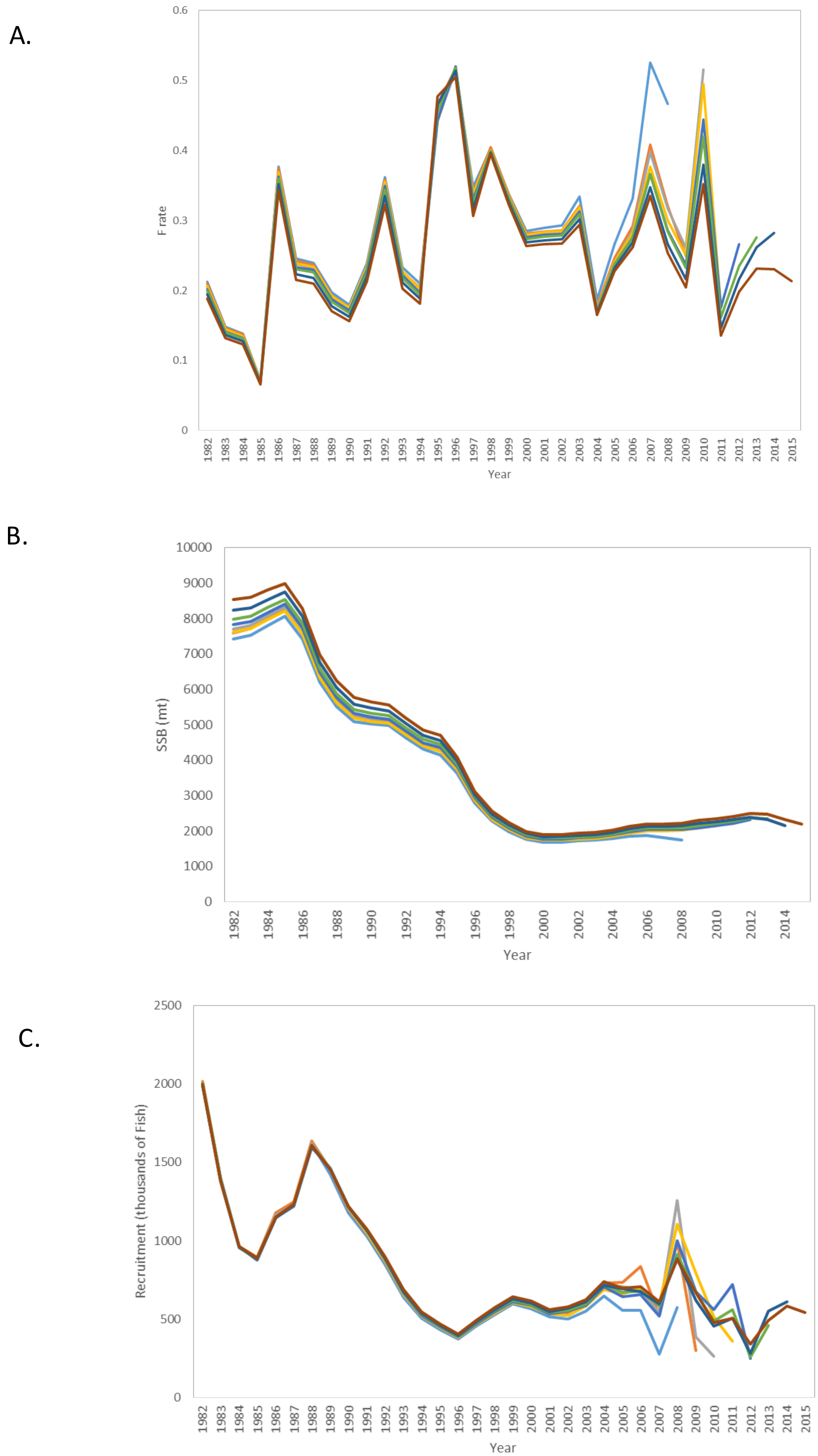


Figure 5.1.7. Retrospective analysis for the MARI region for F (A), SSB (B), and recruitment (C)

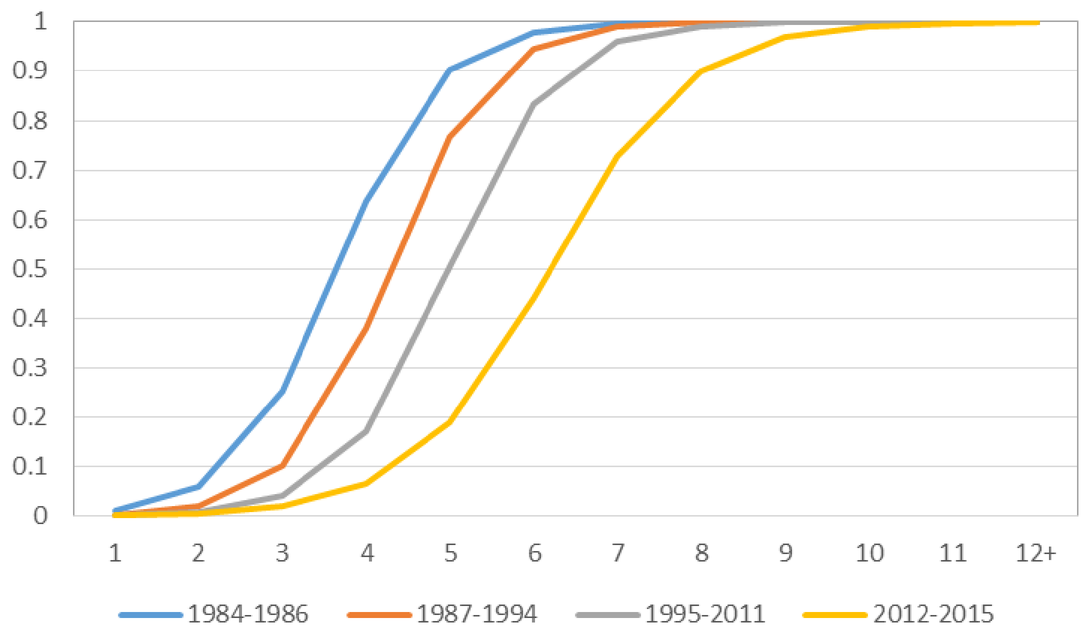


Figure 5.2.1 Estimated selectivity patterns for the fishery in the LIS region.

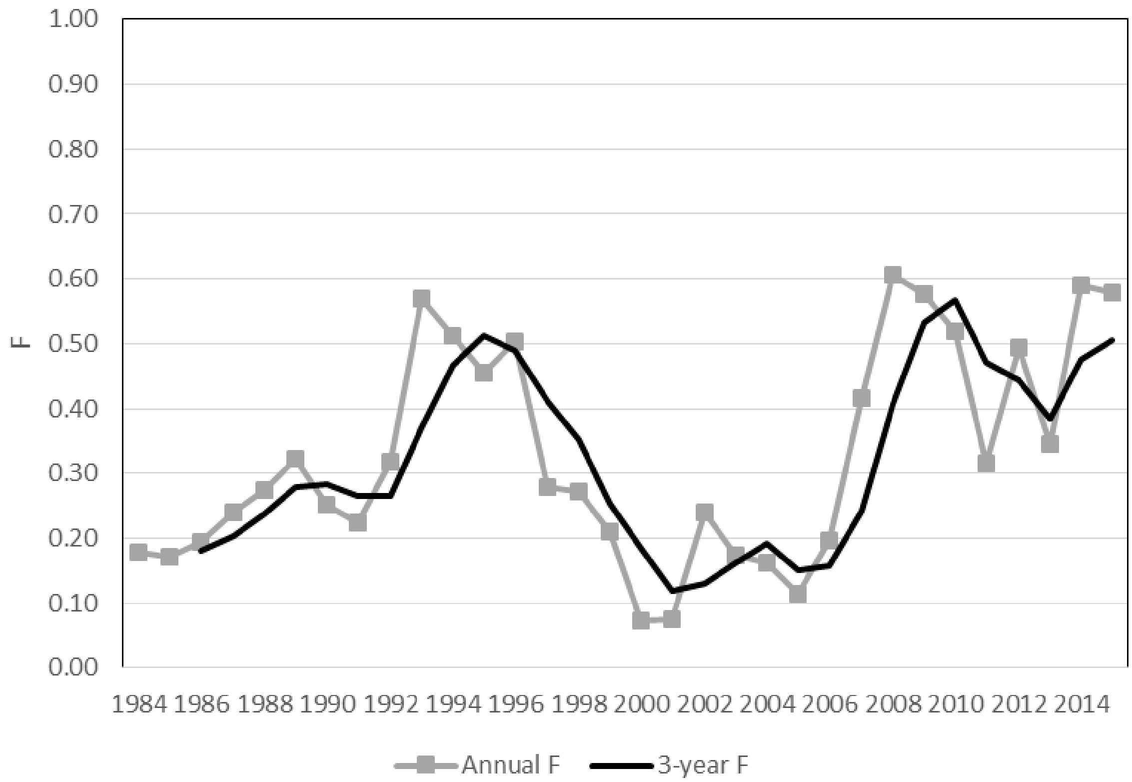


Figure 5.2.2 Annual fishing mortality (F) and 3-year average for LIS.

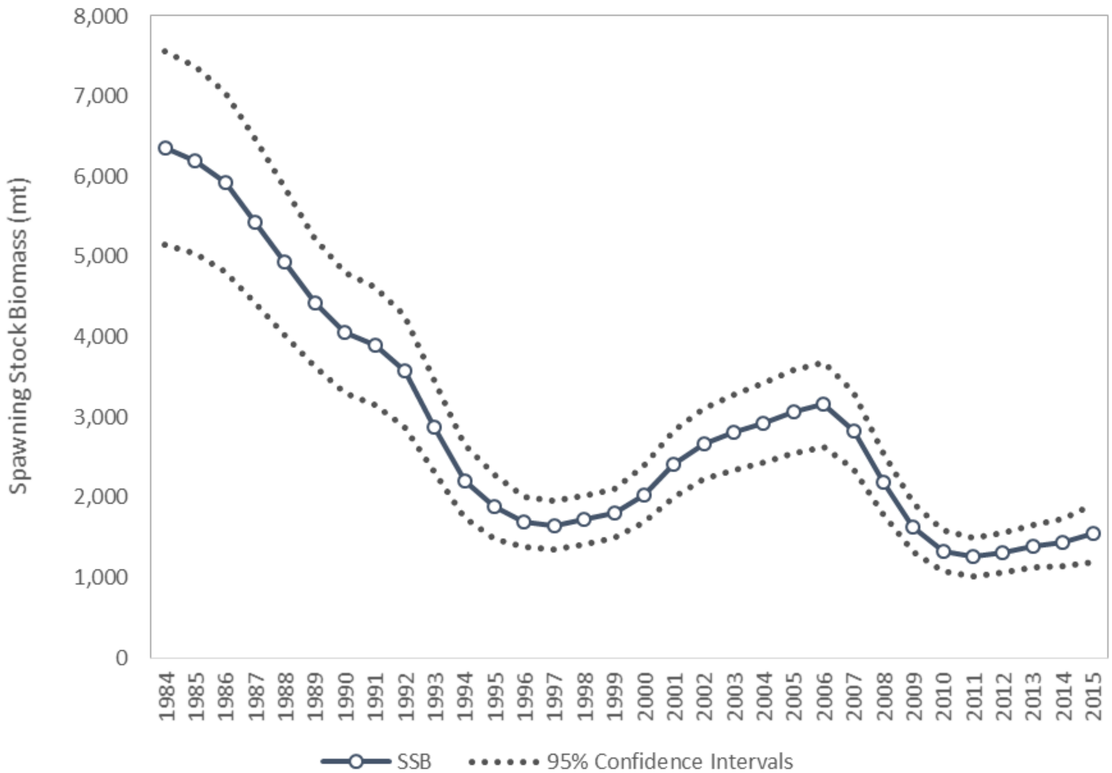


Figure 5.2.3. Estimates of spawning stock biomass for the LIS region.

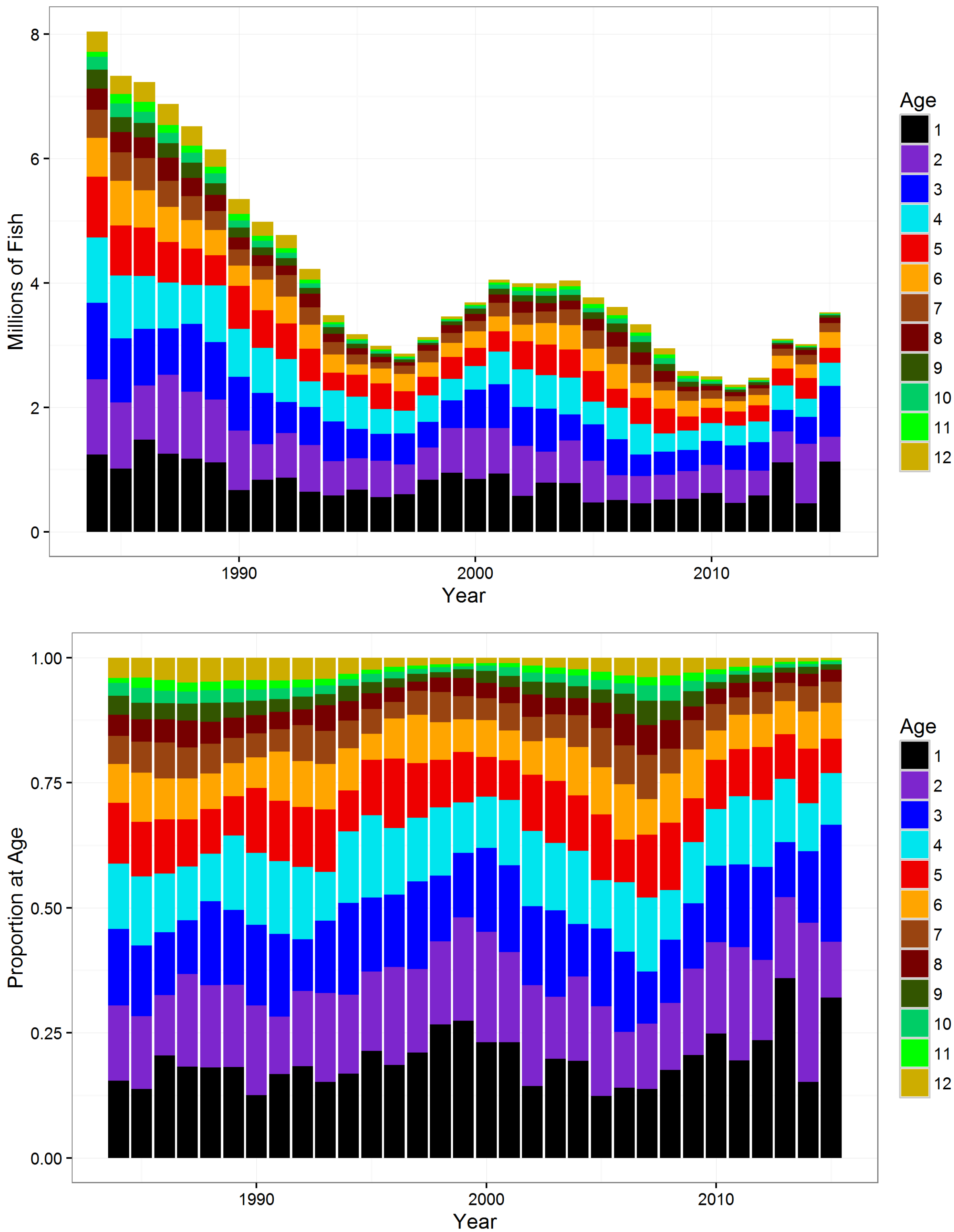


Figure 5.2.4. Abundance at age for the LIS region in total numbers of fish (top) and percent of population (bottom).

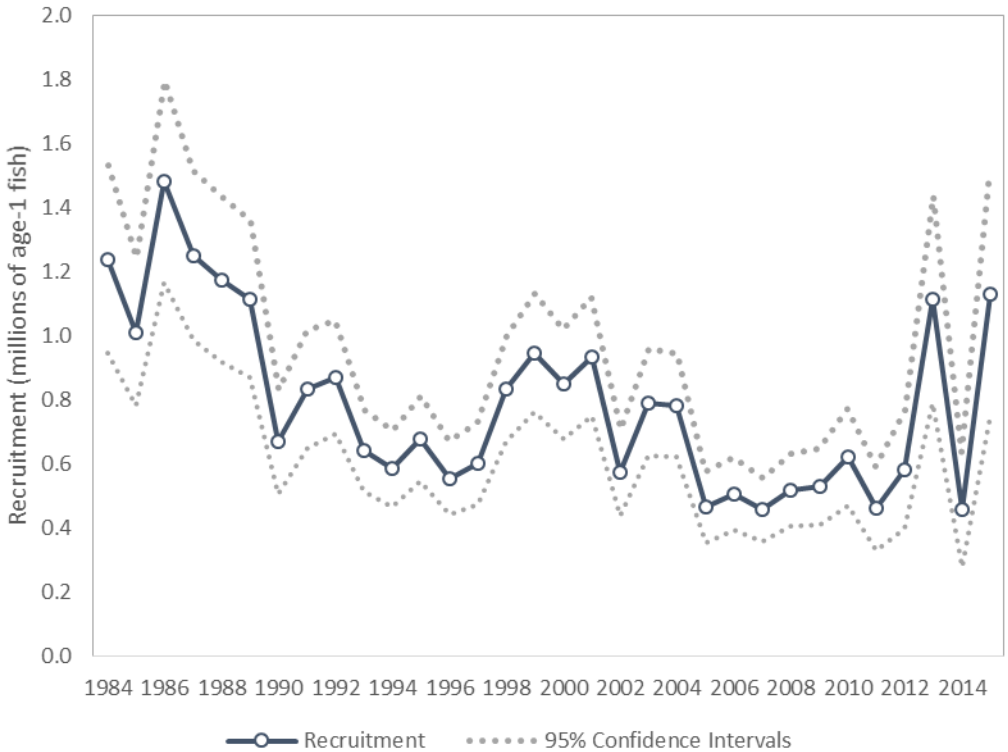
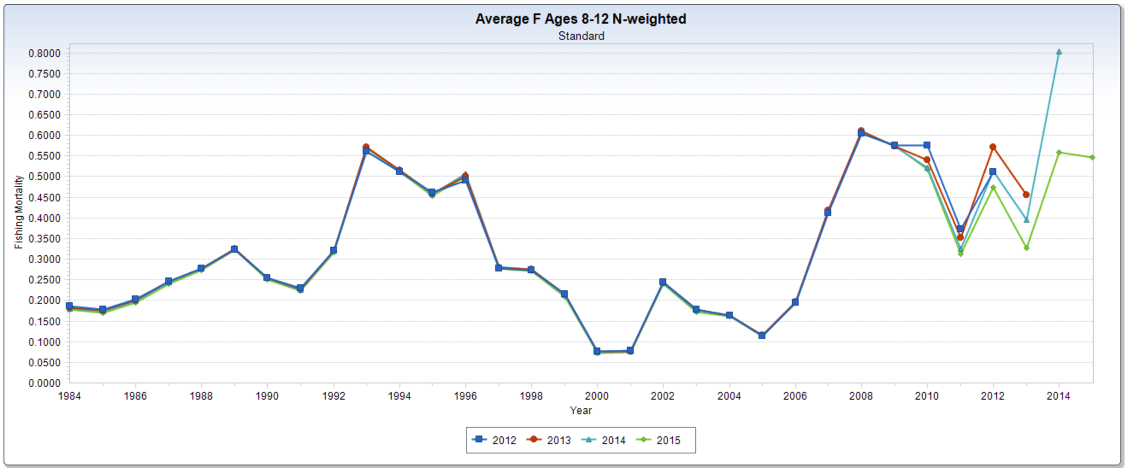
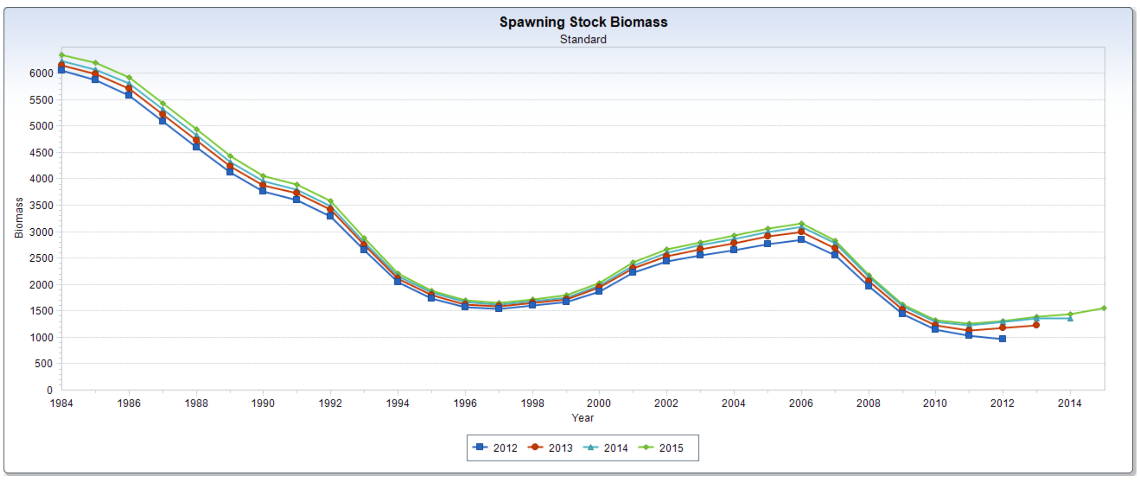


Figure 5.2.5. Recruitment estimates for LIS region.

A.



B.



C.

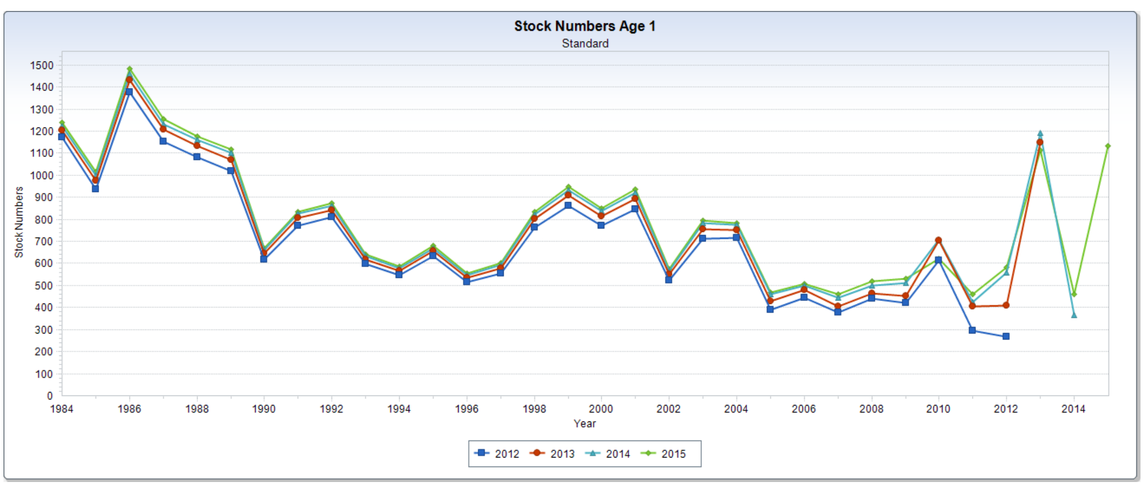


Figure 5.2.6. Retrospective analysis for LIS region for F (A), SSB (B), and Recruits (C).

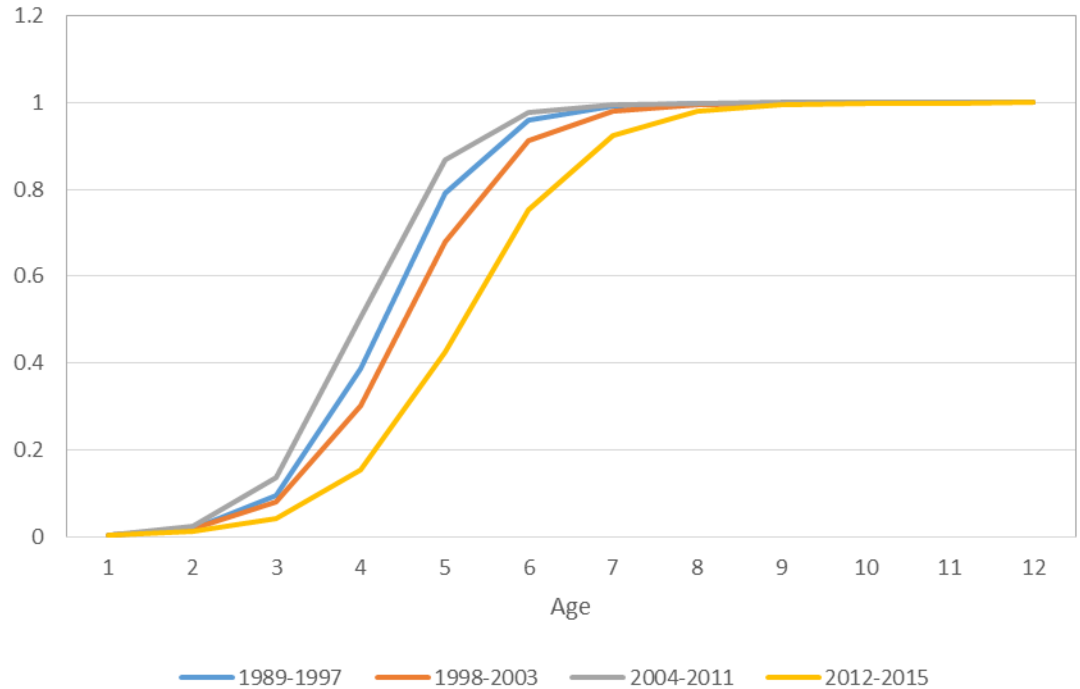


Figure 5.3.1. Estimated selectivity patterns for the NJ-NYB region.

Figure 5.3.2. Fishing mortality estimates for the NJ-NYB region.

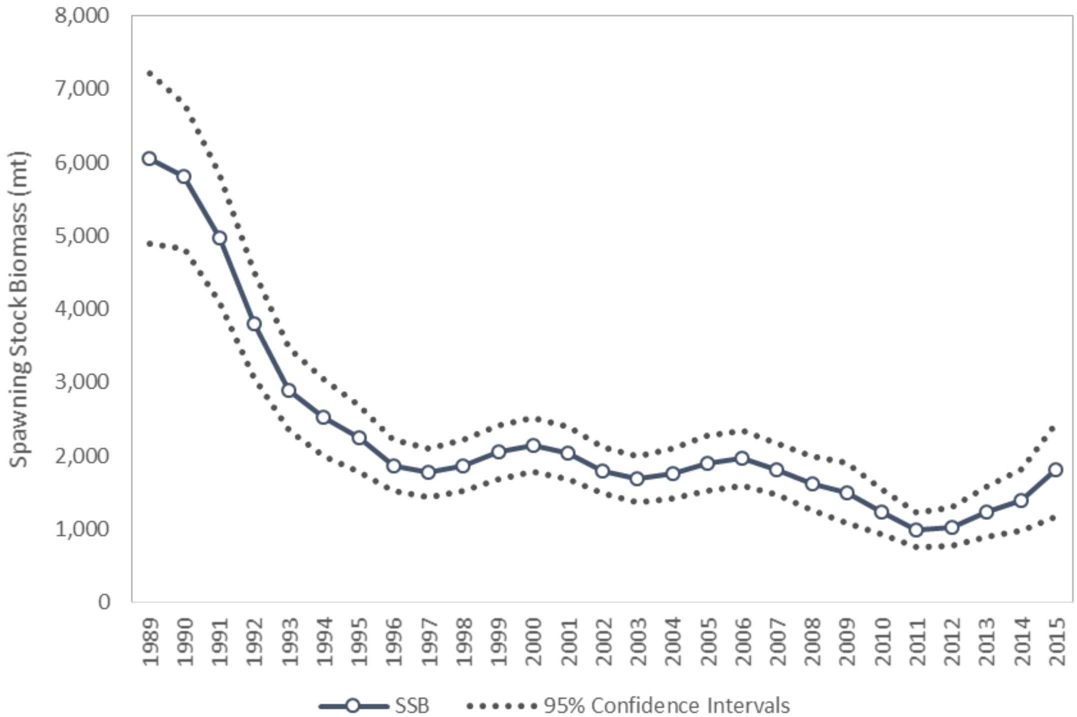


Figure 5.3.3. Spawning stock biomass estimates for the NJ-NYB region.

NJ-NYB

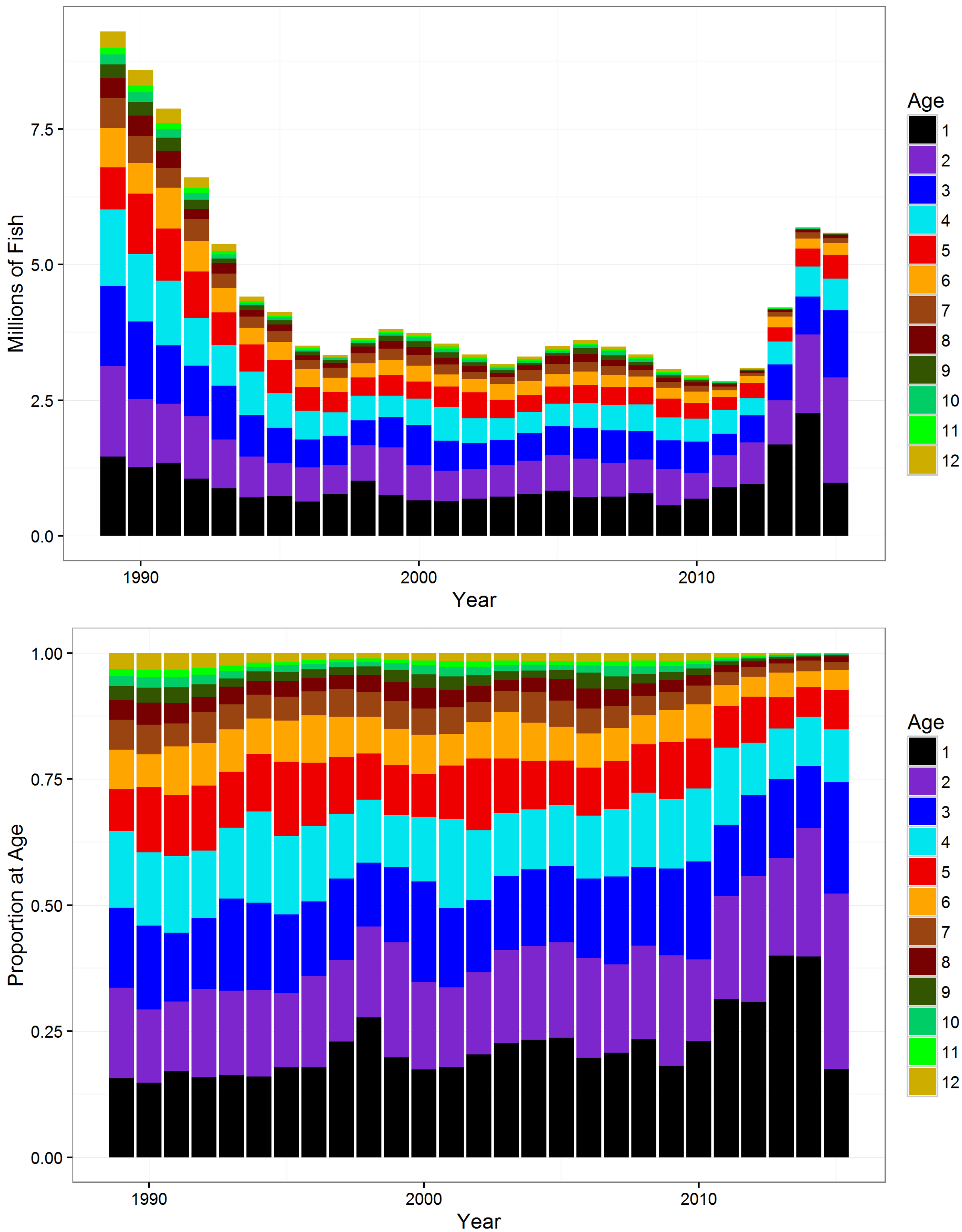


Figure 5.3.4. Abundance at age for the NJ-NYB region in total numbers (top) and proportion of population (bottom).

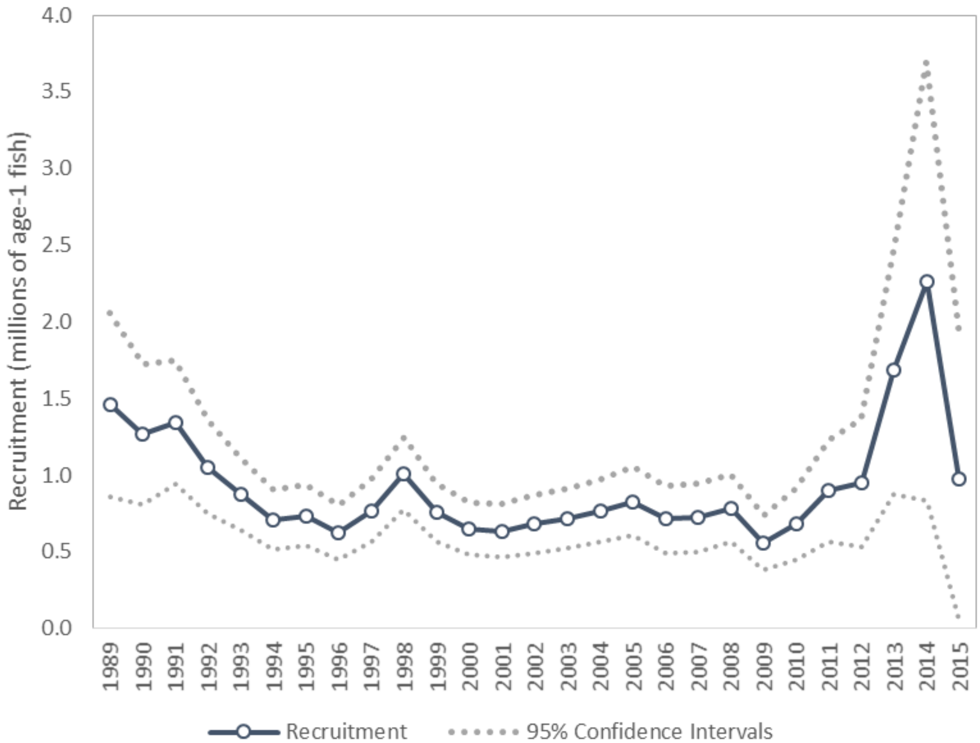


Figure 5.3.5. Recruitment estimates for the NJ-NYB region.

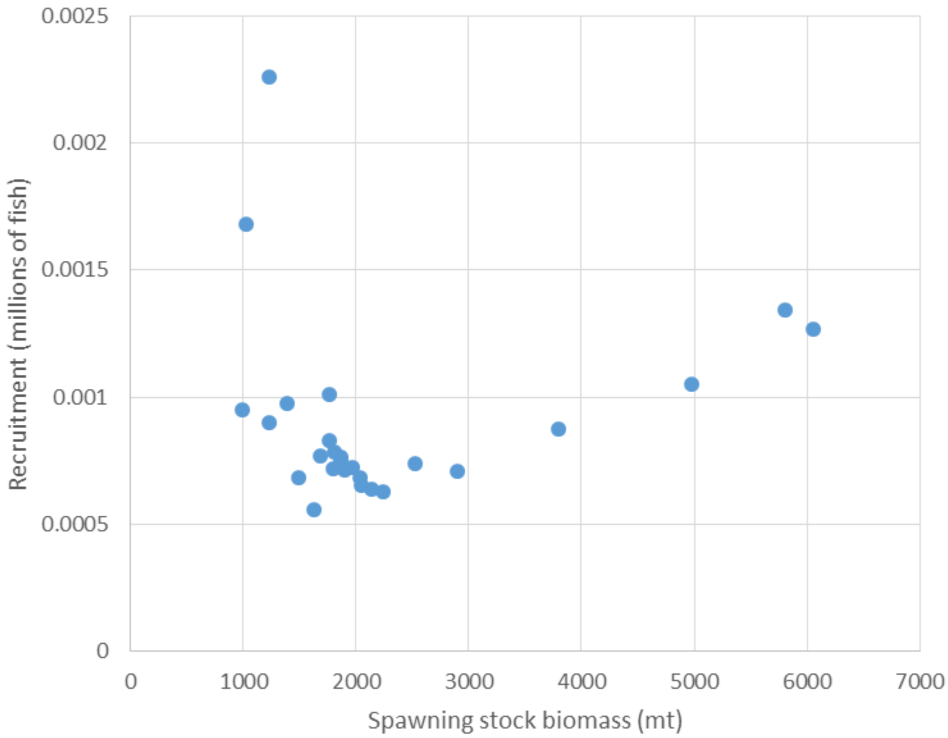
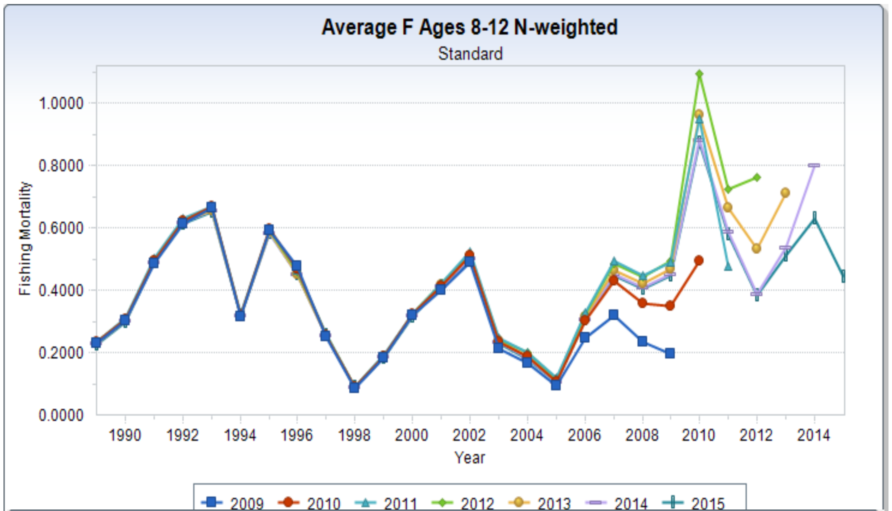
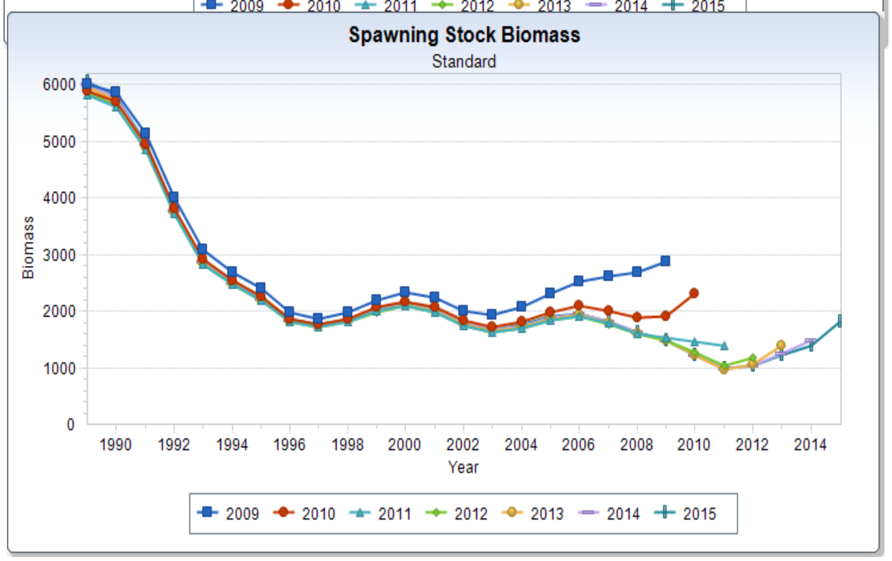


Figure 5.3.6. Stock-recruitment data for NJ-NYB region.

A.



B.



C.

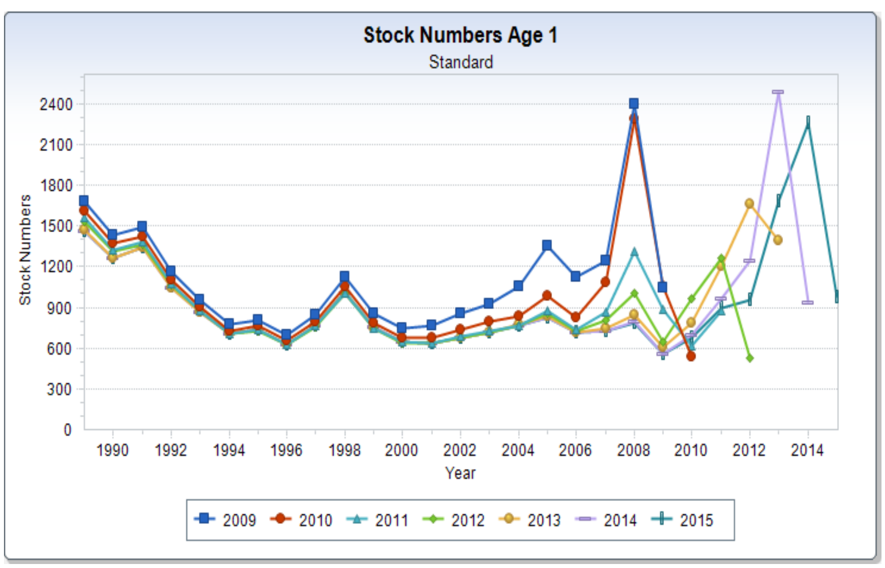


Figure 5.3.7. Retrospective analysis for the NJ-NYB region for F (A), SSB (B), and recruitment (C)

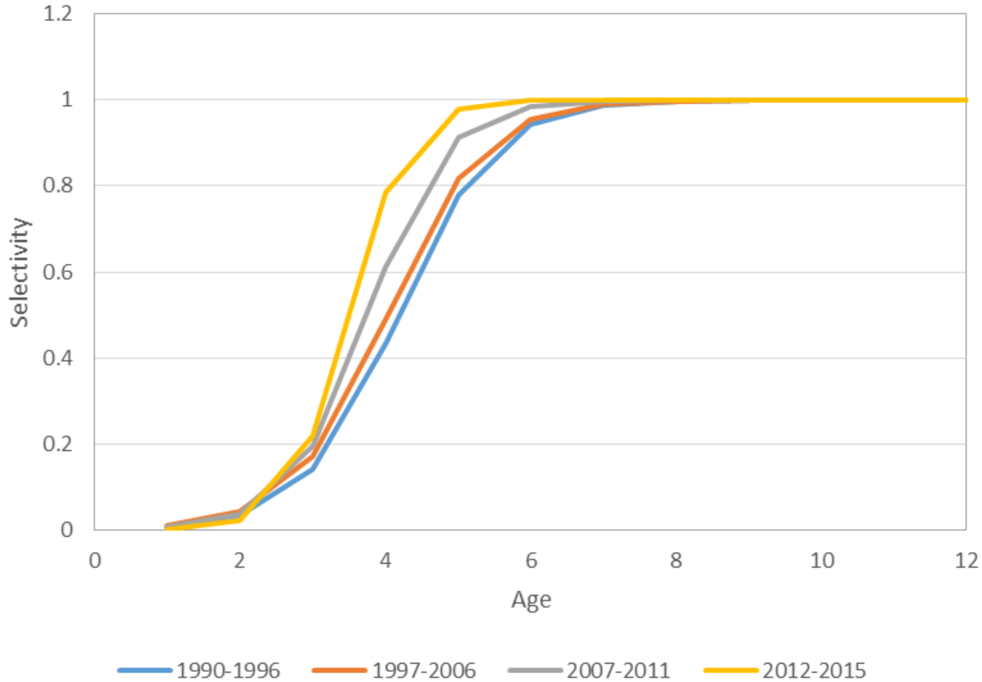


Figure 5.4.1. Estimated selectivity patterns for the DMV region.

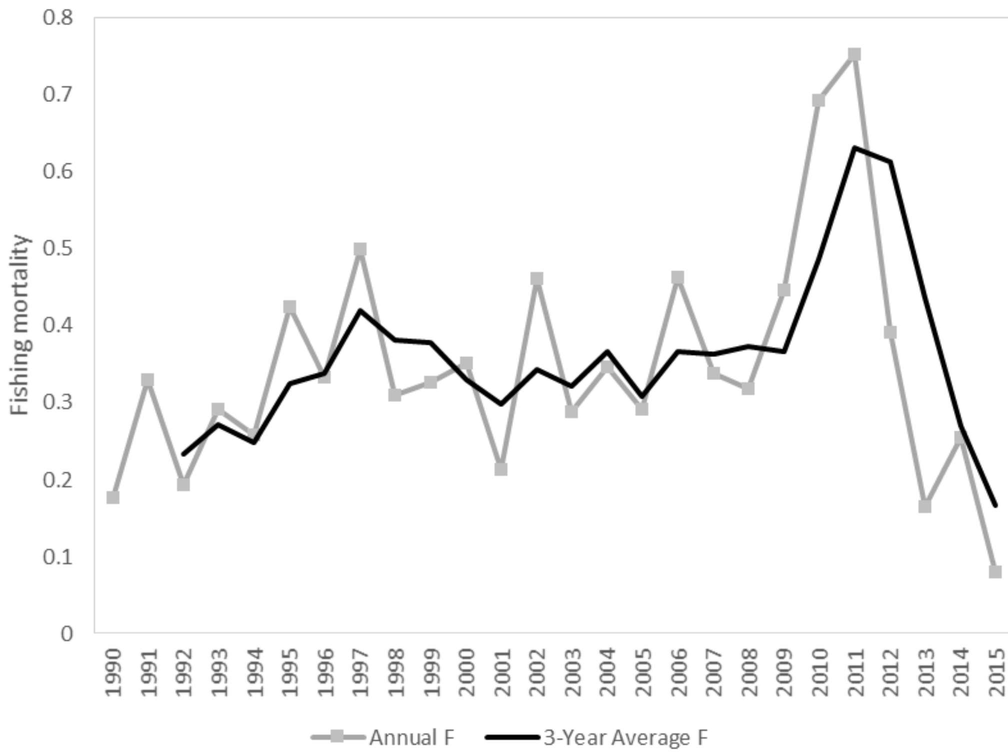


Figure 5.4.2. Fishing mortality estimates for the DMV region.

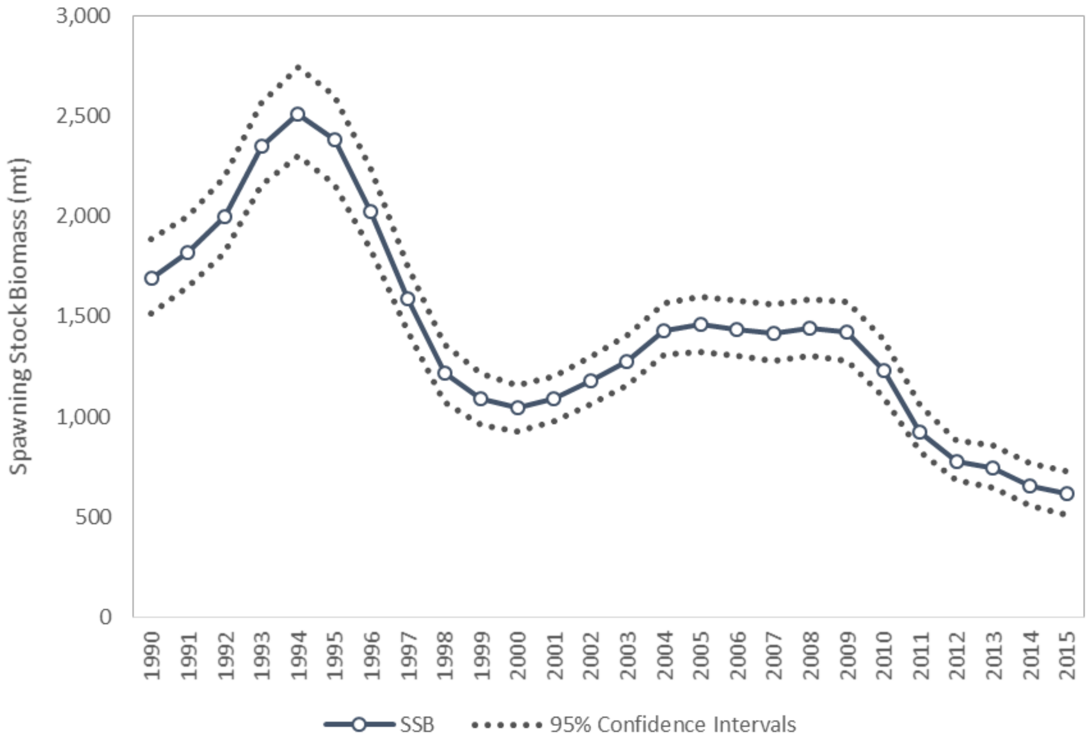
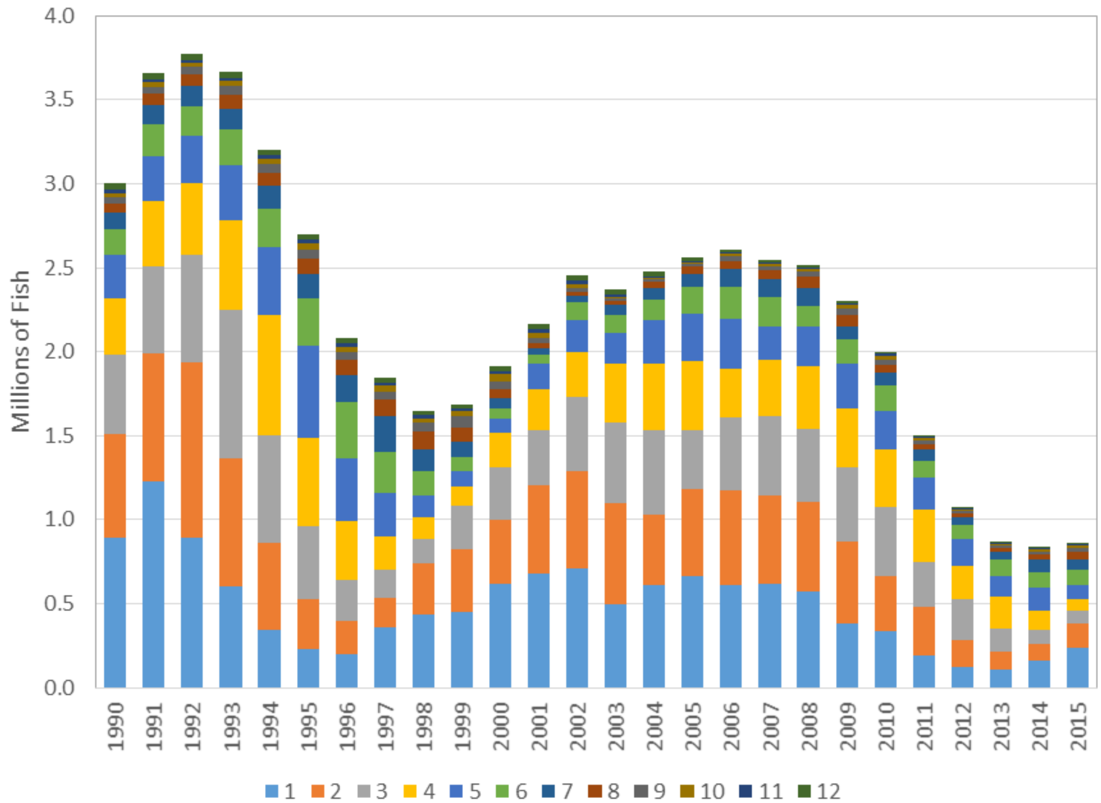


Figure 5.4.3. Spawning stock biomass estimates for the DMV region.



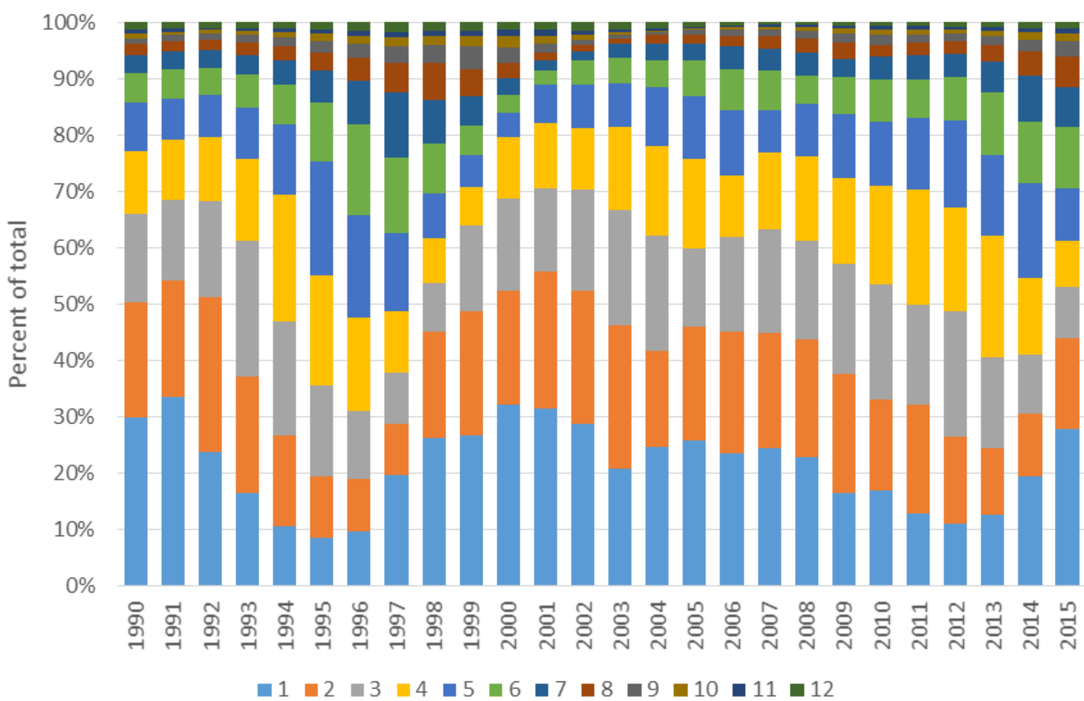


Figure 5.4.4. Abundance at age for the DMV region in total numbers (top) and proportion of population (bottom).

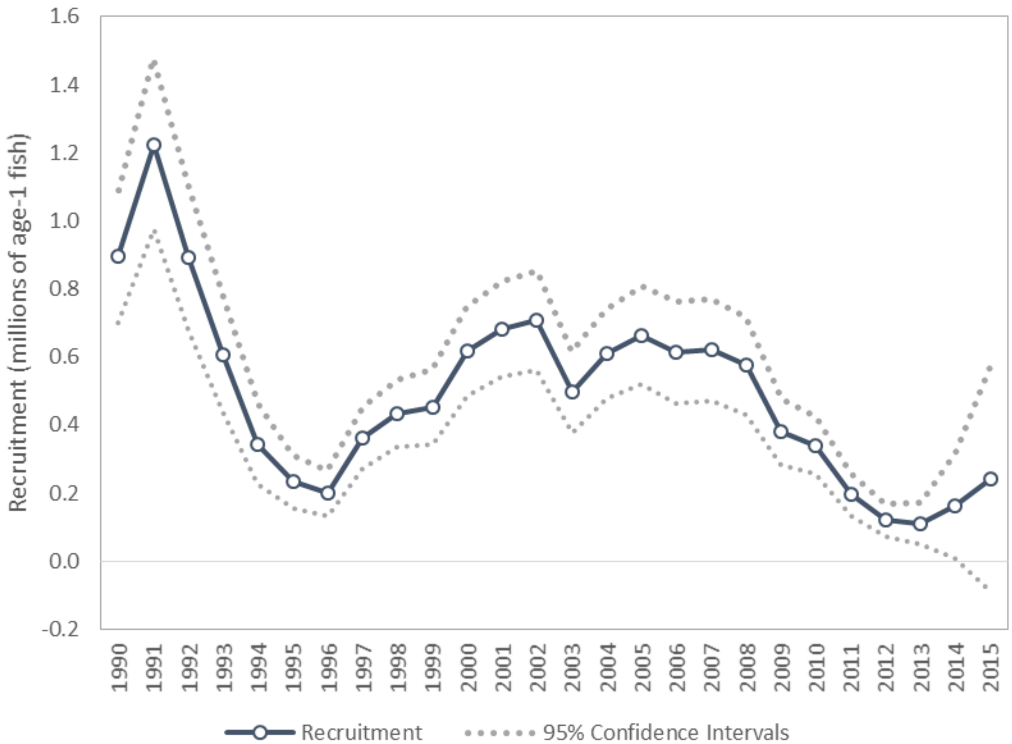


Figure 5.4.5. Recruitment estimates for the DMV region.

DMV

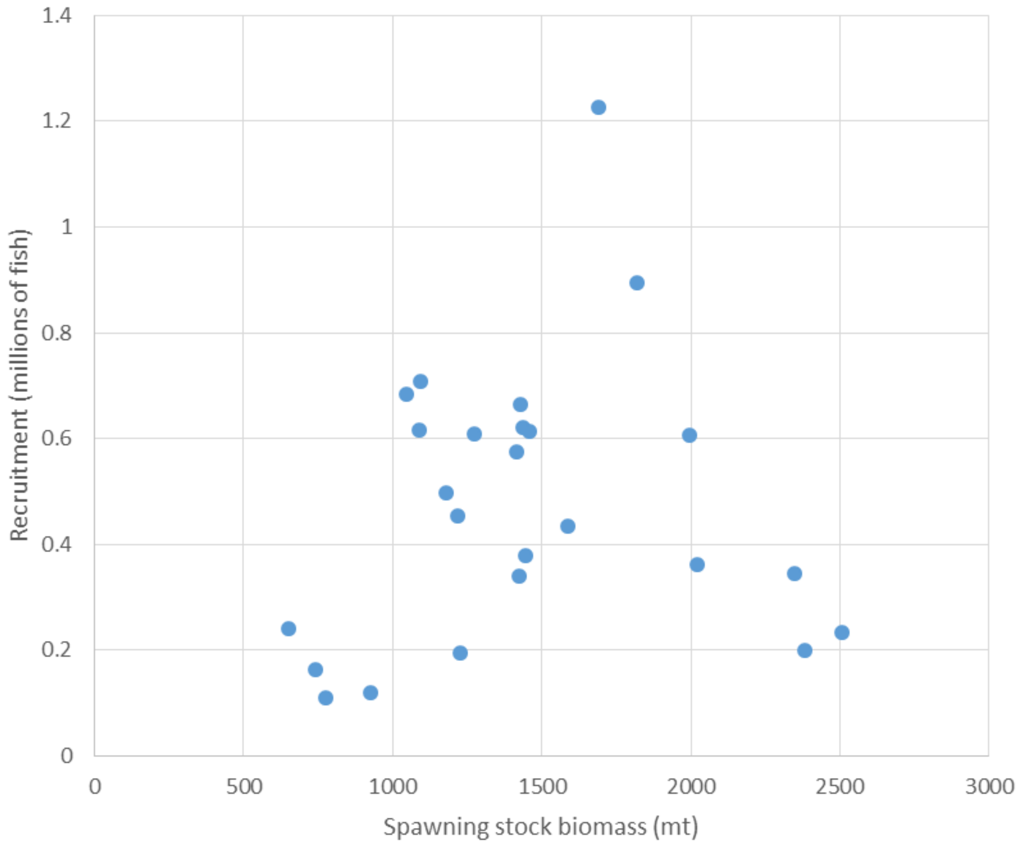
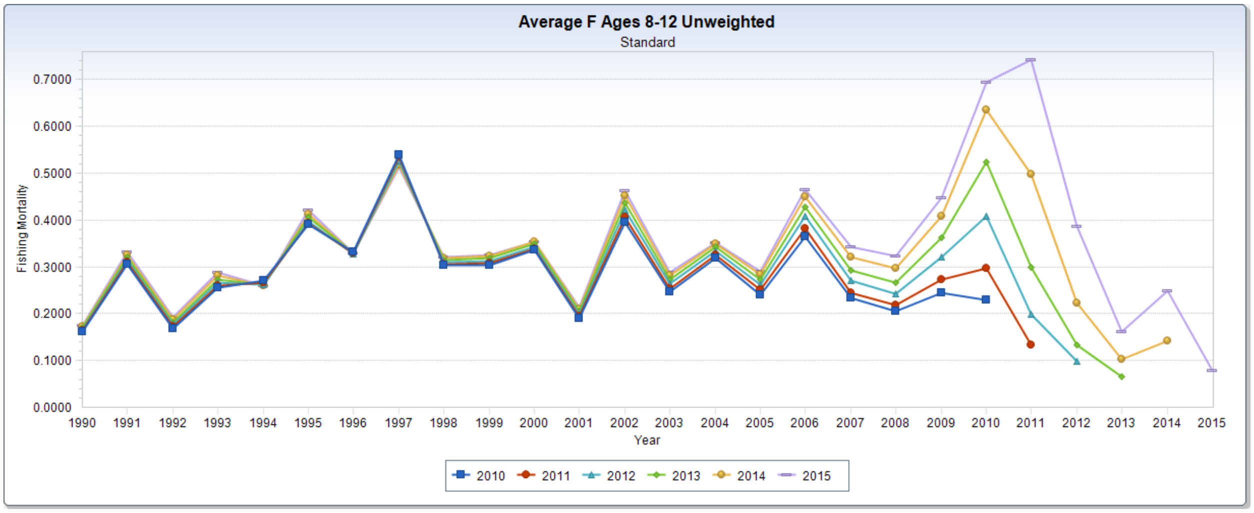
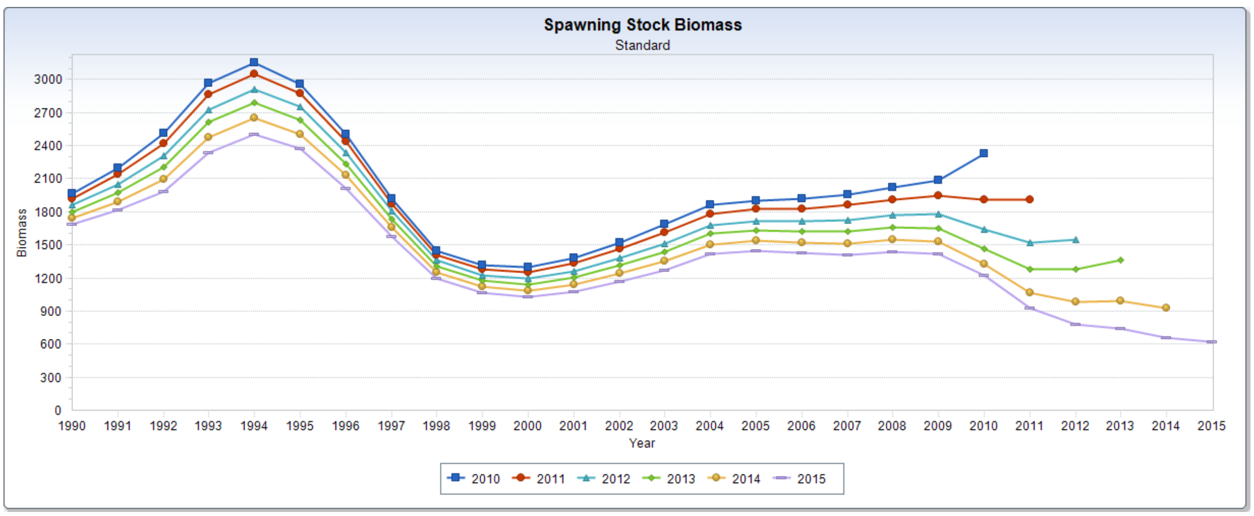


Figure 5.4.6. Stock-recruitment data for the DMV region.

A.



B.



C.

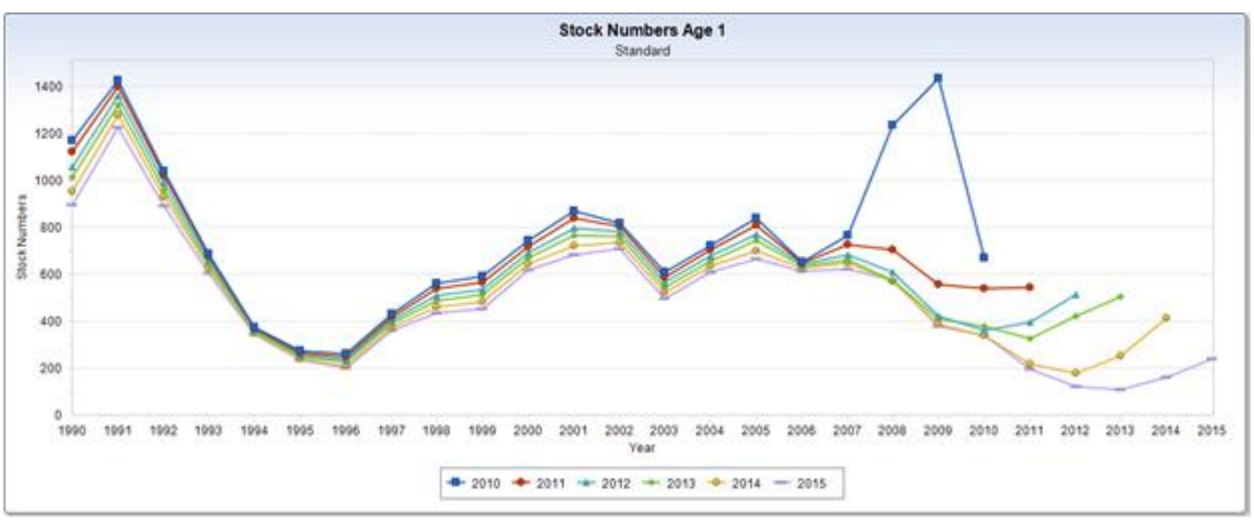


Figure 5.4.7. Retrospective analysis for the DMV region for F (A), SSB (B), and recruitment (C).

Coast

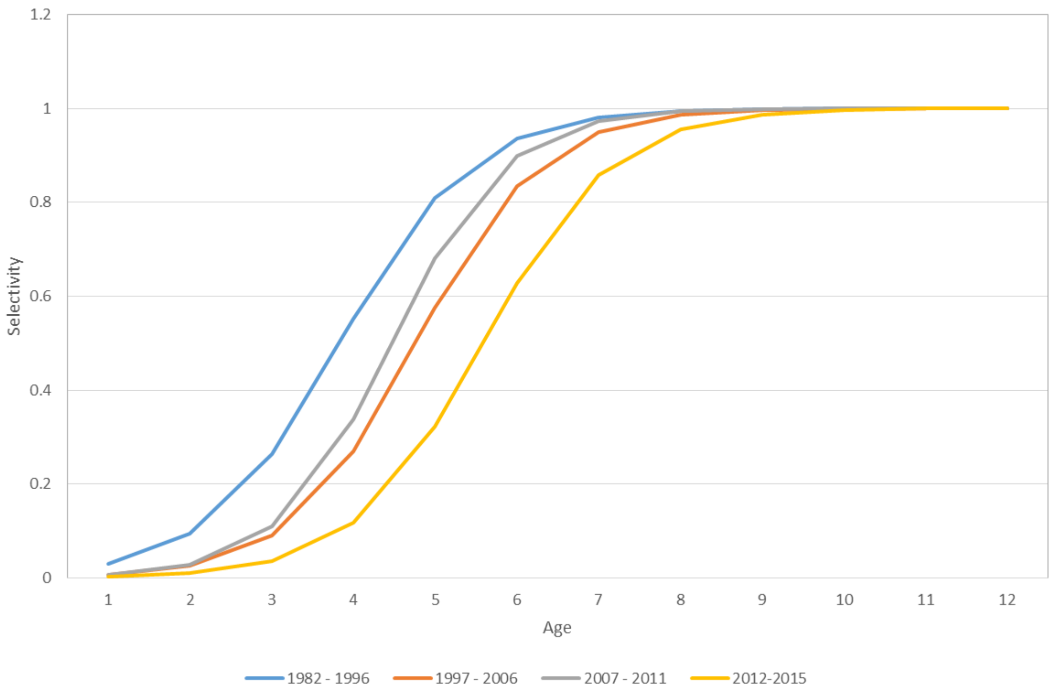


Figure 5.5.1. Estimated selectivity patterns for the coast.

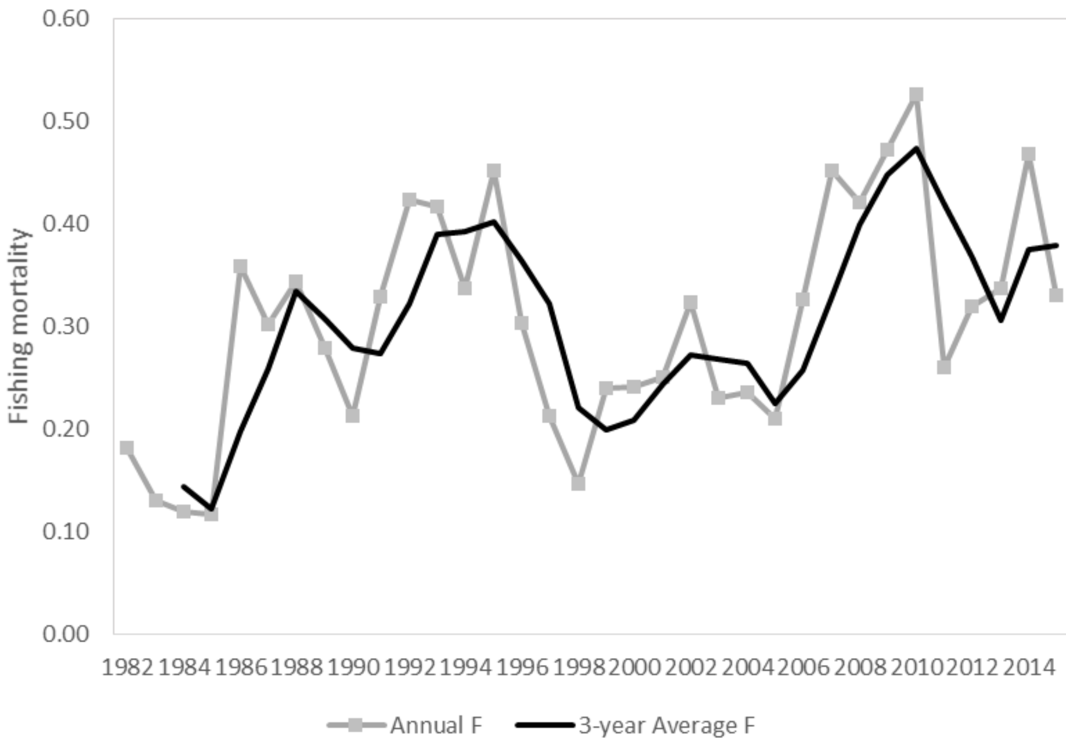


Figure 5.5.2. Fishing mortality estimates for the coast.

Coast

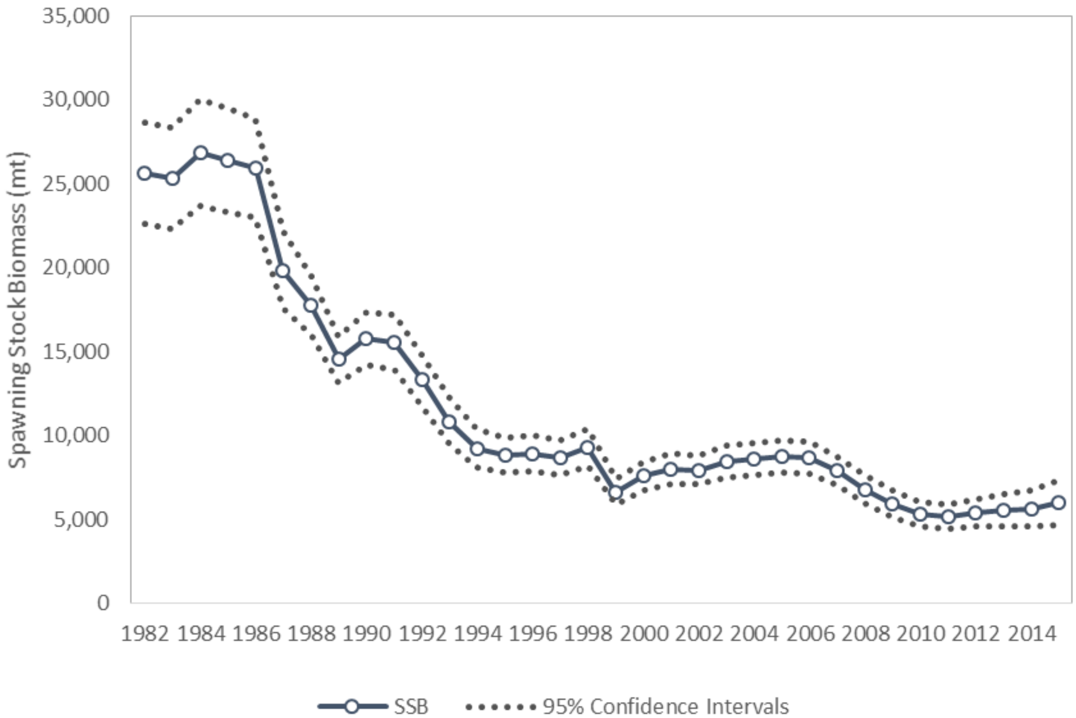


Figure 5.5.3. Spawning stock biomass estimates for the coast.

Coast

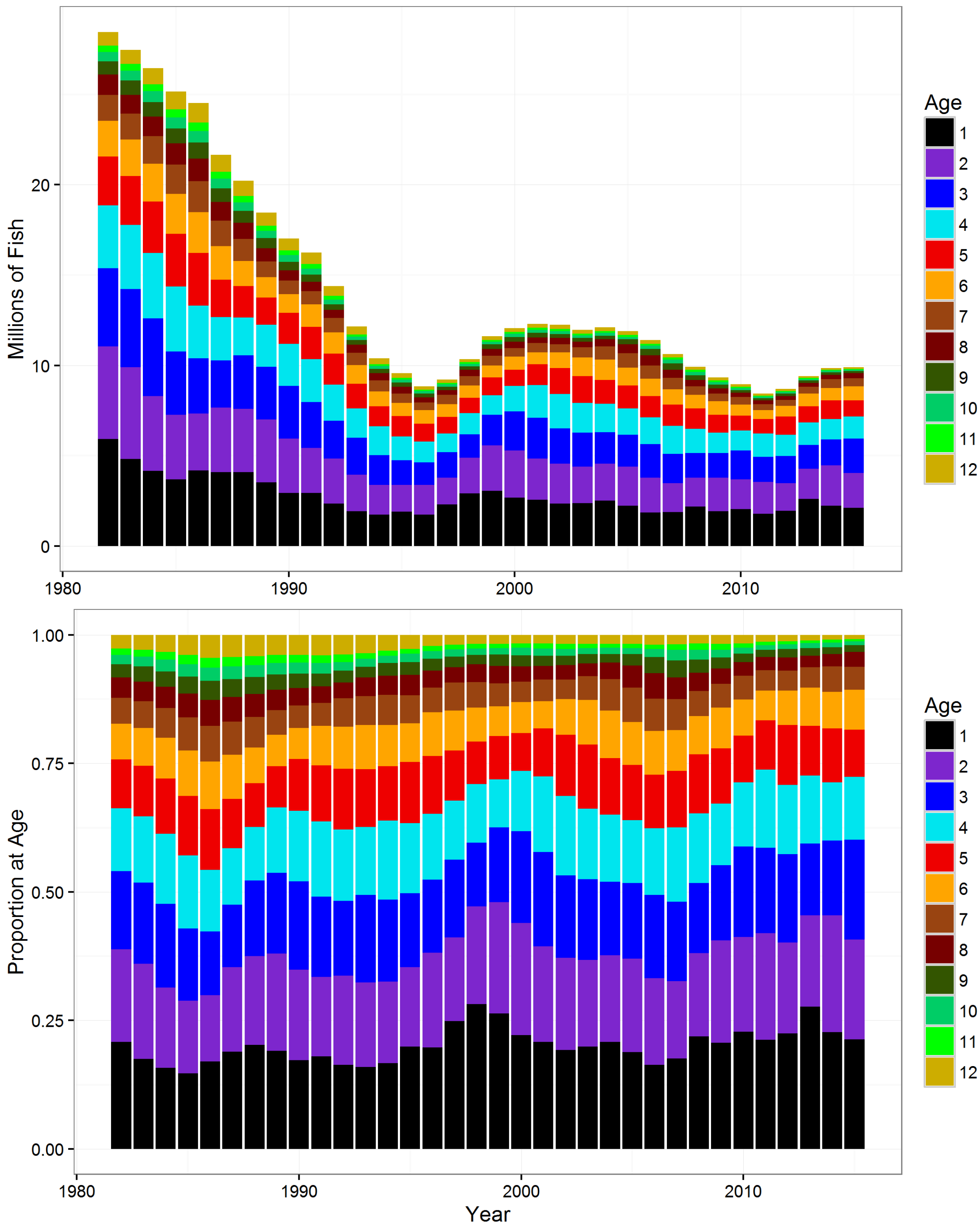


Figure 5.5.4. Abundance at age for the coast in total numbers (top) and proportion of the population (bottom).

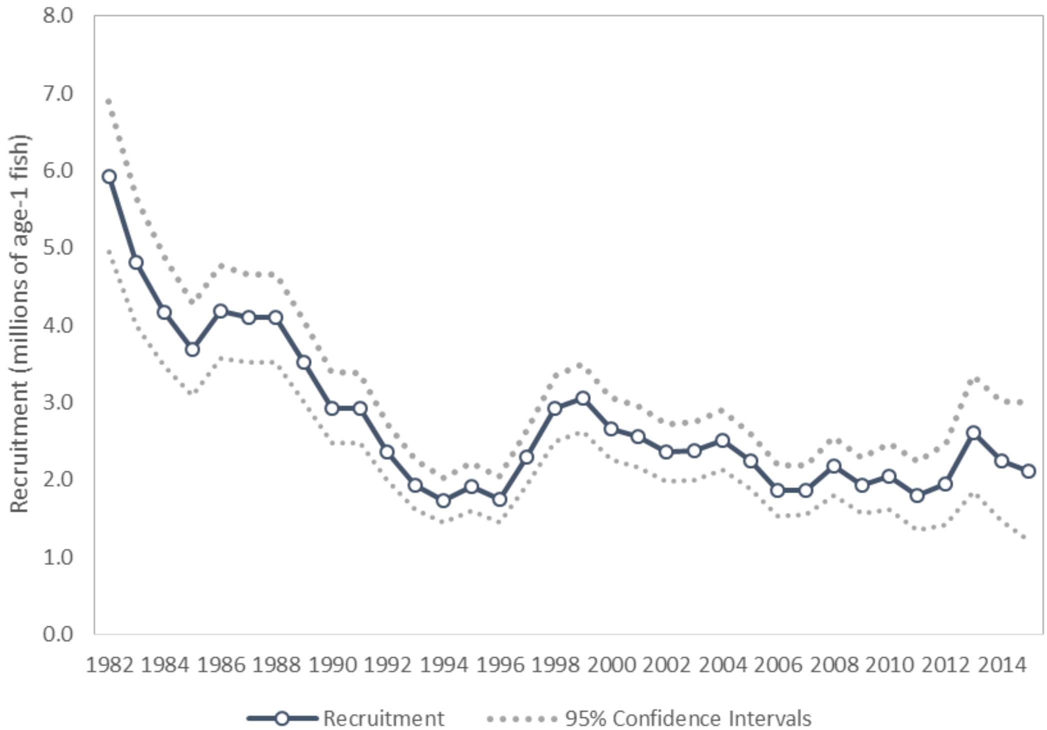


Figure 5.5.5. Recruitment estimates for the coast.

Coast

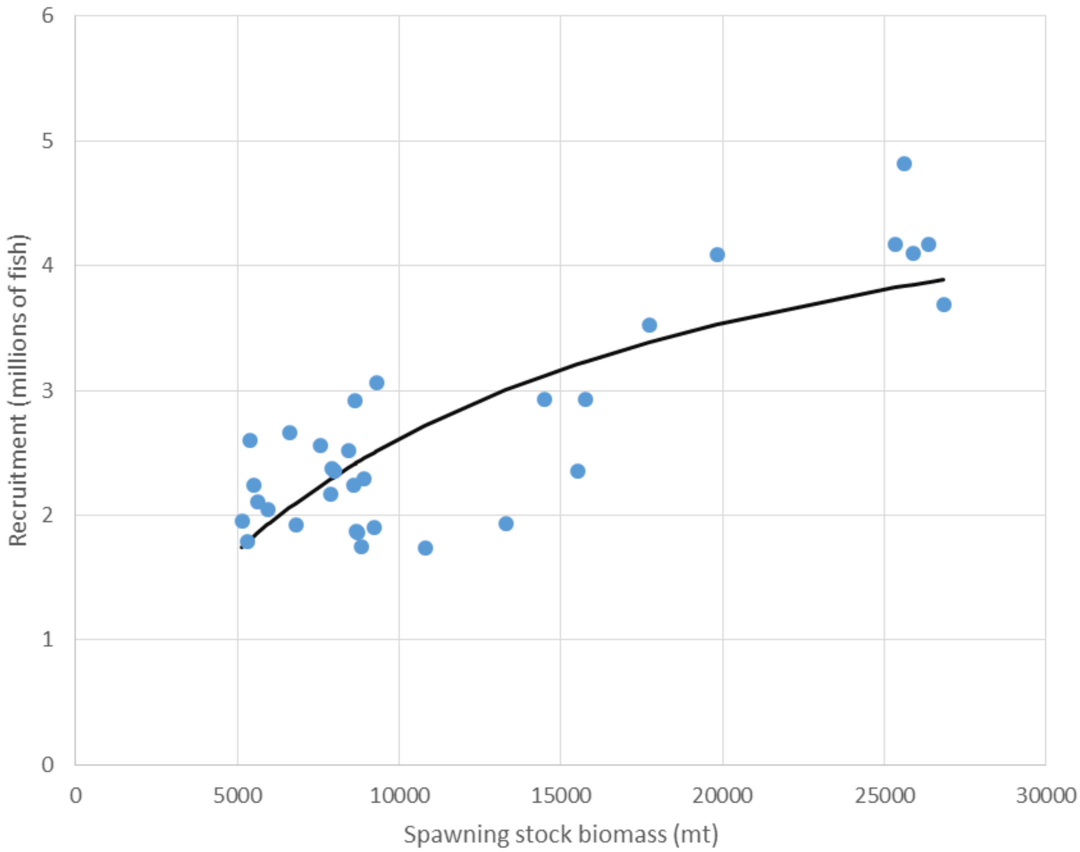


Figure 5.5.6. Stock-recruitment curve for the coast.

Coast

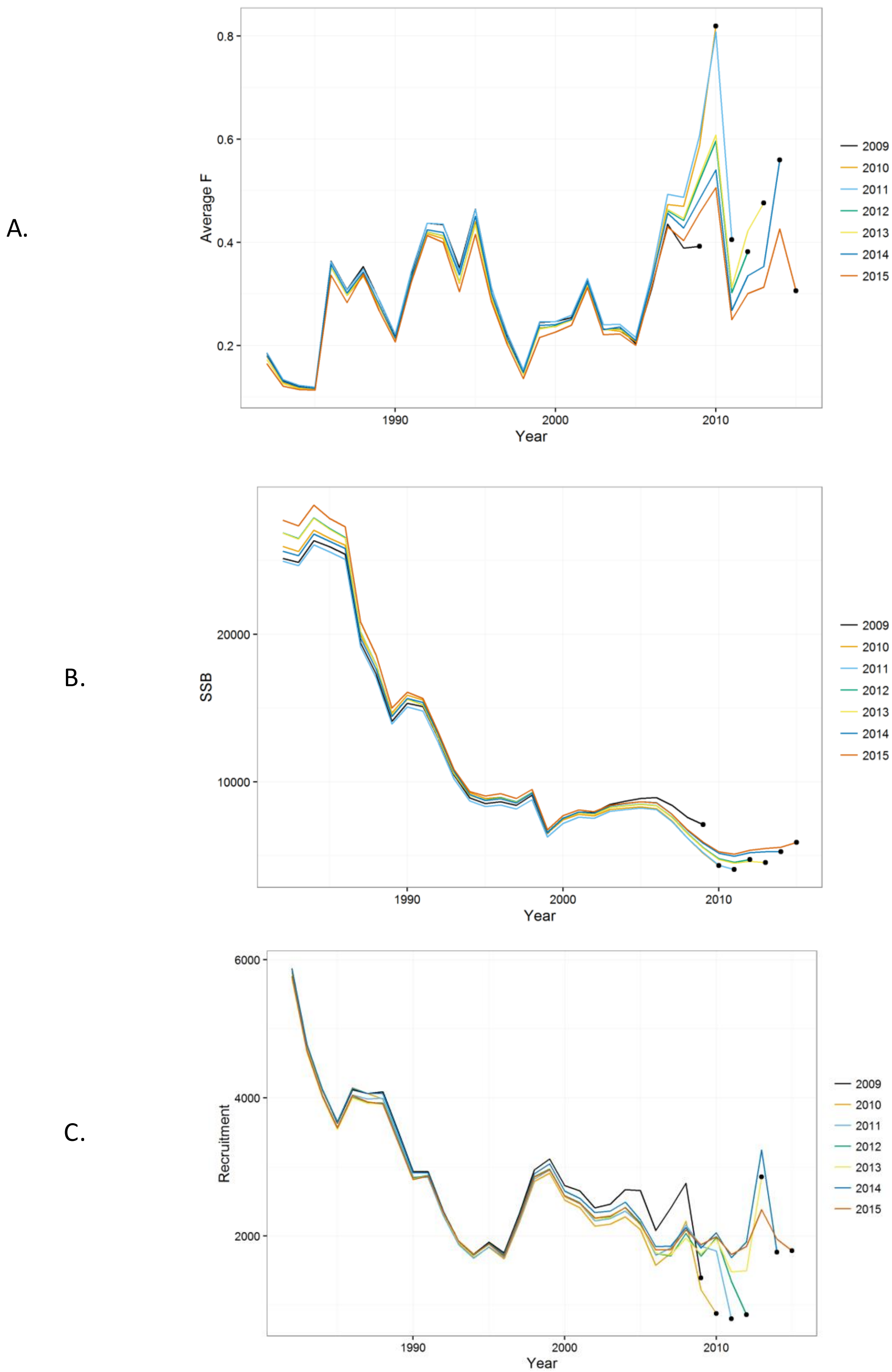


Figure 5.5.7. Retrospective analysis for the coast for F (A), SSB (B), and recruitment (C).

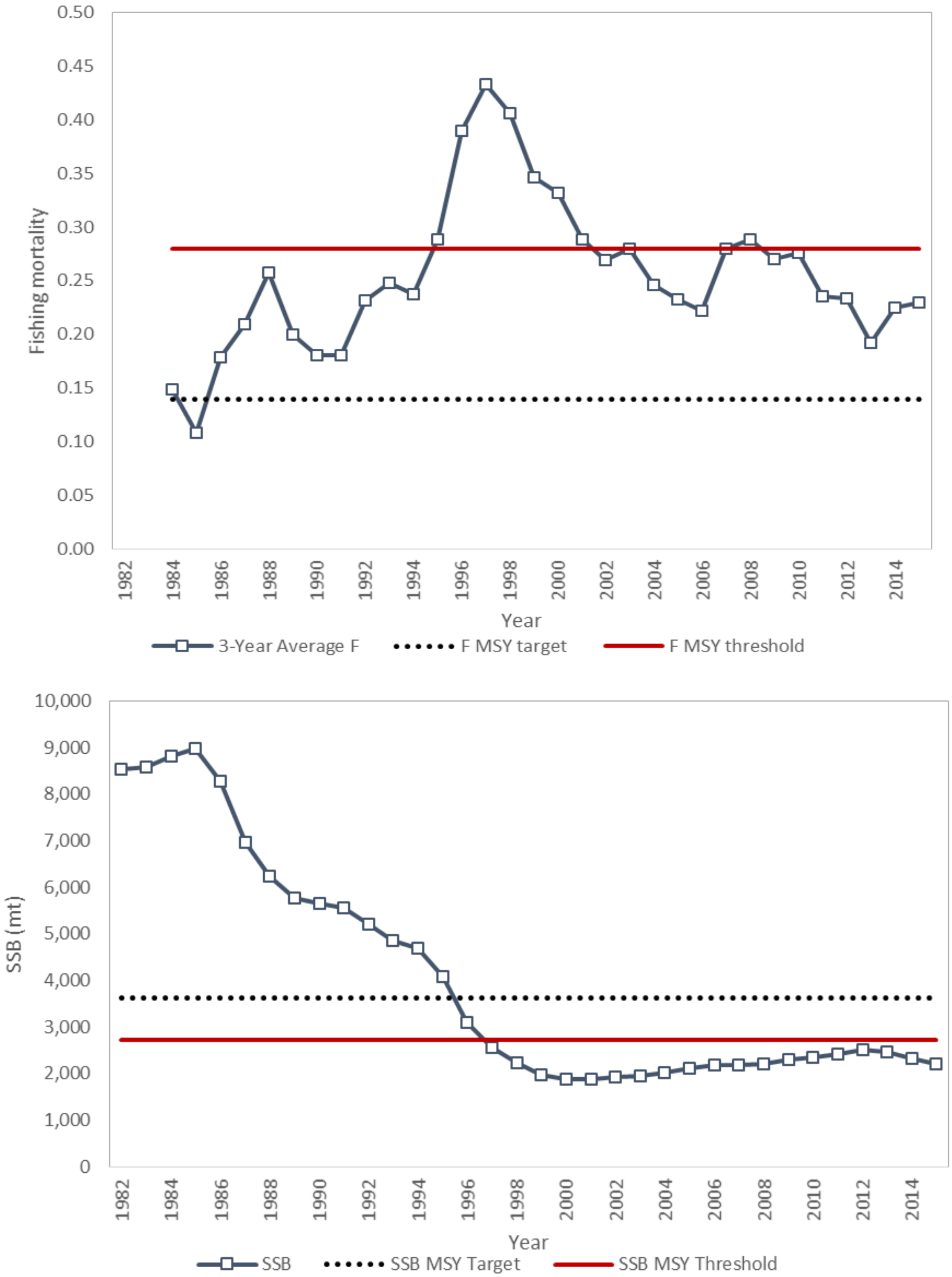


Figure 6.1.1. F (top) and SSB (bottom) plotted with their MSY-based targets and thresholds for the MARI region.

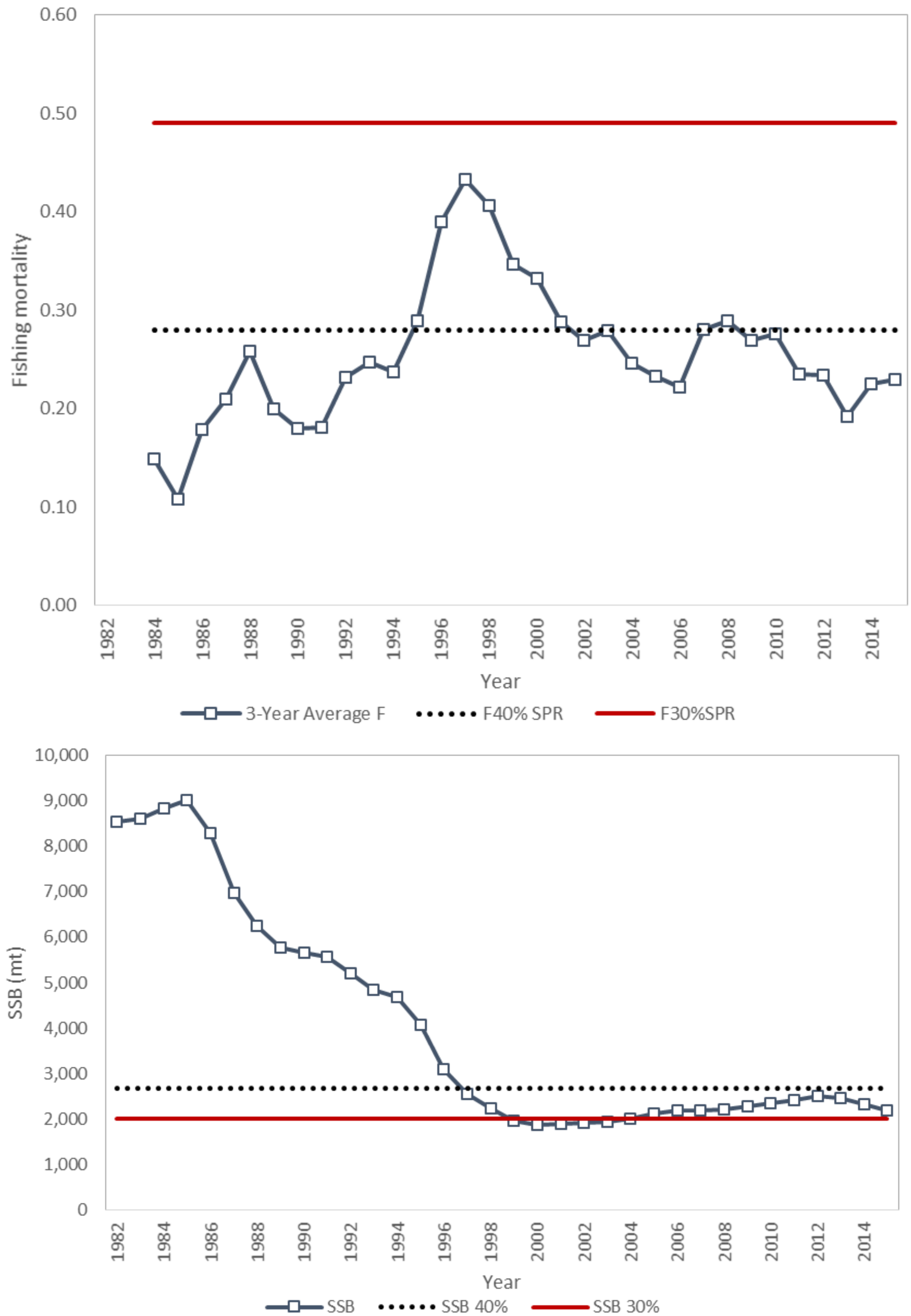


Figure 6.1.2. F (top) and SSB (bottom) plotted with their SPR-based targets and thresholds for the MARI region

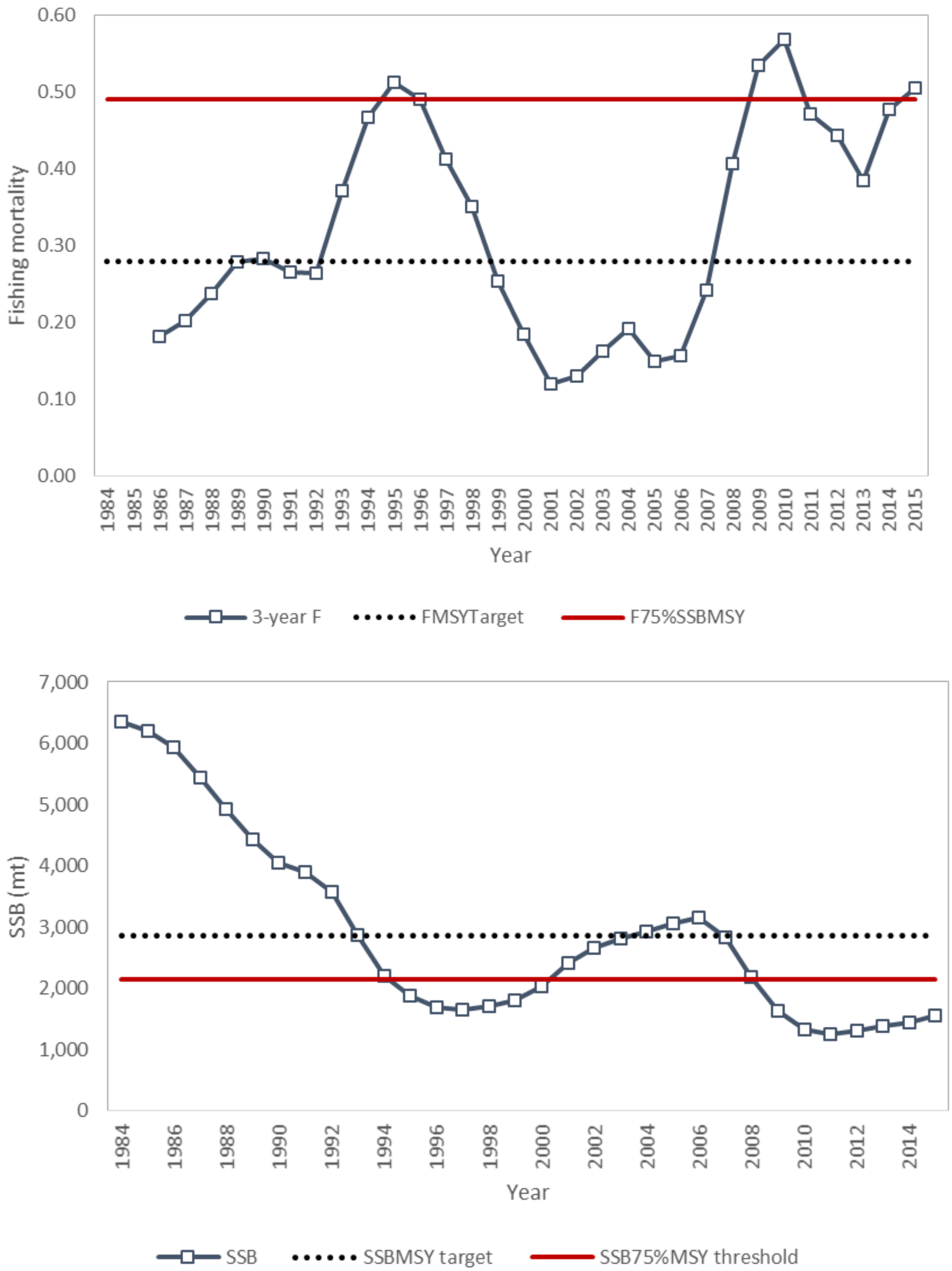
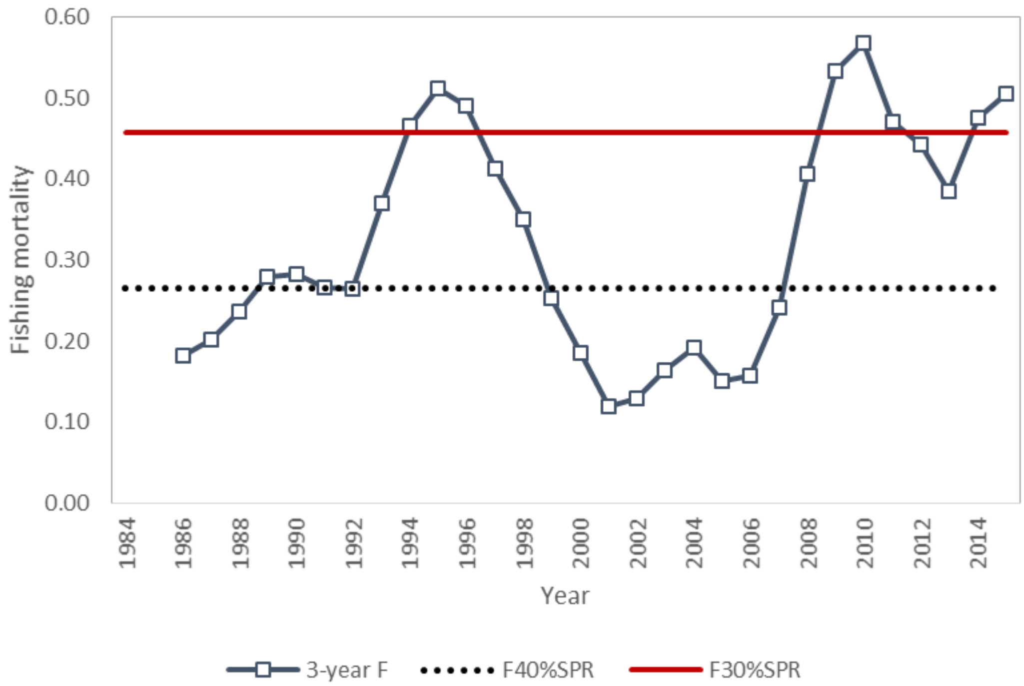


Figure 6.2.1. F (top) and SSB (bottom) plotted with their MSY-based targets and thresholds for the LIS region.



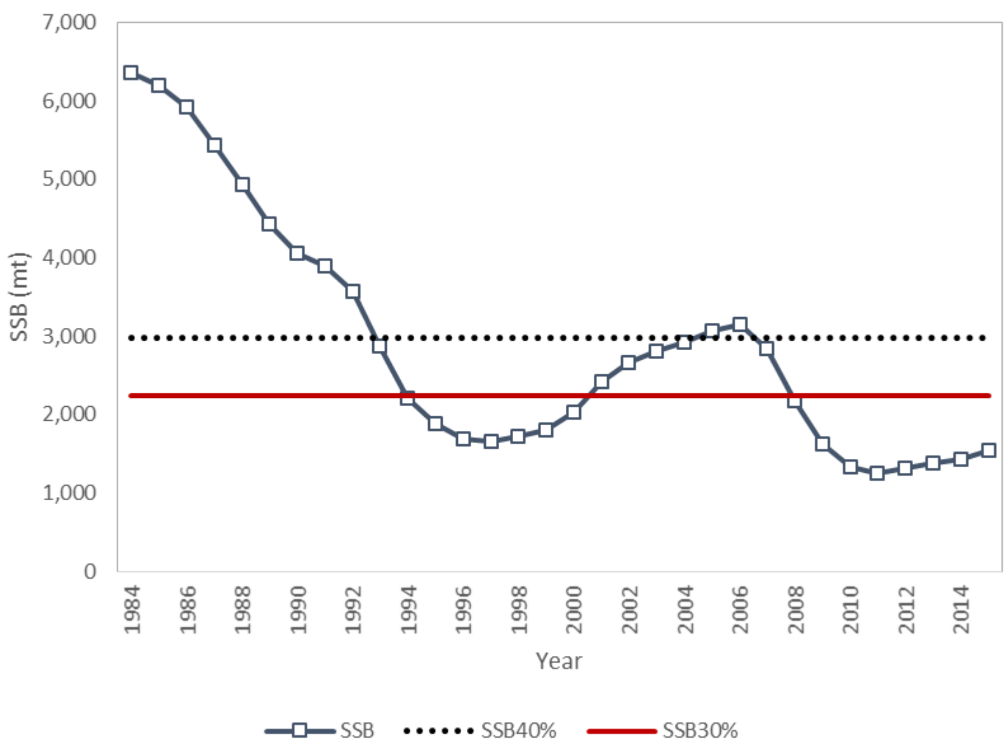


Figure 6.2.2. F (top) and SSB (bottom) plotted with their SPR-based targets and thresholds for the LIS region.

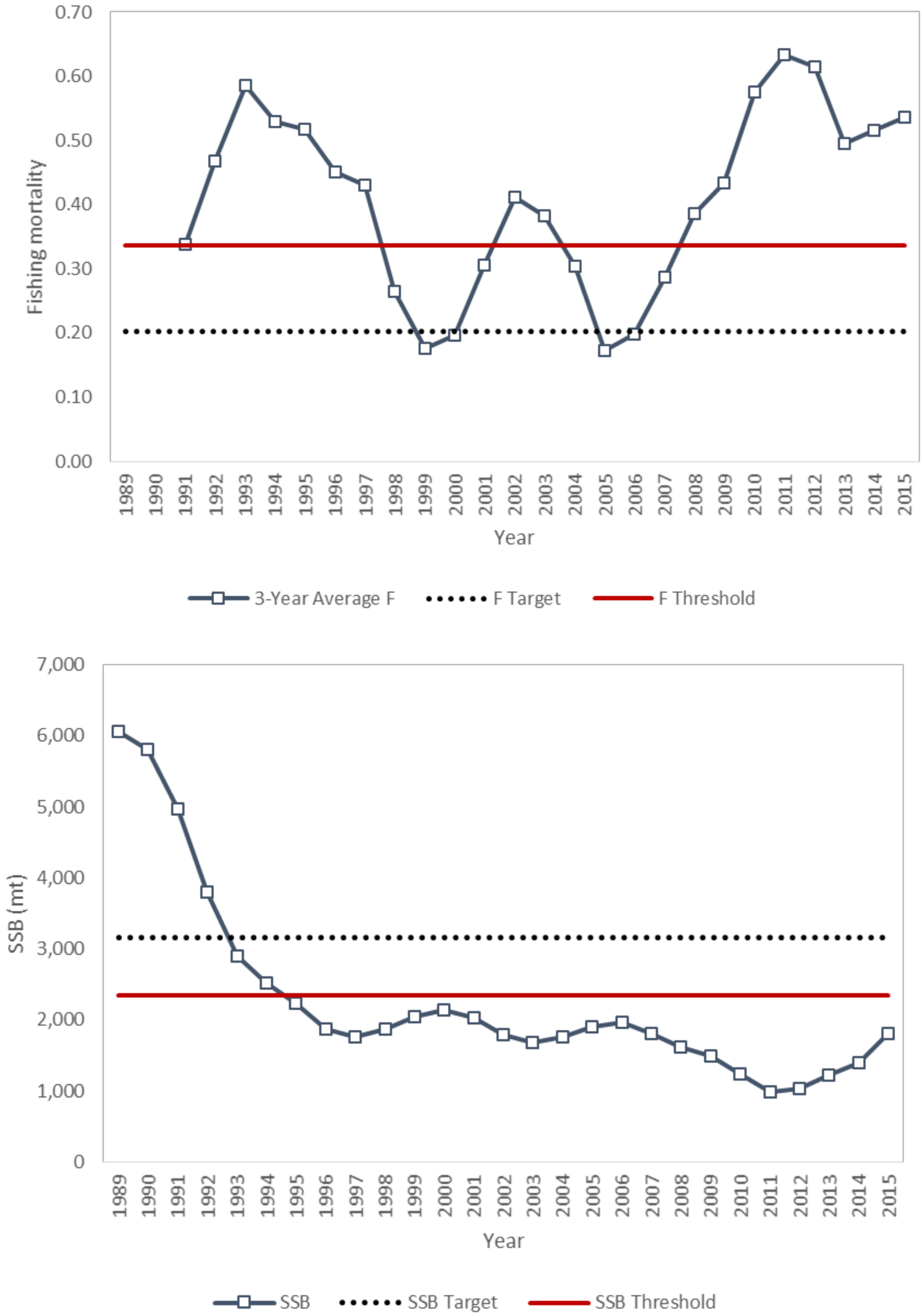
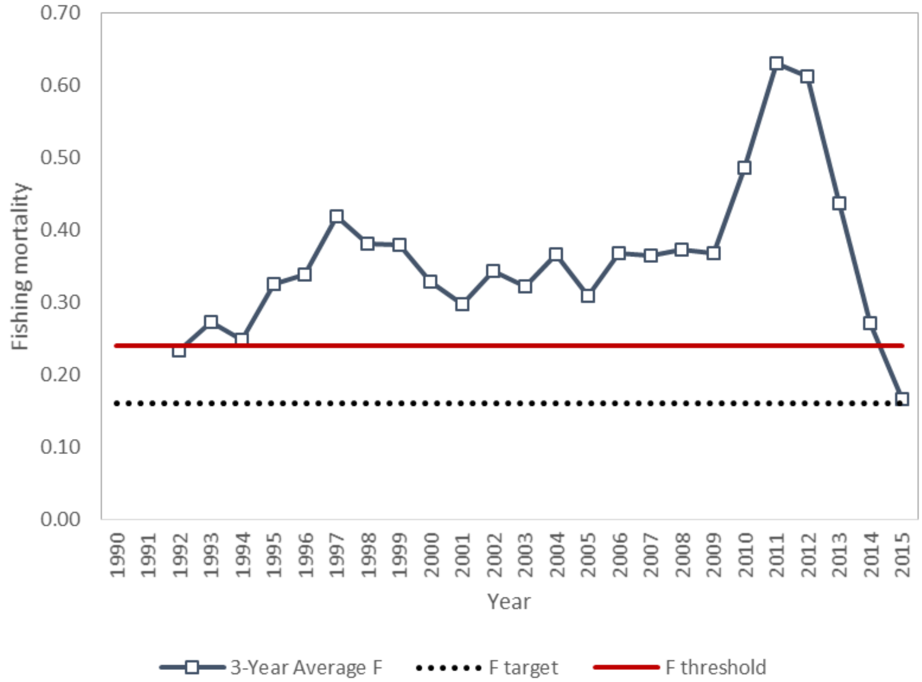
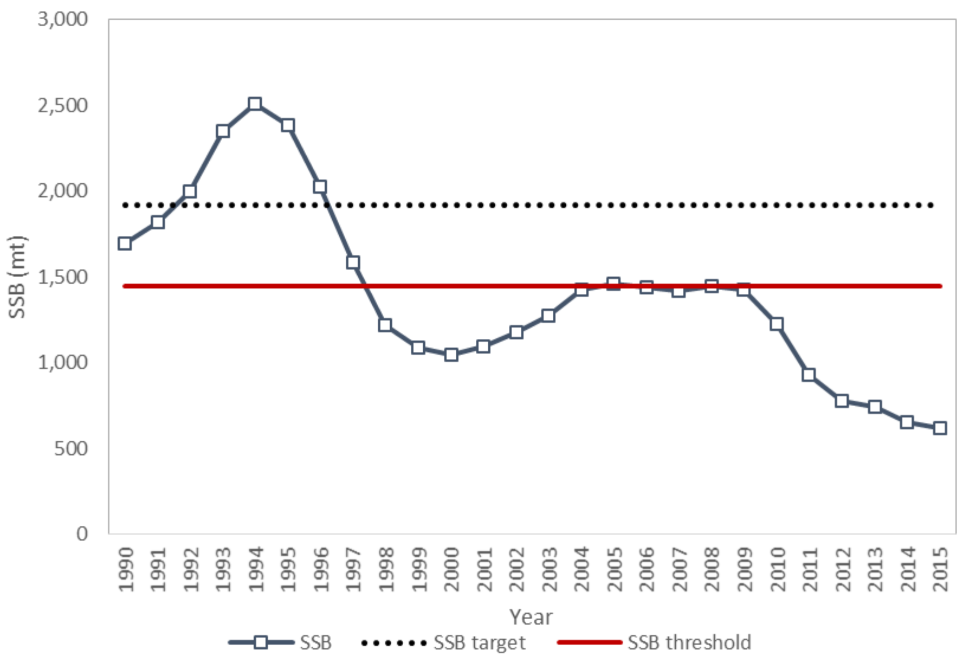


Figure 6.3.1. F (top) and SSB (bottom) plotted with their SPR-based targets and thresholds for the NJ-NYB region.

Figure 6.4.1. F (top) and SSB (bottom) plotted with their SPR-based targets and thresholds for





the DMV region.

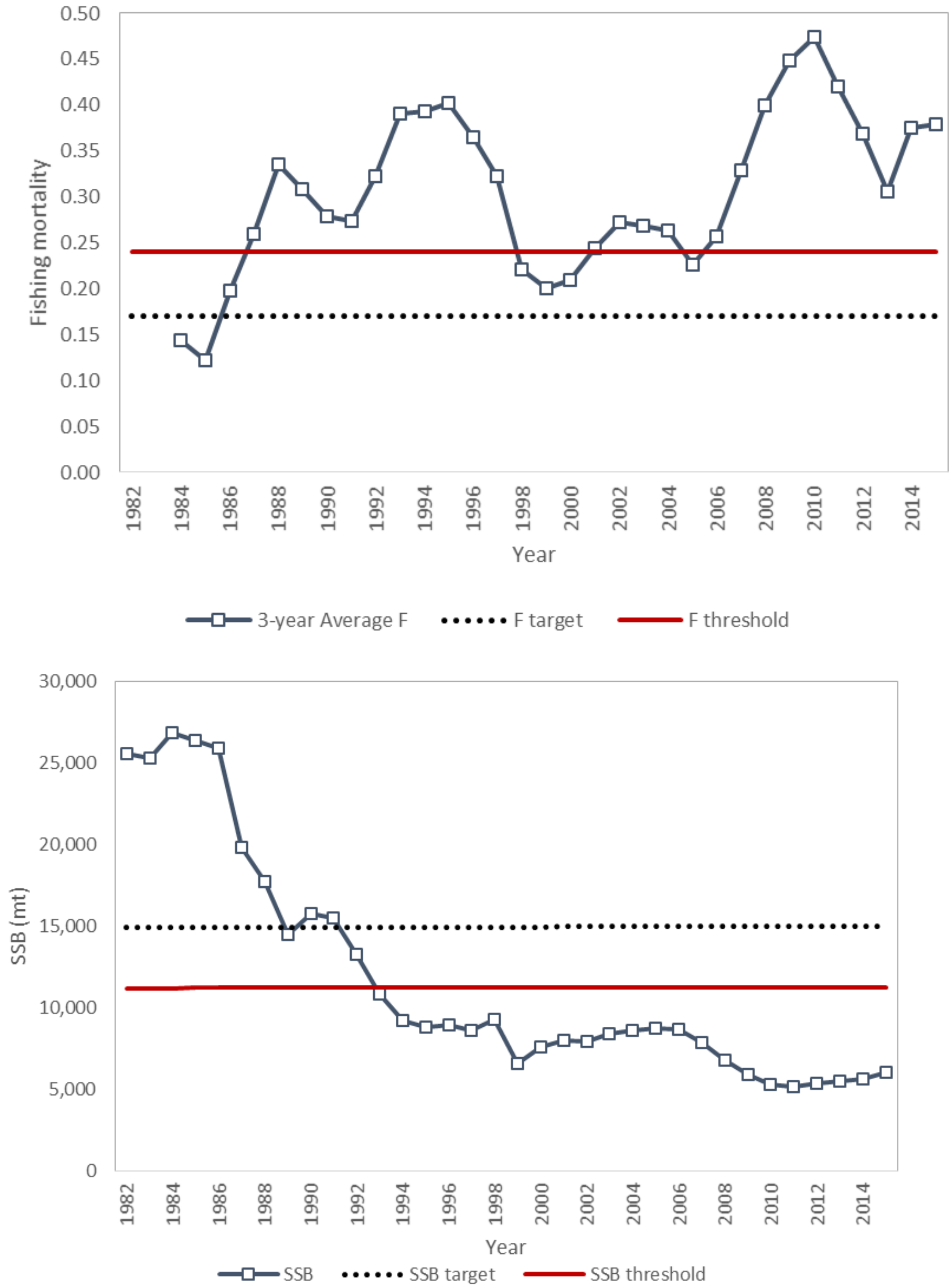


Figure 6.5.1. F (top) and SSB (bottom) plotted with their MSY-based targets and thresholds for the coast.

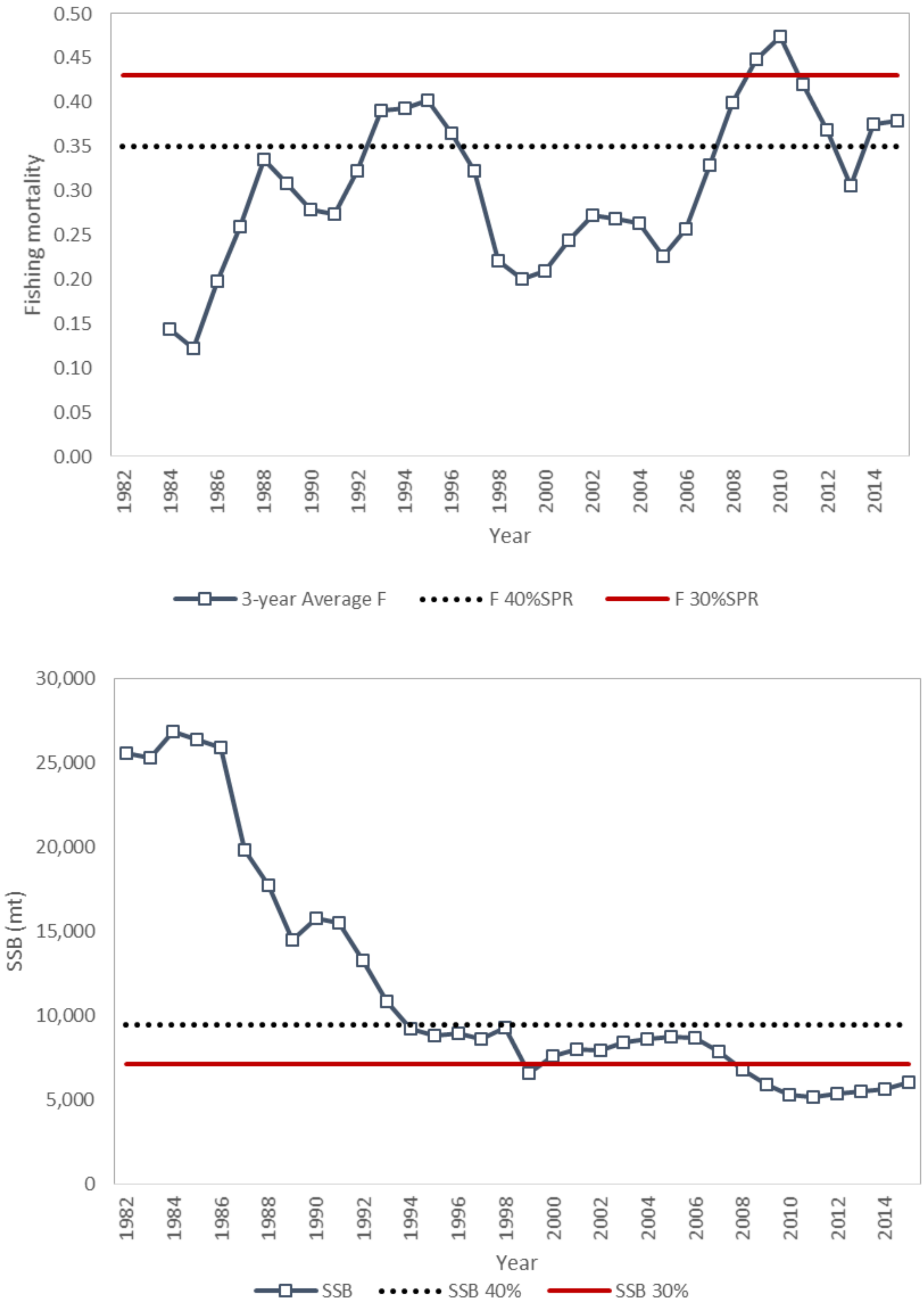
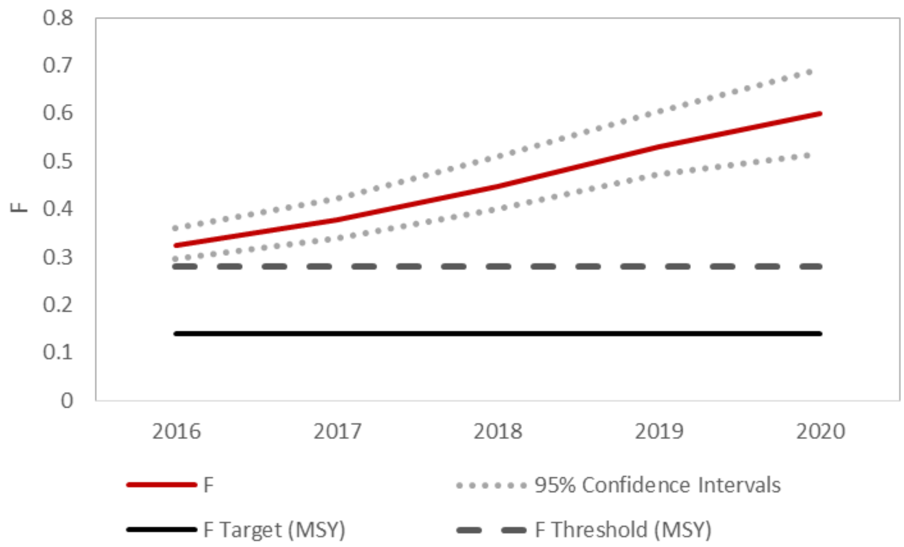


Figure 6.5.3. F (top) and SSB (bottom) plotted with their SPR-based targets and thresholds for the coast.



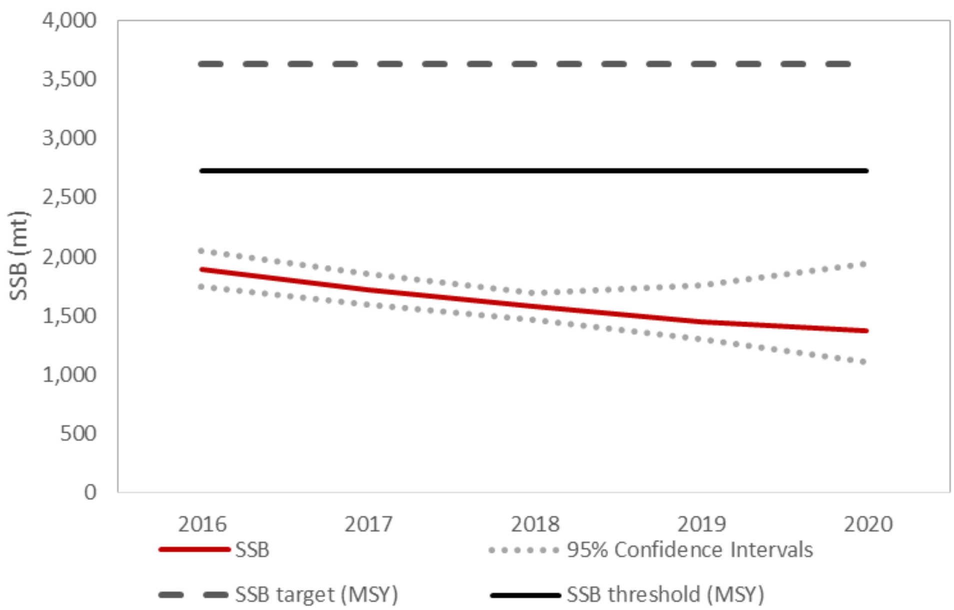
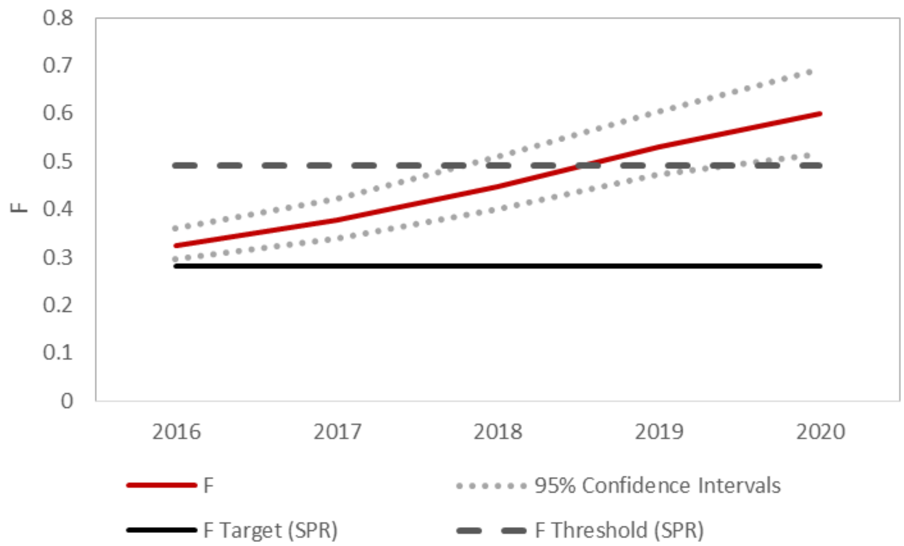


Figure 7.1.1. Short-term projection results for F (top) and SSB (bottom) under status quo landings for the MARI region relative to MSY reference points.



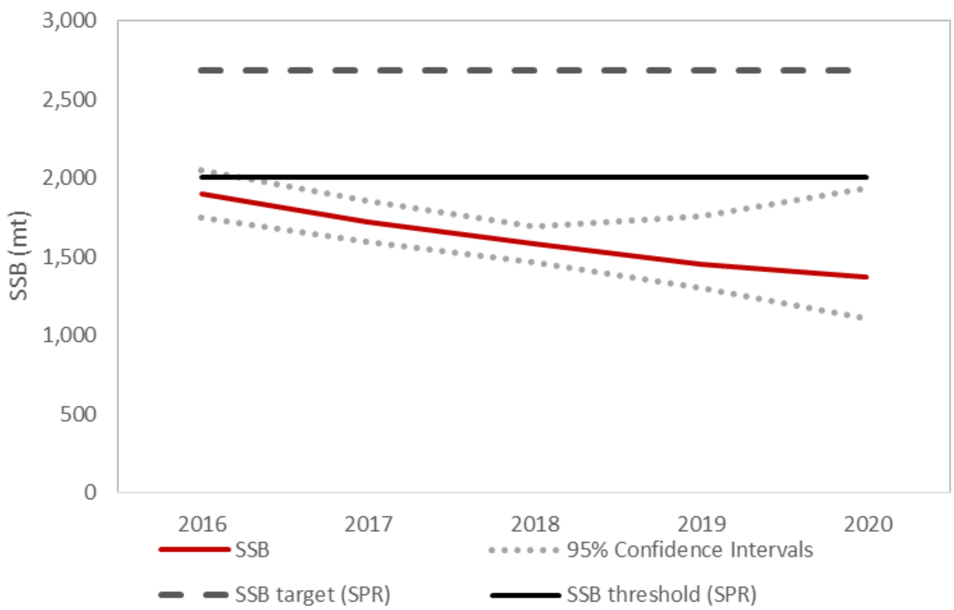


Figure 7.1.2. Short-term projection results for F (top) and SSB (bottom) under status quo landings for the MARI region relative to SPR reference points.

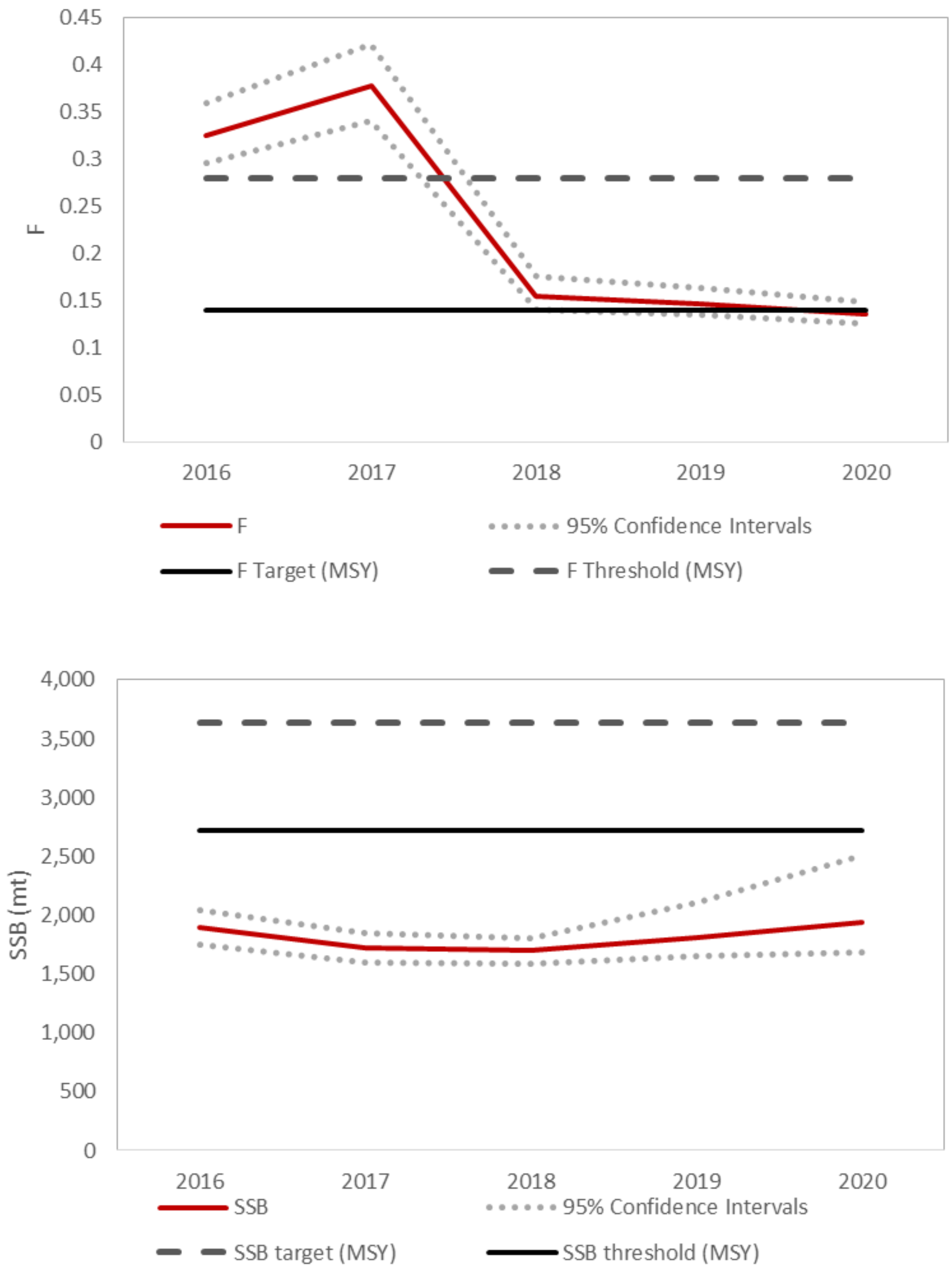
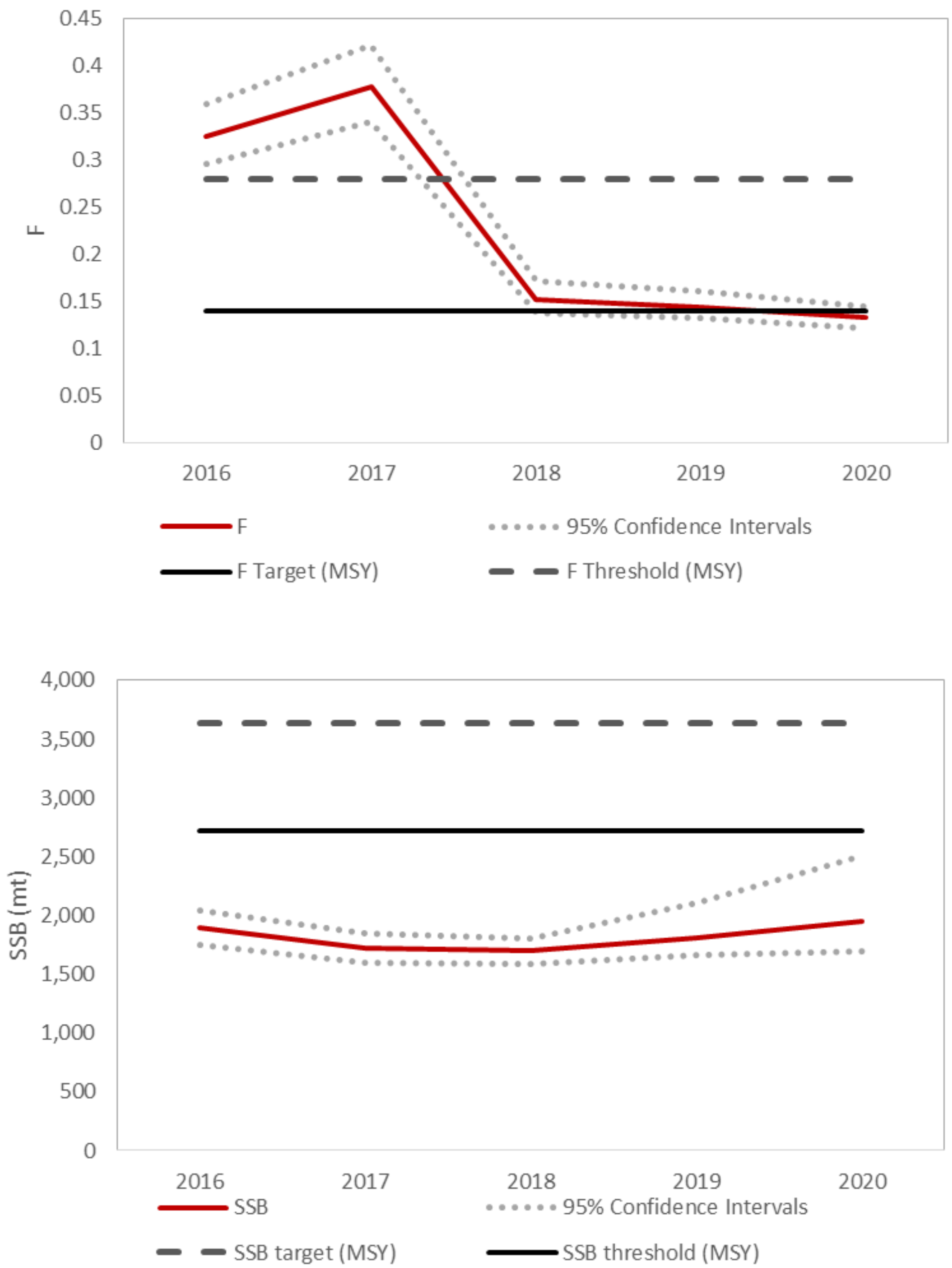
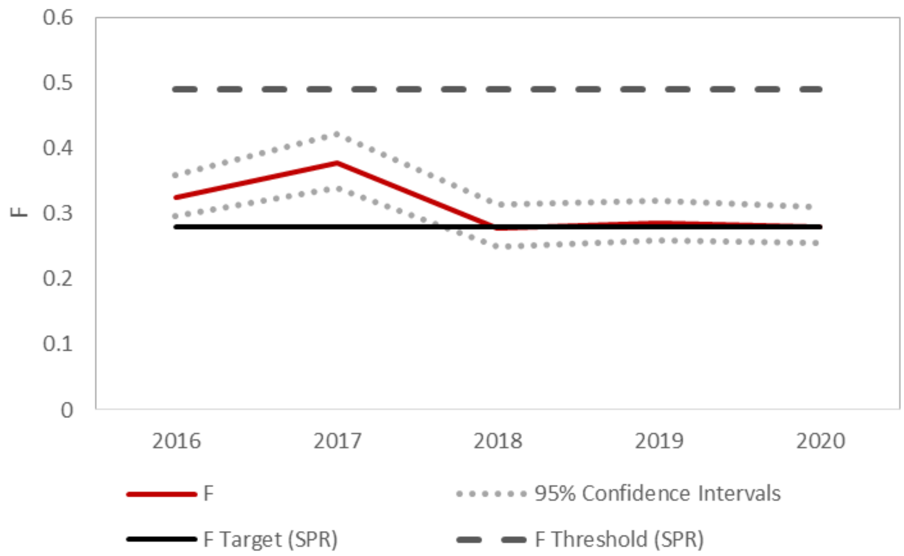


Figure 7.1.3. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the MARI region using MSY reference points.

Figure 7.1.4. Short-term projection results for F (top) and SSB (bottom) with a 70% probability



of achieving F target in 2020 for the MARI region using MSY reference points.



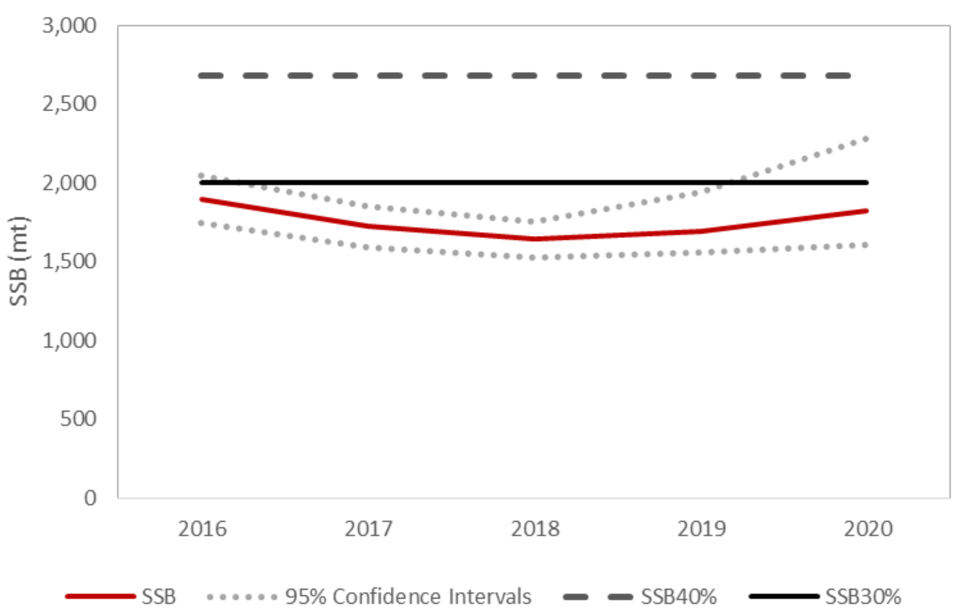
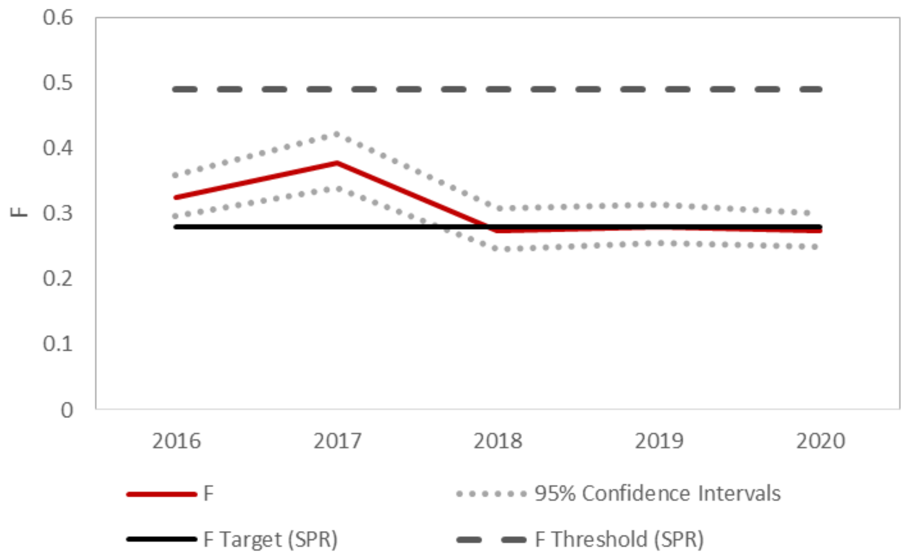


Figure 7.1.5. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the MARI region using SPR reference points.



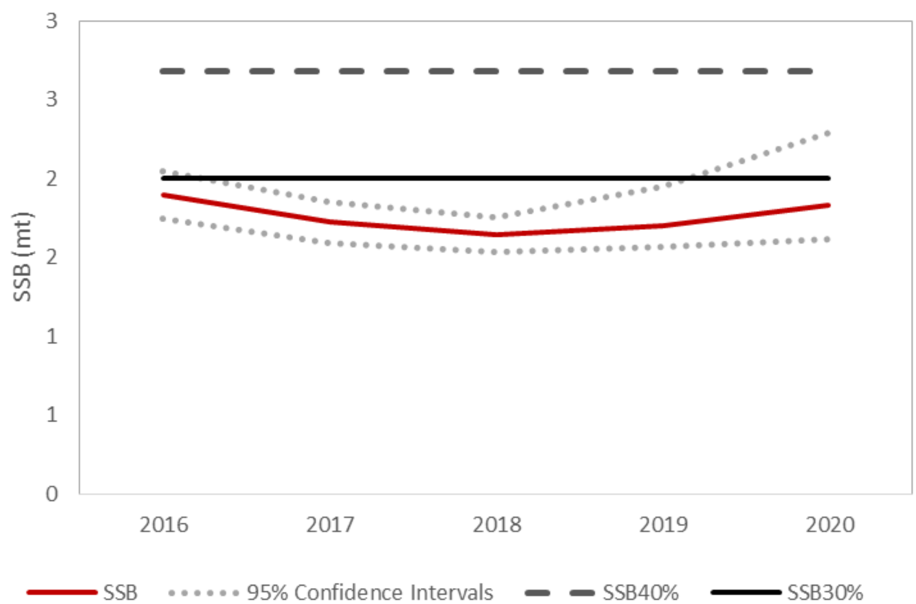


Figure 7.1.6. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the MARI region using SPR reference points.

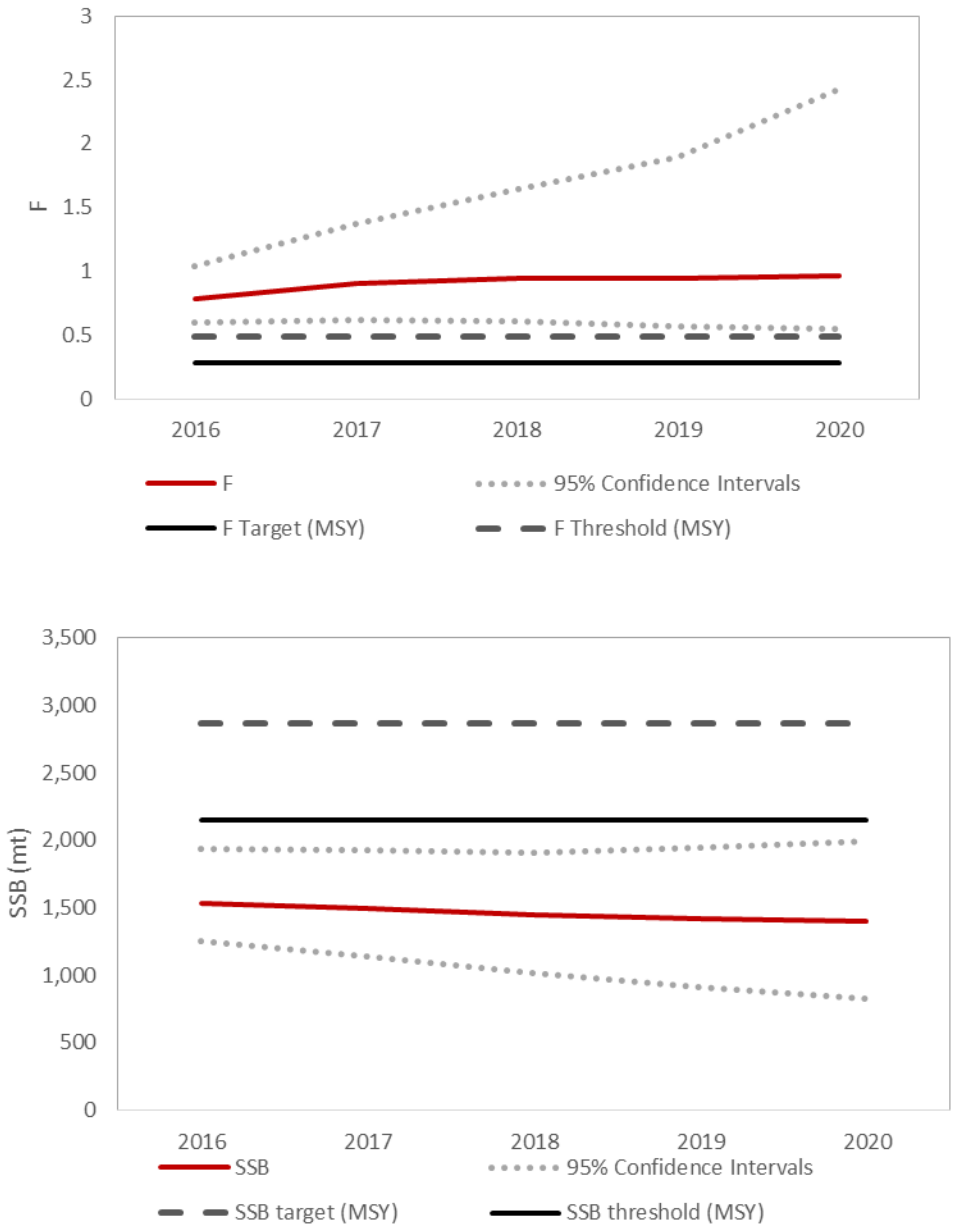
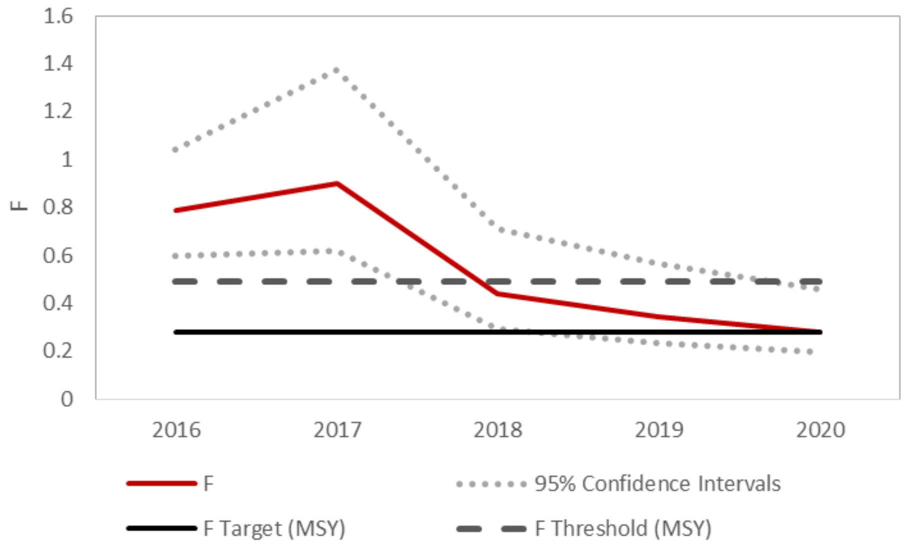


Figure 7.2.1 Short-term projection results for F (top) and SSB (bottom) under status quo landings for the LIS region relative to MSY reference points.



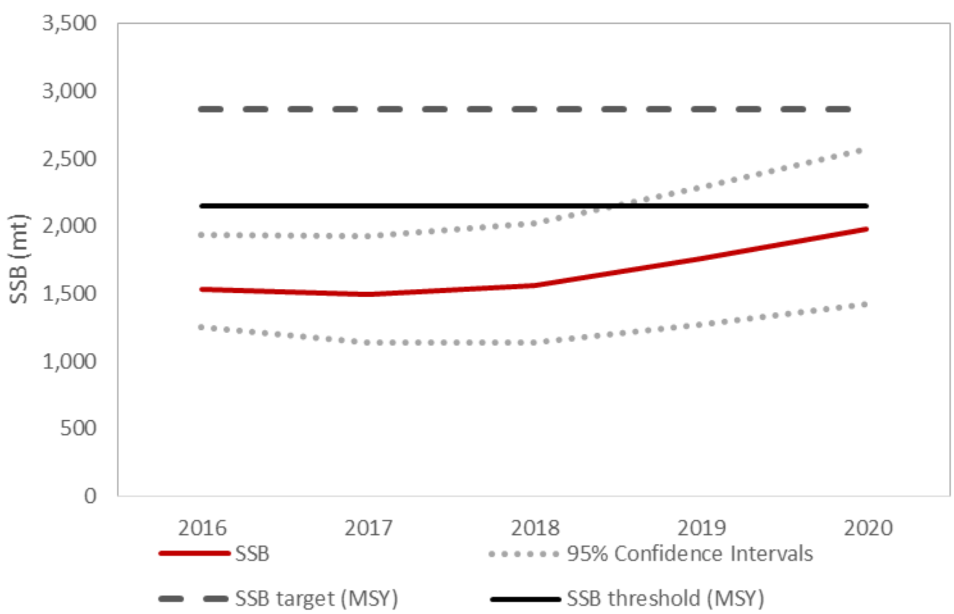


Figure 7.2.2 Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the LIS region using MSY reference points.

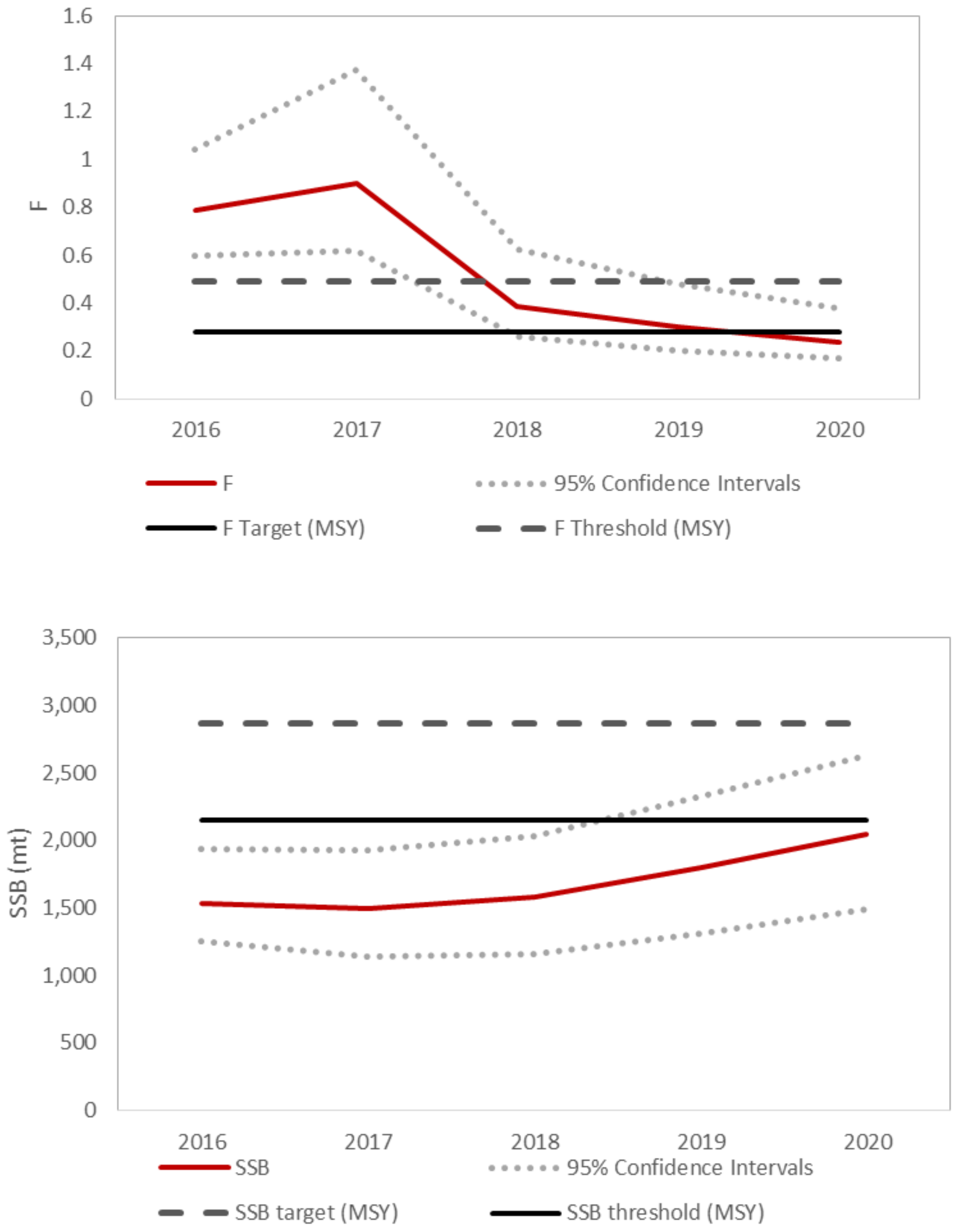
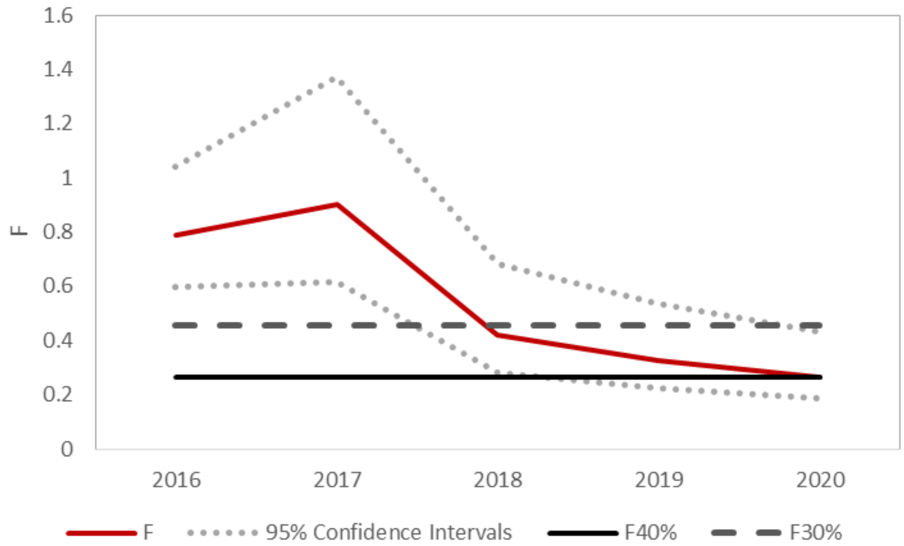


Figure 7.2.3. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the LIS region using MSY reference points.



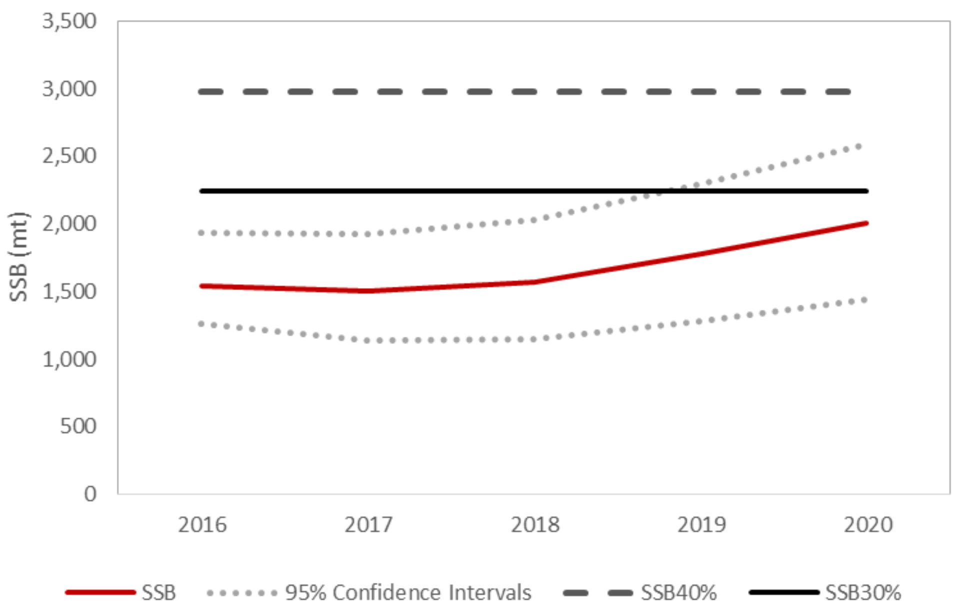
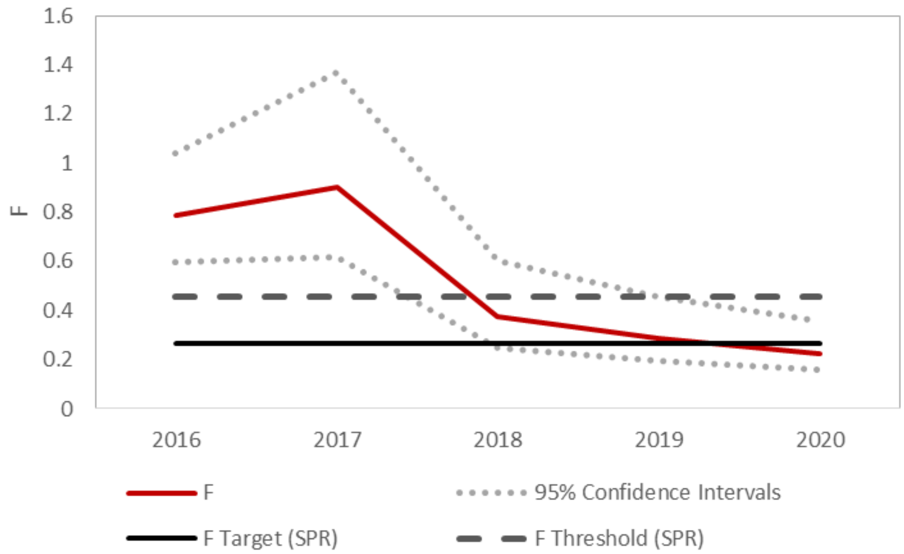


Figure 7.2.4. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the LIS region using SPR reference points.



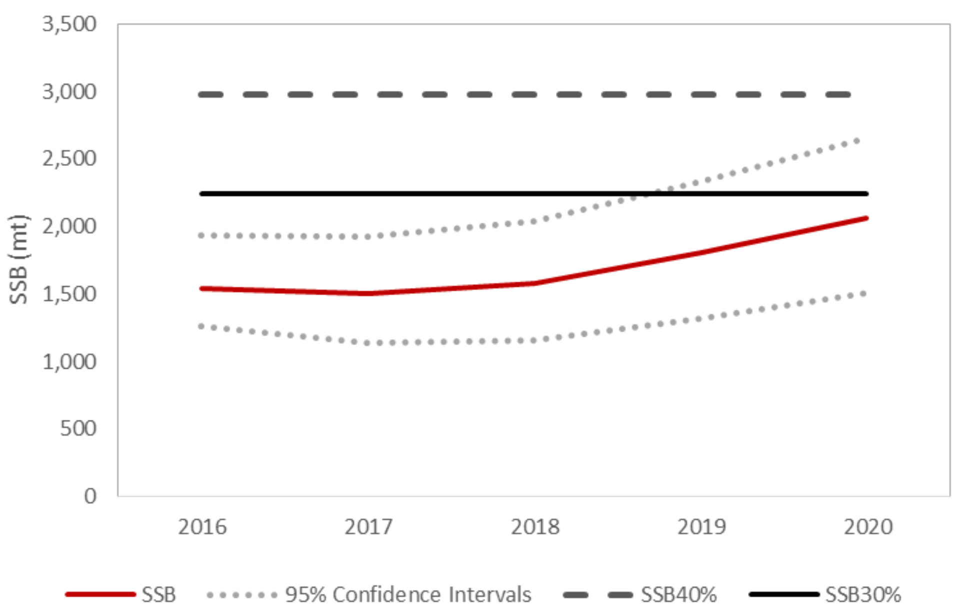
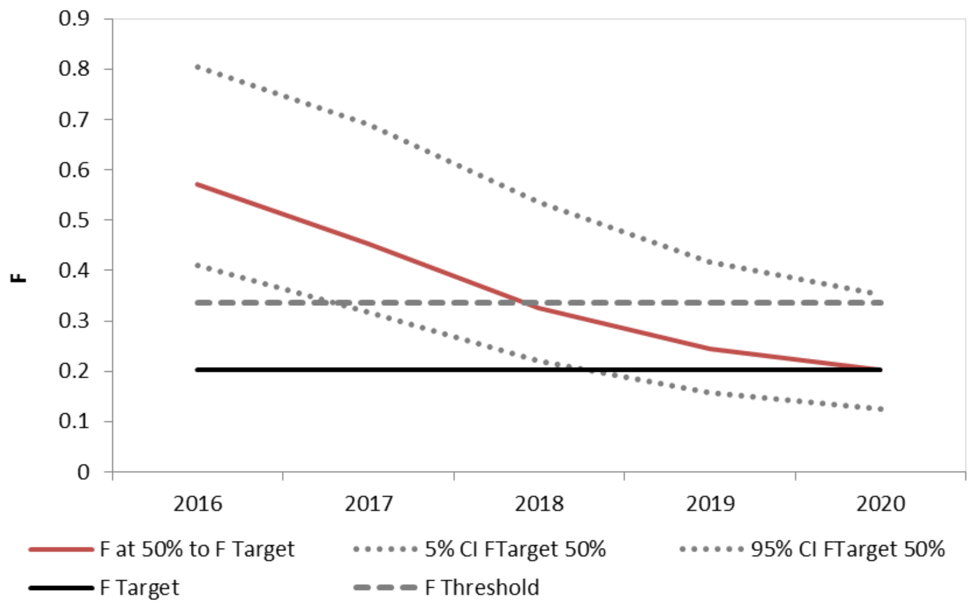


Figure 7.2.5. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the LIS region using SPR reference points.



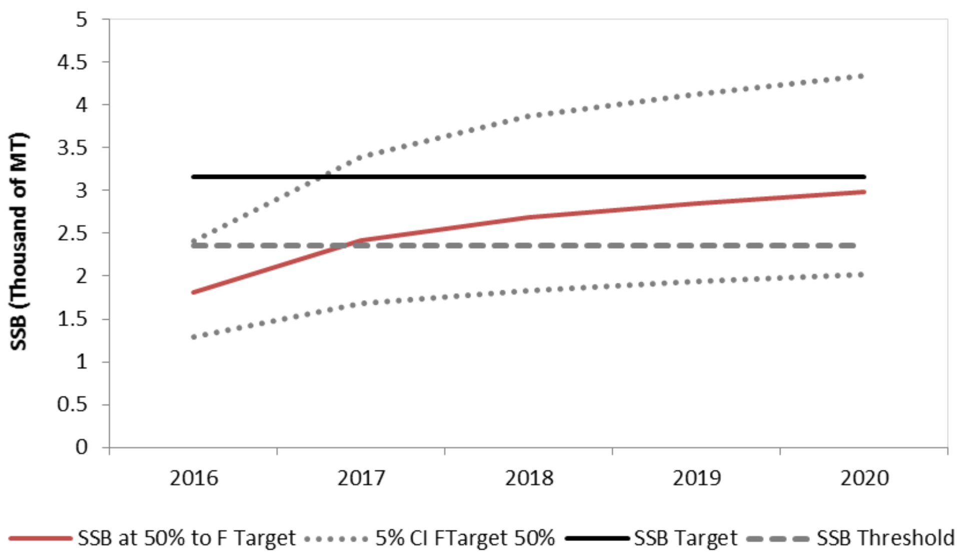


Figure 7.3.1. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the NJ-NYB region.

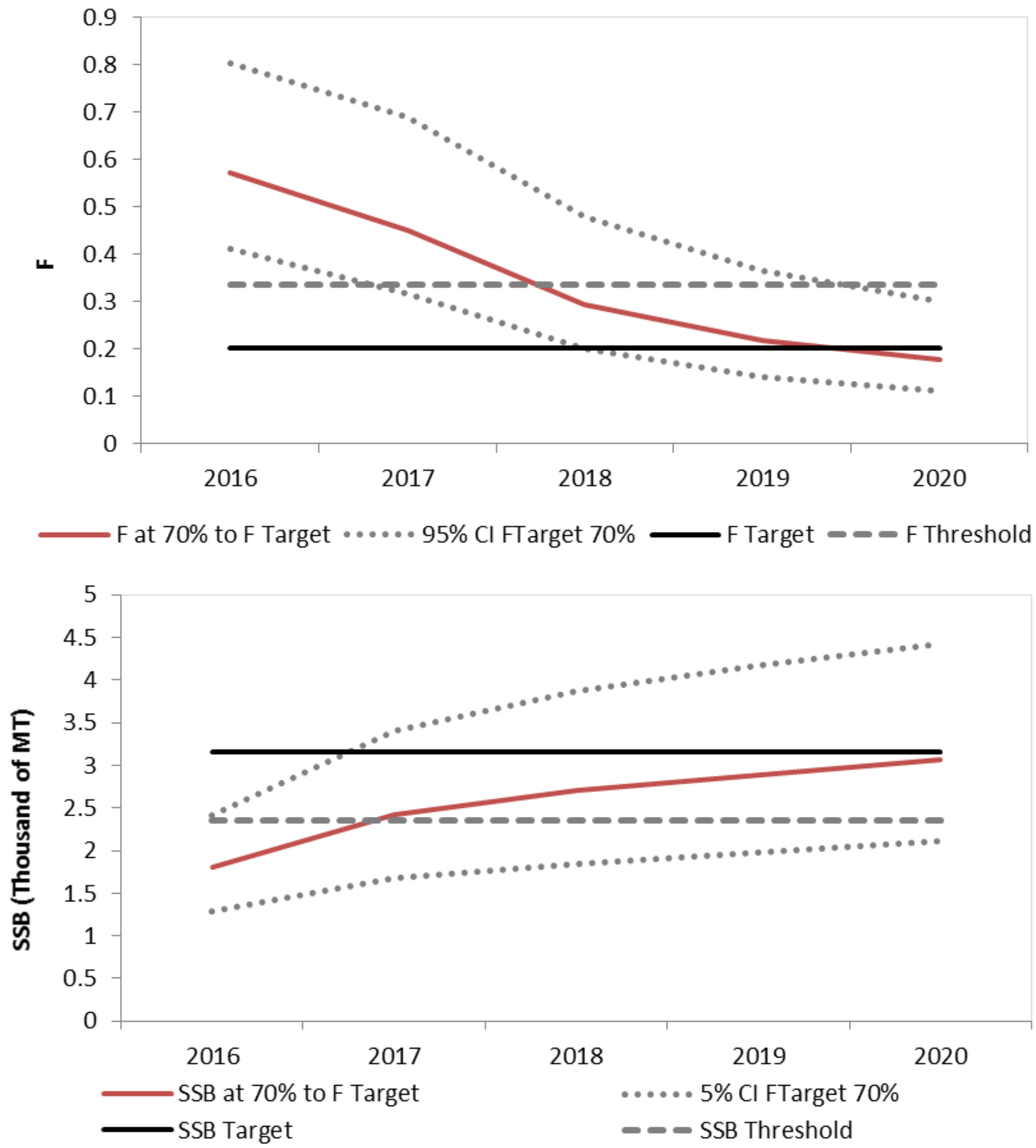


Figure 7.3.2. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the NJ-NYB region.

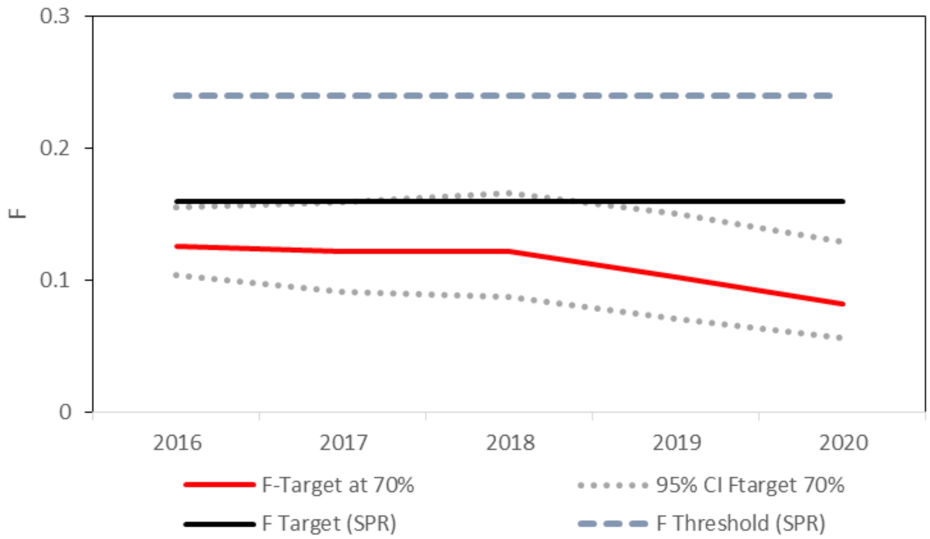
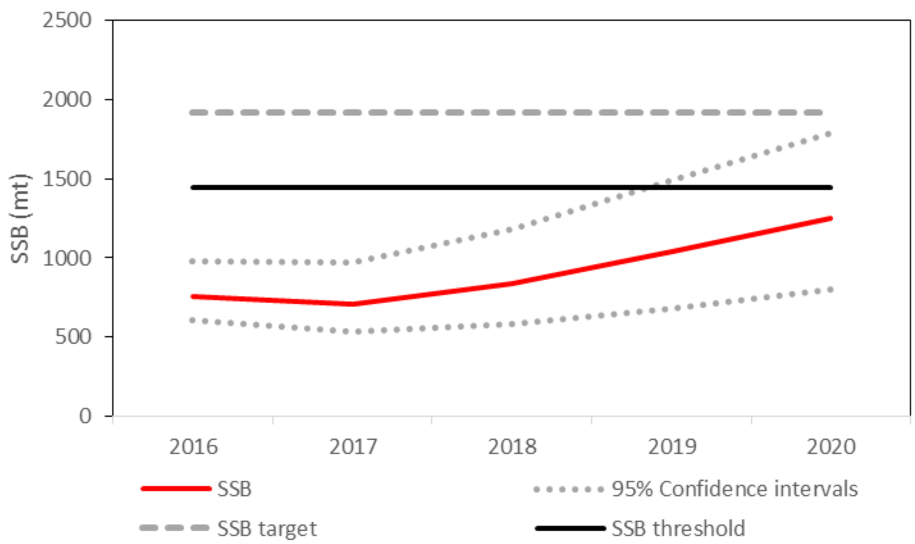
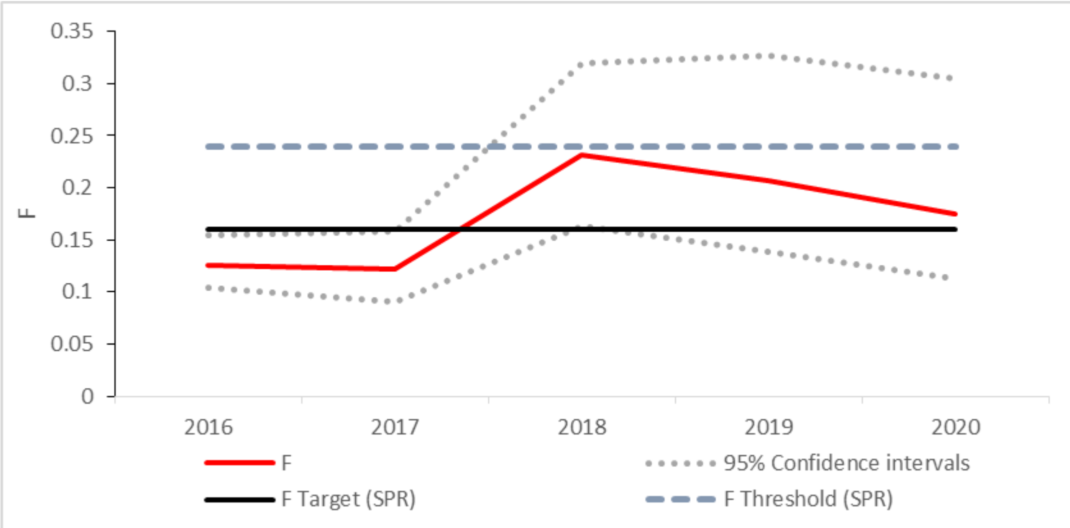


Figure 7.4.1. Short-term projections of F (top) and SSB (bottom) under status quo harvest



scenario for the DMV region.



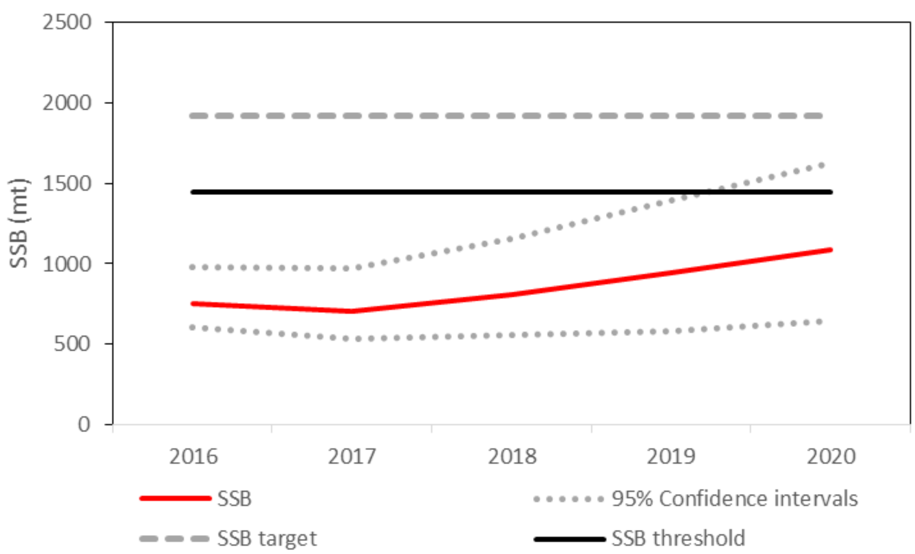
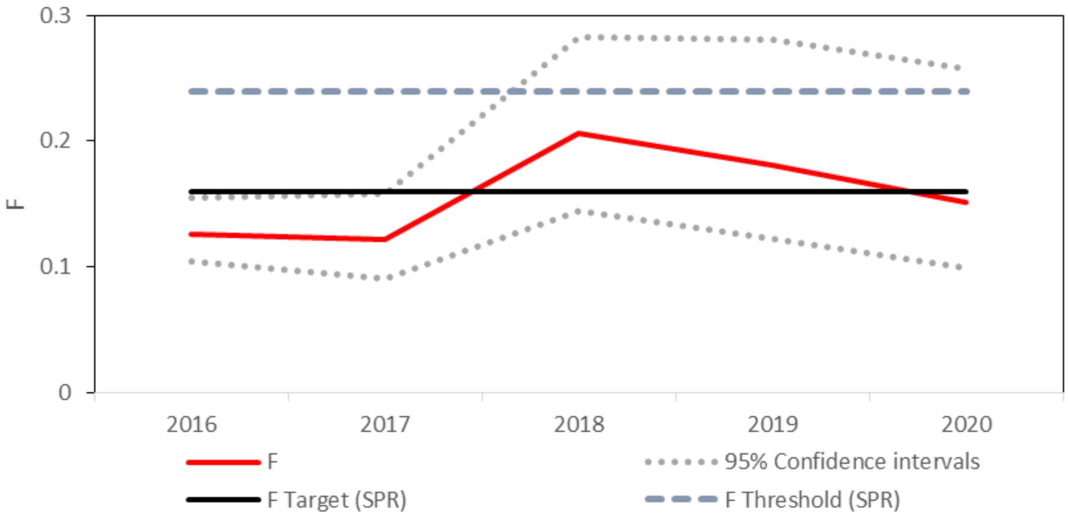


Figure 7.4.2. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the DMV region.

Coast



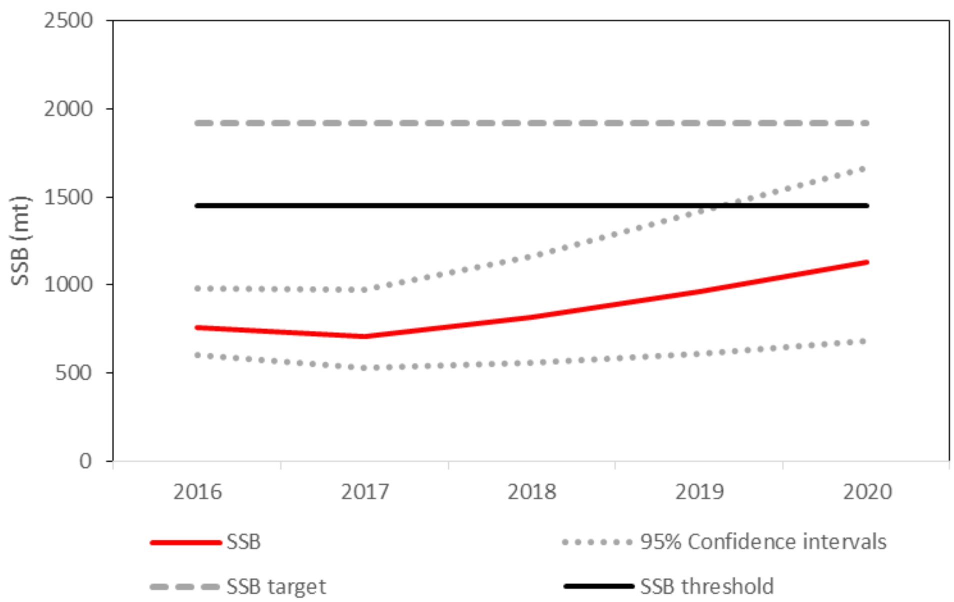
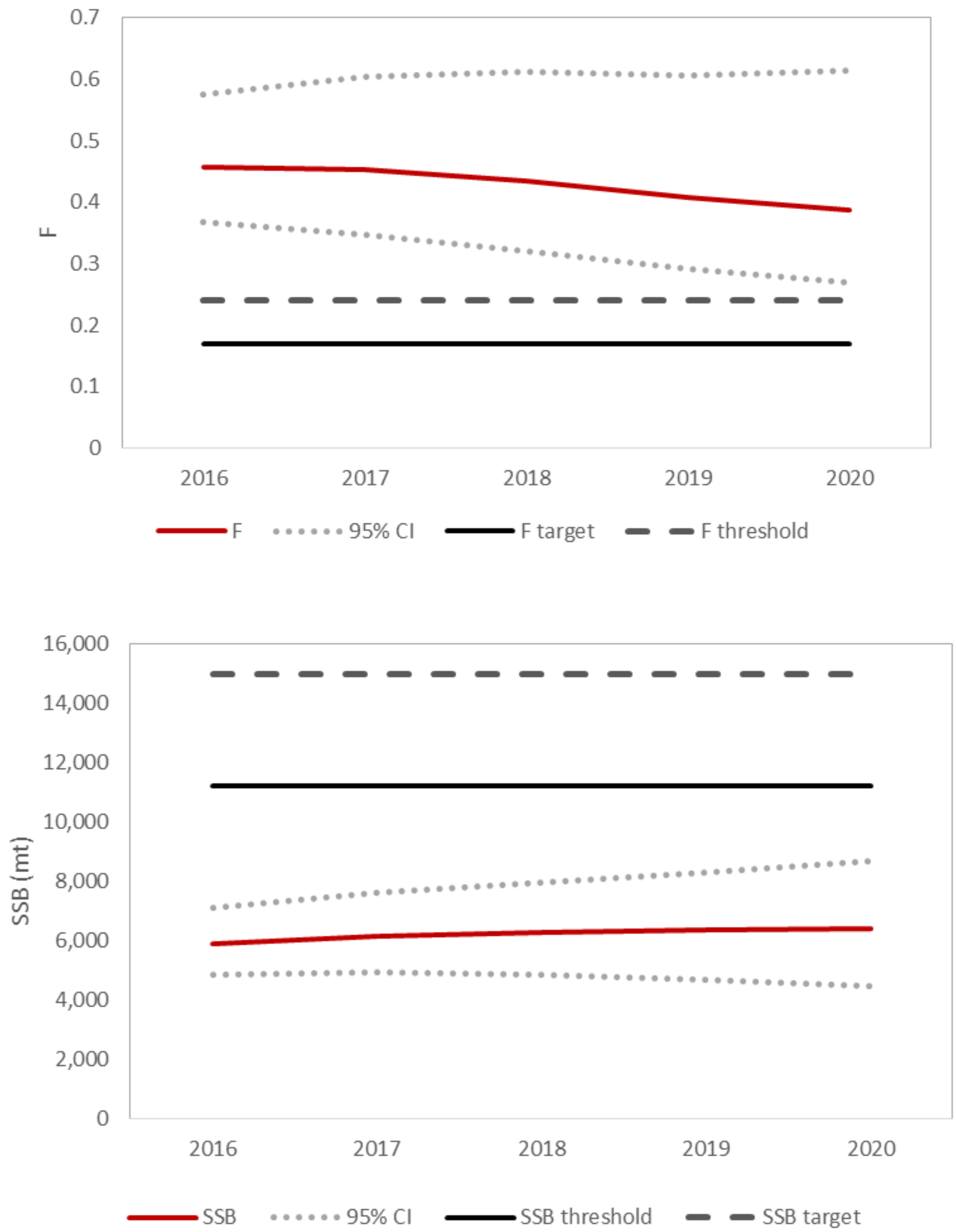
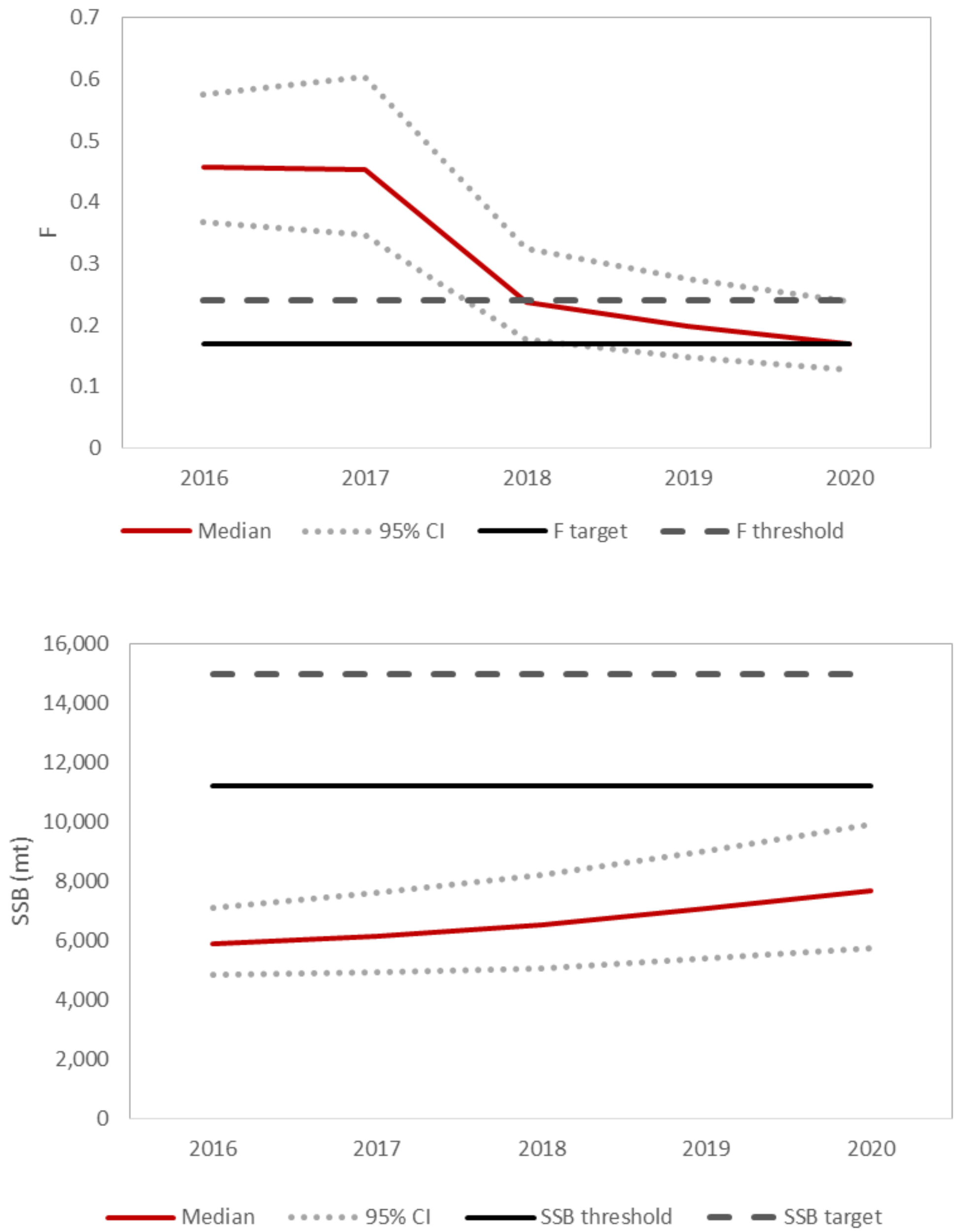


Figure 7.4.3. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the DMV region.

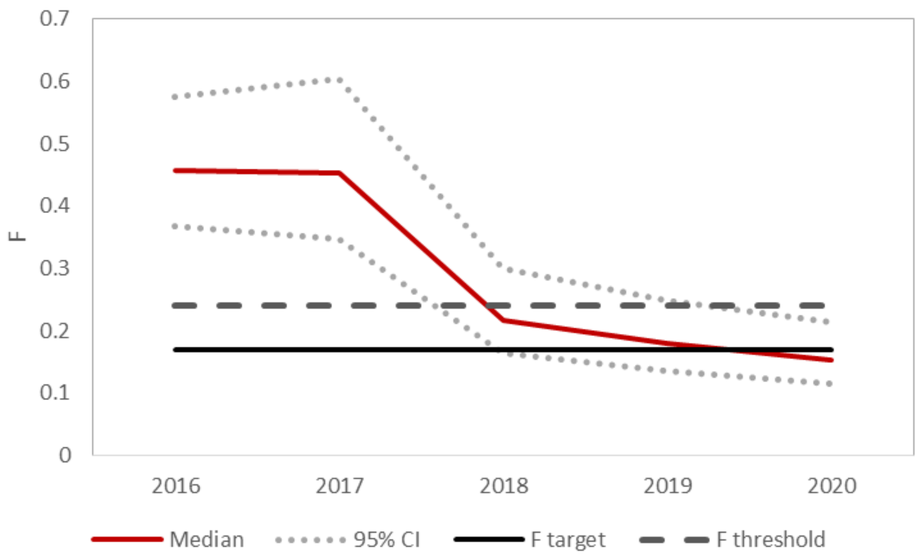


7.5.1. Short-term projection results for F (top) and SSB (bottom) under the status quo harvest scenario for the coast relative to MSY-based reference points.



7.5.2. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the coast using MSY-based reference points.

Coast



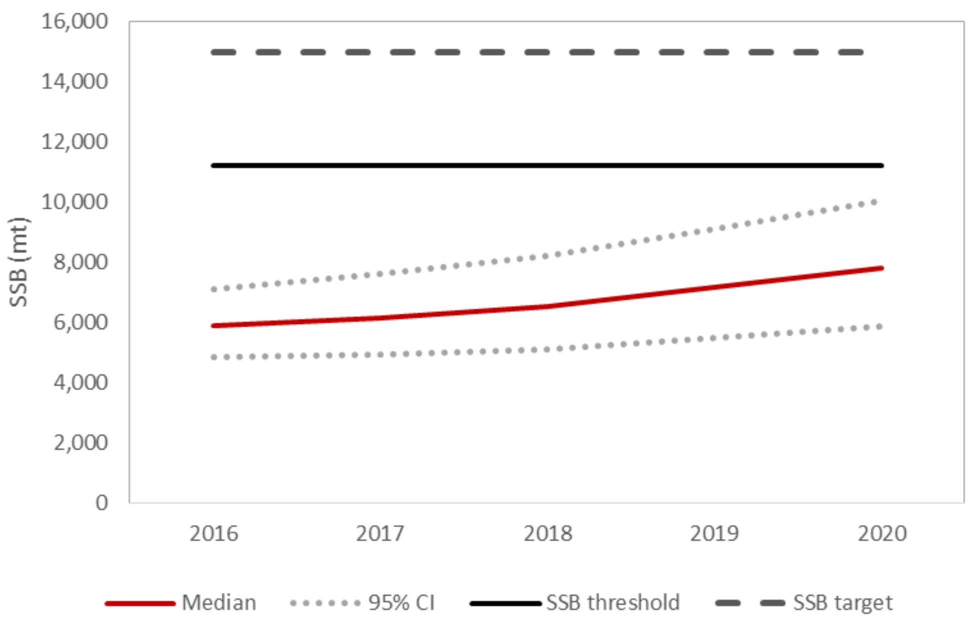
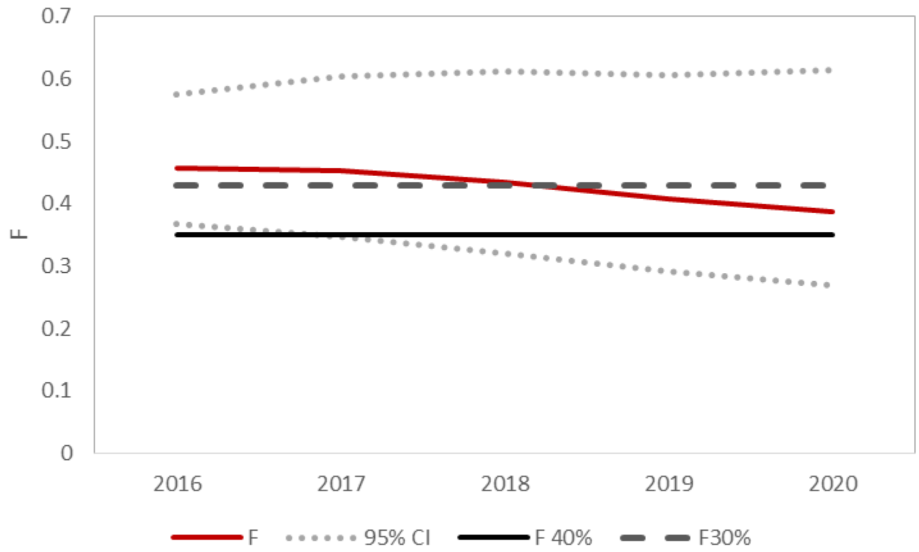


Figure 7.5.3. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the coast using MSY-based reference points.



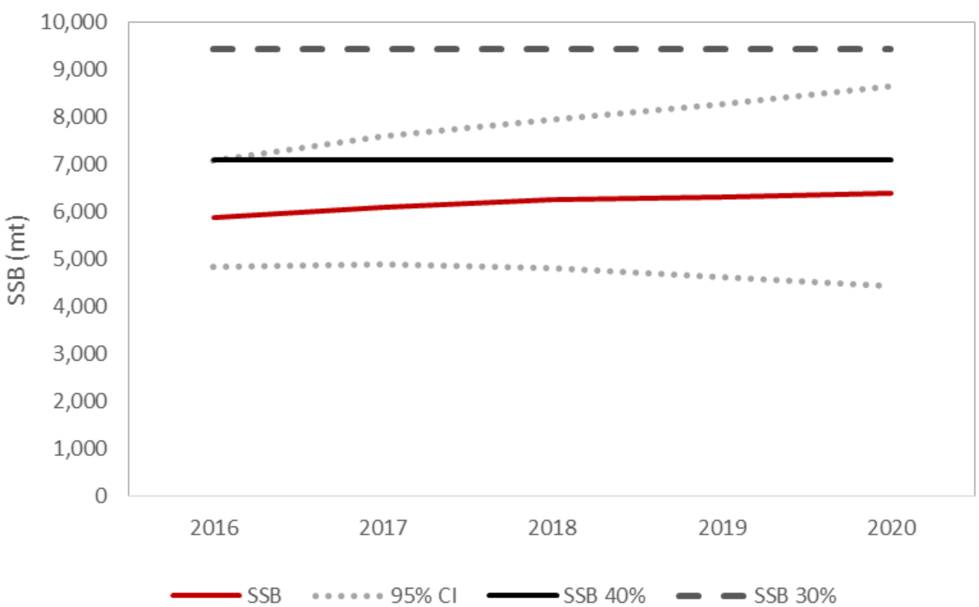
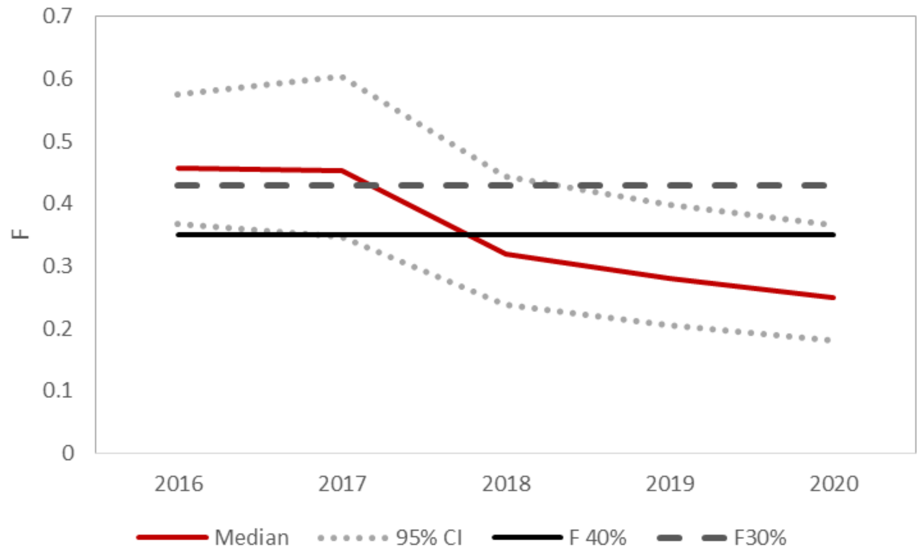


Figure 7.5.4. Short-term projections for F (top) and SSB (bottom) under the status quo harvest scenario for the coast relative to SPR-based reference points.



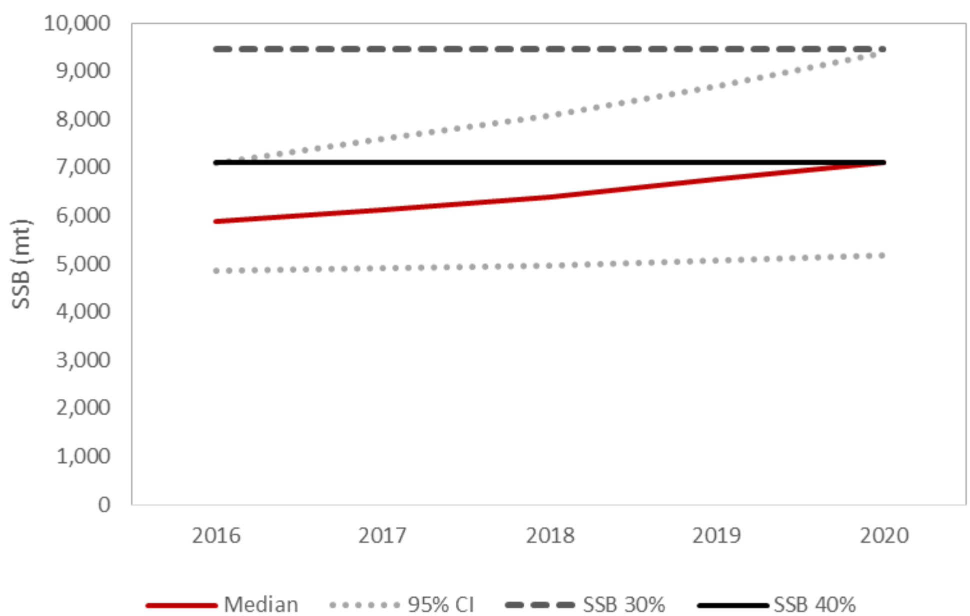
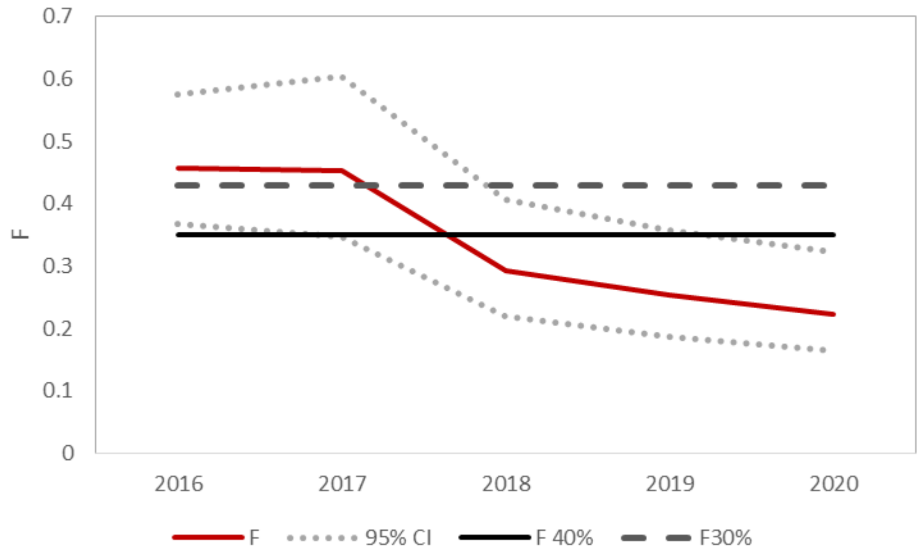


Figure 7.5.5. Short-term projection results for F (top) and SSB (bottom) with a 50% probability of achieving F target in 2020 for the coast using SPR-based reference points.

Coast



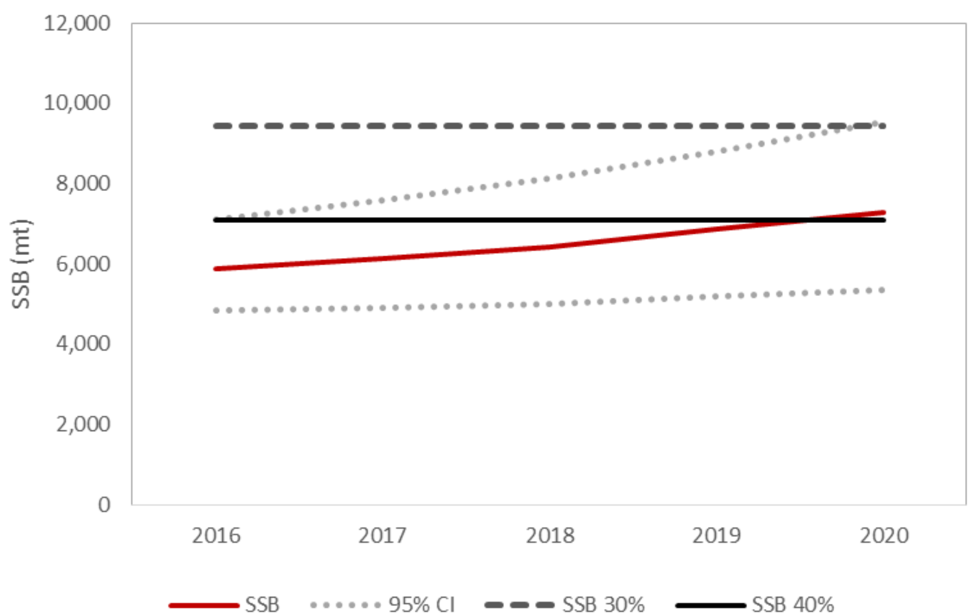


Figure 7.5.6. Short-term projection results for F (top) and SSB (bottom) with a 70% probability of achieving F target in 2020 for the coast using SPR-based reference points.