This document contains a compilation of supplemental briefing materials and documents submitted after the briefing book deadline for the October 2019 Council Meeting. The main briefing book is available at http://www.mafmc.org/s/2019-10_Briefing-Book.pdf. Please refer to the October 2019 meeting page (www.mafmc.org/briefing/october-2019) for additional information.

2020 Proposed Actions and Deliverables

DRAFT for Executive Committee Review – October 2019 Council Meeting

SUMMER FLOUNDER, SCUP, BLACK SEA BASS

1. Review 2021 specifications for summer flounder, scup, and black sea bass
2. Develop and approve 2021 recreational management measures for summer flounder, scup, and black sea bass
3. Develop advisory panel fishery performance reports
4. Initiate action to revise recreational management system for summer flounder, scup, and black sea bass to allow for greater stability and flexibility
5. Evaluate commercial scup discards and gear restricted areas
6. Conduct scoping and develop alternatives for Recreational/Commercial Allocation Amendment
7. Continue development of Black Sea Bass Commercial Amendment

BLUEFISH

8. Review 2021 bluefish specifications
9. Develop and approve 2021 bluefish recreational measures
10. Develop advisory panel fishery performance report
11. Continue development of Bluefish Allocation and Rebuilding Amendment

GOLDEN AND BLUELINE TILEFISH

12. Develop and approve 2021-2022 golden tilefish specifications
13. Review 2021 blueline tilefish specifications
14. Develop advisory panel fishery performance reports
15. Support efforts to address private recreational permitting and reporting issues (GARFO lead)
16. Tilefish survey (ongoing)

MACKEREL, SQUID, BUTTERFISH

17. Develop and approve 2021-2023 specifications for Atlantic mackerel, squids, and butterfish
18. Develop advisory panel fishery performance reports
19. Review butterfish cap performance report
20. Take final action on *Illex* Permit and MSB Goals and Objectives Amendment
21. Review recommendations of working group for real time *Illex* management
22. *Illex* growth and maturity data project
23. Review 2020-2021 chub mackerel specifications
24. HMS/chub mackerel diet study (final report)

RIVER HERRING AND SHAD

25. Develop and approve RH/S cap for Atlantic mackerel fishery for 2021-2023
26. Review RH/S annual progress update

SPINY DOGFISH

27. Review 2021 spiny dogfish specifications
28. Develop advisory panel fishery performance report

SURFCLAMS AND OCEAN QUAHOGS

29. Develop and approve 2021-2024 surfclam specifications and 2021-2026 ocean quahog specifications
30. Develop advisory panel fishery performance reports
31. Initiate Commingling/Discarding Issues Amendment[1]
32. Surfclam genetic study (contract; ongoing)

SCIENCE AND RESEARCH

33. Initiate a workshop to review and consider redevelopment of the RSA program
34. Continue to support the Fishery Dependent Data Initiative (GARFO lead)
35. Initiate climate change and distribution shift scenario planning
36. Identify new SSC membership
37. Convene joint Council-SSC meeting

ECOSYSTEM AND OCEAN PLANNING/HABITAT

38. Coordinate Northeast Regional Habitat Assessment (NRHA)
39. Continue work on EFH Redo
40. Initiate EAFM management strategy evaluation for summer flounder
41. Update the EAFM risk assessment
42. Develop habitat- and fishery-related comments on offshore energy development

GENERAL

43. Complete the Commercial Fisheries eVTR Framework
44. Track relevant MSA/fisheries legislation and develop comments as requested

COMMUNICATION AND OUTREACH

45. Continue to implement Council communication and outreach plan
46. Develop and maintain Council action web pages
47. Develop fact sheets and outreach materials as needed
48. Complete website update and improvement project

POSSIBLE ADDITIONS

49. Expand summer flounder recreational management strategy evaluation to cover scup and black sea bass (contract)
50. Develop RH/S discussion papers (biological caps, New England alignment, hotspots)
51. Review red crab and lobster fishery exemptions for discrete deep sea coral protected zones
52. Initiate Fixed/Variable Costs Surveys and Employment Amendment (all Northeast fisheries)[1]
53. Initiate action to address right whale issues
54. Modify list of ecosystem component species from Unmanaged Forage Amendment (e.g., addition of cancer crabs)
55. Maryland Recreational Ocean Effort Video Estimation project (contract)

---

[1] Additional details and background on these proposed deliverables: http://www.mafmc.org/s/NextStepsITQReview_Input_2019-10-02.pdf

**Summary of the Atlantic Surfclam and Ocean Quahog (SCOQ)
Advisory Panel Meeting and
SCOQ Committee Meeting - September 17, 2019**

To review

SCOQ Catch Share Program Review – Next Steps

The Mid-Atlantic Fishery Management Council's (Council) SCOQ AP and SCOQ Committee held separate meetings on Tuesday, September 17, 2019 to review and provide comments on the Fishery Management Action Team's (FMAT) technical recommendations to address potential actions from the Catch Share Program Review conducted by Northern Economic, Inc. The input from the AP and Committee will be provided to the Council's Executive Committee at the October 2019 Council meeting, when the Council discusses its 2020 Implementation Plan. The following provides a summary of common themes provided during those meetings.

<u>AP Meeting (morning session)</u>

AP Members: Thomas Alspach, Tom Dameron, Michael Ferrigno (listen-only webinar), Howard King, Jeffrey Pike, David Wallace. Staff: Jessica Coakley, José Montañez.

Others: Doug Potts, Peter deFur, Peter Hughes, Daniel LaVecchia, Mike Ruccio (listen-only webinar).

Jessica Coakley presented a summary of the FMAT recommendations and reviewed the Actions Summary Matrix. The AP provided the following comments regarding the four general topics/issues that were discussed.

1) Discards - Evaluate the possibility of using electronic monitoring to assess discards (co-mingling) in these fisheries

- It was asked: what is the connection between the evaluation of the catch shares program review and discards? Discards would occur regardless the catch share program or not. Could you connect the dots for me? Staff responded: As part of the catch share program review, one of the emerging issues that was raised by the industry in particular was the shifting in the clam distribution and this commingling issue as something of concern. The oversight team flagged this as an issue/area that may need work (in the memo to the Council in June). Industry has indicated that this is a problem given current fishing regulations (i.e., industry cannot currently land both surfclams and ocean quahogs on the same trip) and they have raised this issue directly with the Council and GARFO.

This is how this ended up folded into the list of potential issue for Council consideration because.

- This is really a commingling issue and not a discard issue. However, if you do not have quota for one of the two species and land both species (surfclams and ocean quahogs) because of the commingling, then you may end up discarding, but you cannot be blamed for that. Another item that is included in the catch share program review discussion is that there could be of surfclams discards in ocean quahog trips and vice versa.

- Maybe the name of this topic needs to be reworked. As this is really a commingling issue and not a discards issue.

- Staff indicated that if the Council we were to move on, to address this issue, using a white paper or amendment, we could find a more articulate way to describe/title of this issue. The discard/commingling issue was bundle by the oversight team for simplicity.

2) Improved Social and Economic Data Collection

Crew permit or registry

- Question: Is the information needed regarding employment for the boats only? Bumble Bee owns ocean quahog quota and a large percentage of the workers in our factories are minorities, which is an important component of the overall fishery per se. So, I think it should be expanded to include perhaps information about the processors that process the clams harvested through ITQs. Staff responded: In the past, at some point, there were mandatory processors reports which were held at headquarters (national processors surveys). Then, they were made voluntary. We used to collect processor's information on things like employment, etc. But this is now voluntary and not well reported. Here we are addressing the crew piece but it could be expanded to include processors employment as well.

- Disagree with the crew permit idea/issue. Because, it could be revocable by enforcement should the crew do something wrong; and we may have less access to workers as some people may not want to go through a permitting process in order to be on a boat. A registry may be different and perhaps ok to have. This should become the burden of the vessel owner. There is a different demographic component when it comes to the crew members in the clam fisheries and you may have a hard time with that type of registry collecting accurate information. Going through the employer, say at the end of the year, would likely produce better results. Staff responded: for example, the Council and other Committees have asked for this type of employment information as it is important to better assess fishery management impacts. We may need to have the flexibility to craft to specific fisheries, but in all, this information is needed. Also, regarding crew members, we know that some crew members move across different fishing fleets, and this is not captured at all. So, we know that crew members move around and this makes intercept surveys harder to conduct. Therefore, intercept surveys are difficult to implement given these dynamics. Having an understanding of the boundary of the universe of people that we need to survey (through a crew permit registry) would assist in the collection of relevant information (via surveys) to conduct more robust analysis in terms of economic and social impacts of future changes in fisheries management/regulations.

- What is the purpose of knowing who the crew members are? Is tracking people the right thing to do? Do we even ask their age when they come to work for us? So, why do we need to ask their age? Is the purpose of this to track what they do? I disagree with collecting this information directly form the crew members. The boat owners could provide canvass information once a year if needed. Staff responded: the information that could be gathered is general demographic information (e.g., age range) and not intended to eb tracking people's moves. For example, one of the most frequently asked pieces of information by members of Congress, constituents, and other groups as well is employment. When they are proposing to build windfarms for example, they want to know how many people could potentially be impacted. Lastly, understanding the universe of people participating in the fisheries could also enhance future collection of social information that would help the Council better assess crew members attitudes towards specific fisheries management regulations.

- General information could be collected to help, but dockside surveys/personal interviews could be less costly and work well.

Fixed cost/variable costs

- Regarding the collection of information on fixed/variable cost, there are a lot some pretty substantial hurdles due to the potential time required to provide the information. Also, collection this information on a trip basis would be challenging. For example, we have a boat that has a 24,000 gallon fuel tank. We refuel this boat every few weeks and use the boat to conduct multiple fishing trips during that two week period. It is very difficult to assess fuel costs on a per trip bases for all those trips. In the clam fishery, collecting cost information on a trip by trip basis may be difficult. Perhaps, annualizing these cost would be better for the clam fisheries. Staff responded: no specific approach to collect this type of information has been presented. Specifics will be developed in the future if needed. This is needed for multiple fisheries throughout the region, so more work would be needed to assess specifics.

- Because clam boats run two to three trips per week throughout the year. You need to consider collecting information annualized. This would provide good cost averages. Collecting this information for short time periods (trip-by-trip basis) will not work due to difficult logistics. Also, engine replacement, clam dredge gear, etc. need to be annualized. Collecting this information weekly, or on a trip-by-trip basis will not be accurate.

- Staff indicated that if the Council goes through the process of addressing this issue thought an amendment, industry input will be solicited on the potential costs information to be collected through its normal amendment process and we will work with the APs, FMAT, Committees, etc.

- Staff indicated that NMFS published a technical document that summarizes all the fixed/variable costs information collected throughout the country. If the Council decides to address this issue in the future, we will make sure that this information is used when developing cost information needed to avoid unnecessary burdens to the industry.

3) Decline in Independent Operators & Barriers to New Entry (these two areas are inter-related)

- From time to time, I remind myself that it has been an entire generation since Amendment 8 was first implemented. I would imagine that most people in the Council and Committee may not even remember that the purpose of Amendment 8 was to encourage and promote a decline in independent operators. That was the purpose of the ITQ program. It strikes me as ironic to say the least that now we are concerned with how we get these independent operators back into the industry. Specially, after creating a structure to allow them to exit the fishery and easing the pain during this transition process (by allowing them to take their value of their ITQs).

- It is a significant, huge undertaking to figure all of this out. My company has gone to vessel operators in other fisheries and asked them to come to work for us and they will not touch our propositions with a ten foot pole. If you look at what is coming down the pipeline in terms of wind energy development and the amount of ocean that we may lose because of that development. Many operators would not consider investing capital to enter the clam fishery because of the risks and unknowns surrounding this industry. Also, younger generations value quality of life above a paycheck and do not want to get into this fishery as it requires a lot of sacrifices to take on the life of a fishermen. This is a multifaceted complex problem because of the industrial nature of the fishery. All of these issue complicate things and we wonder where the new entrants will come from. Every industry representative here understands that the is extra quota out there for us to harvest and we try to create additional market to use the excess quota. We are the experts and have the knowledge of how this industry operates. And to think that a new entrants without any knowledge of the industrial fishery can just come in and figure this out and take advantage of the slack in the market is difficult. The risk/reward incentives are not there. My company would love to see new entrants in this market, if you have a 60 cage surfclam boat or a 60 cage ocean quahog boat, and you want to fish for us, we will sign a contract with you tomorrow. But those people are not out there to make a $5 million investment on a new boat and come to Surfside and say we would like to fish for you.

- Question: The idea here is to basically make a white paper that would address moving this into a bigger further process? Because, I agree with the prior comments, the barriers of entries are a multiple levels due to the complexity of the business. So, when you say that this is a “moderate task” you are referring to the development of the white paper per se and not the complexity of the issue? That could be a major task in the future? Staff responded: Yes, the moderate amount of work needed is in the drafting of the white paper. So, if we get some teams together to draft the specific things/issues that we have been discussing in a white paper (e.g., water quality discard issue in the processing sector, harvesting constraints (gear needs, etc.), put all of these information regarding barriers of entry together and package it up for the Council to have a conversation. The FMAT also discussed framing the barriers of entry in the clam fisheries in the context other industrial fisheries in the region or around the country (that may also have or be facing similar barriers of entry) like the Atlantic herring fishery. The white paper will identify those points that represent barriers of entry or challenges for entry in the harvesting and processing components of the fisheries. Again, this task is moderate because it is just about identifying those barriers of entry versus doing something to address them. The task of doing something in the future to address barriers of entry could range from moderate to extremely difficult.

- Unless this issue is a requirement, you may want to leave this alone. Because this is a documents that is going to create an enormous amount of debate in regards of who is putting this white paper together. Similar to the debate that we are having in regard to the excessive shares alternatives. Industry was not brought into the process/economic analysis of developing the Excessive Shares Amendment. If industry is not involved in developing this white paper, it would be extremely broad and highly speculative.

- The clam industry is an industrial business. It has maybe one mom-and-pop business that were started in New Bedford because they had three boats that fished on Nantucket Shoals. This is a rudimentary function and is an anomality. The fact of the matter is that clams have moved offshore and the high production areas in New England have been closed by the Habitat Amendment. So, this creates problems for small clam boat operators. Those small boat operators cannot move offshore to Georges Bank because their boats are too small and the testing regulations by the FDA are such that they cannot afford the testing because they cannot not do the high volume required to afford the testing cost. Small boats are not equipped to travel the long distances required to fish on Georges Bank. The fishery has turned into an offshore fishery; it used to be an inshore day boat fishery. The fishery requires large investments to buy large capable boats and processing facilities. We invested capital into the fishery over a long time period. New entrants would have to invest needed capital all at once in order to be competitive. The investments would have to be very large, like in the menhaden fishery (i.e., large boats and processing plants to handle the harvest). You would need investments of hundreds of millions of dollars to enter the industrial fishery if you started from scratch. The end result of the white paper would be a significant documents describing the barriers of entry at multiple levels in the business for an industry that is highly regulated fishery by the EPA , FDA, NMFS, and other regulatory entities.

- Do not mind helping out with information that could be used to develop a white paper. But what is the objective of this task? How could you help us? Will the NMFS be able to help us? How can we train new captains and mates? There is no school for that. What are we going to do with all the information that is collected and the white paper? If the FMAT specifically indicates what the goal of developing the white paper is, then we can be more receptive to helping. How can we incentivize new people to enter the fishery? Could the NMFS help with this not a regulatory issue? The people working in the industry are again, how can you help incentivizing people to enter the fishery? Cannot even put our fishermen in our processing plant 401K plan due to the Jones Act. So, when this white paper is done, how can you help us? You are regulating us but we need your help too to help maintain the clam industry in years to come. It is all about the boats, the processing plants, and the people that work in the industry. So, where can the NMFS/Council help? We know what the problems are, so collecting additional data without a plan to help the industry is useless. Staff response: Along those lines, one of our social scientists (on the FMAT) indicated that it is important to highlight those issues that we have been discussing today. It was highlighted that there is a program somewhere in New England from an NGO that was working through getting fishermen to obtain their operators permit through training (or something similar). This was discussed when the FMAT briefly discussed the impediments for getting new people to participate in the fishery. Also discussed occupational barriers like getting health insurance. So, having a conversation to discuss occupational barriers would further our understanding on these issues. The Council may not be able to do anything to help to overcome specific barriers that are identified but NMFS or other agencies may be able to potentially help address.

- Congress has been working on the Young Fishermen Development Act for 3 years and it is out of the senate commerce committee and it looks like it will be out of the house this year. It is a small grant program ($ 2 million/year) that would be given to fishing organizations, Rutgers University, etc., and the idea is to help young people get into the industry. This is modeled to the Alaskan project. This specific project is very promising. But to get to this issue, the first part of the sentence in the first column (in the Actions Summary Matrix) says regarding this issue "If independent participation in the harvesting sector is important," I don't know if this is important or not. Perhaps a way to address this is by doing a visioning paper or a visioning statement (we have done this on a couple of fisheries throughout the country) of what we want the industry to look like in the future before we state that we do want/we don't want independent participation in the harvesting sector.

- Regarding operator permits, there are zero requirements to receive an operator permit. Everyone at this table could send an application in and get an operators permit as long as you don't have any criminal records against you. However, for operators of vessels over 200 GRT, you need to complete a 7 step seamanship courses to get the master in charge of a vessel. There are not requirements for vessels less than 200 GRT.

4) Imbalance Between Annual Catch Limits and Harvest

- This is a solution looking for a problem. The imbalance between the quota and landings is a problem that has not been well defined for us. By addressing this we are looking for a problem that does not exist. If this is an issue, we would like to know why.

- This is another effort to resurrect alternatives 5 and 6 of the excessive shares amendment if those are not adopted by the Council. This has been a highly controversial topic under the excessive shares amendment. The imbalance between the quota and landings is not an issue to the clam industry and has only been reported as a problem/issue by two anonymous emails/letters that were submitted to the Council. SCOQ ITQ holders have not reported that this is an issue.

- We own all of our quota and could not function if you set the quota to market needs. This will make us close our processing plant. There has never been sufficient analysis or reasons provided to show that this is a problem This is not a sustainability issue. Aligning the quota with industry needs cannot be based on economic factors.

- Lowering the quota to meet the harvest levels does not make sense. We should be looking at the opposite; we should be looking to expand markets / sell more clam and not to reduce the quota. Setting the quota to market need is counterintuitive. As soon as an idea like this hits the trade magazines (quota reduction), the large buyers would reduce their orders to the industry as look for substitute items to meet their needs.
- Large buyers of clam products are starting to take a look at this issue and this is starting to affect our industry. Forecasting is a big part of how these big companies do business

and if there is an issue with quota reductions in the future, that would affect our business. Kicking the tire on this issue is not good for us. The sustainability officers for those large clam buying companies are looking closely at this issue and this could end up hurting us.

- This is not a terrible important issue right now. Where does the notion of aligning the quota with market supply comes from? This is not a requirements of the MSA or found in any regulations.

Committee Meeting (afternoon session)

Committee Members: Peter deFur, Peter Hughes, Maureen Davidson, Sonny Gwin, Stew Michels, Doug Potts (designee: Pentony), Mike Ruccio (listen-only webinar). Staff: Jessica Coakley, José Montañez.

Others: Mike Luisi, Thomas Alspach, Tom Dameron, Howard King, Jeffrey Pike, David Wallace, Daniel LaVecchia, Michael Ferrigno (listen-only webinar), Dave Frulla.

Jessica Coakley presented a summary of the FMAT recommendations and reviewed the Actions Summary Matrix. In addition, the input provided by the AP during the morning meeting was presented to the Committee. The Committee provided the following comments regarding the various topics/issues that were discussed.

Peter deFur/Jessica Coakley – as we indicated, this is a regulatory issue. Industry cannot currently land both species on the same trip. On a quahog trip you need to have all quahog cages tag individually (with a quahog cage tag) and on a surfclam trip you need to have all cages tag individually (with a surfclam cage tag). So, it is an enforcement issue if you have both species on the same trip. There are ocean quahogs discarded in surfclam trips and vice versa. In addition, processors do not want to process both species simultaneously (at the same time) due to processing logistics. In addition, sorting clams on the boat also presents logistical challenges. Industry has asked GARFO for a solution to this issue, but this has not yet been identified.

Going to provide a quick comment to help the Committee's understanding on this issue. At the FMAT meeting we discussed that we do not have a good handle on the extent of the commingling problem. What are the geographic areas where this commingling problem is occurring? How intense is the overlap? We need this information to better assess how to proceed. Industry has indicated that they are willing to help map the area where this issue is a concern. GARFO has also indicated that they could look into issuing EFP and work with industry to better map the extent of the commingling issue.

Is the industry asking to land both species at the same time? Are they interested in that? Response: they have asked this question before; this is a regulatory issue. At the present time, 1 clam on the wrong species in one cage is not allowed. NMFS has indicated that not following those regulations is not possible at the present time.

An AP member offered the following input: this was raised from the industry perspective with regards to the concern that if you land one quahog in a surfclam cage, it is considered a violation (and vice versa). Unfortunately, there are a lot of unprosecuted violations going on because we are having this problem. We did not intend to come to the Council to ask it to find a way to help the industry deal with the processing aspects/issue associated with commingling. Because these are issues that can be addressed/solved by industry. What we are interested is in a regulatory relief so that if an enforcement regime is initiated, we do not suddenly get dozens and dozens of violations because you are finding the occasional surfclam in an ocean quahog cage or vice versa. Some type of exemption could be used to achieve this issue. We are not asking the council to help us with how to process clams that are brought into our processing plants. We are asking for help so we do not get tag for violations, simply because a handful of surfclams can be found in an ocean quahog cage. Staff responded: in order to highlight part of the broader discussion, the talks we have had with the FMAT and GARFO is that just saying it is OK to have some quahogs mixed in a surfclam cage at face may addresses the enforcement issue, it does not address the catch accounting issues and stock assessment issues. First, these animals are landed in huge cages that are lifted with cranes; enforcement is not going to dump every cage on a vessel and count how many quahogs are mixed in the clam cages. Right now, you report x number of surfclam or ocean quahog cages landed. Allowing for mixing of both species in the same cage would not tell us if you have 10% or 20% of mixing, with climate change the commingling distribution may change from clam bed to clam bed. Maybe there is a 30% mixture in one bed and 5% mixture in another bed. All of this catch has to be accounted somehow for it to be input into the stock assessment model and annual catch limits. So, the solution to this issue is not as simple as it seems. If you try to address this problem from the enforcement perspective alone, you can degrade the stock assessment information and quota monitoring efforts. That is how the topic of electronic monitoring and dockside monitoring came into the picture for discussion. In regard to the EFP idea that was discussed, the notion is to allow industry to go out there are help assess the level of commingling/mixing and the scale and scope of the problem in some areas. While this may give you a snapshot of the scale and the scope of the mixing, with climate change and heterogeneity of clam beds (e.g., small, medium, large destiny beds; patchiness), the distribution/mixing is going to be heterogenous as well. As such, if you were to find that in one area assessed there is a 10% mixing, you cannot apply that 10% mixing value to the whole region for stock assessment purposes. Therefore, this does not address the long-term monitoring needs to address the commingling issue. While there is a regulatory component to the problem at hand, it is much better if the council gets involved to assess address this more broadly, so that all the components of the system are addressed.

What about in the processing side? Do we have a mechanisms that provide us with how many ocean quahogs or how many surfclams were processed that we can rely on? Staff response: to get to the commingling piece, we know how many ocean quahogs or surfclams are purchased for processing from dealer reports. There is some sampling that is done at dock side to take measurements and things like that. According to ASPD, industry should be reporting if there are for example, ocean quahogs mixed with surfclams in their dealer forms. But we have not looked into those data streams to see if this is been reported. The flip side of that is that industry has also indicated that the processing plants try to avoid getting mixed animals or commingling. As an example, if you are a hand shucking surfclam facility, you do not want to have ocean quahogs mixed with the surfclams. So, in this last example, they are getting rid of the ocean quahogs before they go to the processing plan or they may be tossed in the trash at the processing facility. We do not know if they are being reported when they get tossed out in the trash at the processing plant. The FMAT is going to assess all available data streams to better assess the scope of the problem and what is being reported.

If you are solely a surfclam hand shucking operator, you do not want any ocean quahogs mixed with the surfclams as you are paying a lot of money (for ocean quahogs) that have very little value and also bring your processing yield down. Are these animals going into the trash or are they going into a retention table and reported at the end of the day. However, in some cases, a plant may not have ITQs for both species. So, if a clam is tossed out at the plant, is this considered a discard (if it has not been utilized)? Do we need some type of allowance to account for discards/tossed out animals when you do not have ITQ for that species that has been tossed out/discarded? How do we address these issues? What do we call these animals, discarded or tossed out or not utilized? A white paper may be the way to go in order to better understand how the processing plants are currently dealing with the mixing/commingling issue. Staff indicated: we have discussed that as we move forward this topic (discards/commingling) may need to be renamed to better frame the actual issue. We also discussed that maybe this could be addressed with some type of electronic monitoring (EM) system or with dockside monitoring or a mixture of both.

This is a high volume fishery, from my perspective, EM is not going to be a valuable toll to look at because these animals are running across shakers and through sorters so fast that you are never going to be able to identify a surfclam from an ocean quahog. Dockside monitoring is also a problem due to how big these cages are. We cannot dump these clams all over the floor to look for a needle in a haystack. But all the clams do eventually run through the belts to be processed somewhere in somebody's plant. I don't know if they use visual inspection. At a hand shuck plant, every clam is touched. Not sure how this works at a higher volume plant. We need to assess the ability to monitor this at high volume plants. The EM is in my view at the bottom of the options due to how fast these animals are moving through the harvesting/processing steps. Dockside monitoring need to stay in the discussion. But we need to get more in depth information from the plants on these issues before we go down too far into how to address these topics.

An AP member offered the following input: at our plant we have one or two guys sorting out trash (e.g., broken shells, rocks, trash). These belts at the processing plant are running faster than they would be on the boats. Initially when the industry saw this commingling happening, honestly due to climate change (as surfclams are moving offshore into deeper water in grounds that used to be ocean quahog only grounds), we were looking for an enforcement solution to this problem. If enforcement is not going to be an issue, then problem solved. However, if enforcement is going to be an issue, then, industry is looking for a proper level of tolerance (allowance) of mixed landings of surfclams and ocean quahogs; instead of the current zero tolerance. Just as was done for the small size clams. The quahog plants do not want to see surfclams and the surfclam plants do not want to see ocean quahogs as this is considered waste.

It seems that the Committee has agreed that we need some further investigation of the discard/commingling matter. Thet will be one of the items we discuss at the October meeting when the Council Executive Committee discusses priorities/workplan for the 2020. This is not a new issue and it is not going to go away.

Social and economic data collection is another high priority issue that we need to address. And the issue applies across all fisheries (across all fisheries) in our region not just surfclam and ocean quahog. We will recommend to the Executive Committee that this is also a high priority issue. Staff responded: that we captured this in the matrix that was presented. When we did the eVTR work, we identified that only about 20% of the MAFMC vessels do not overlap with the NEFMC vessels. So, collecting social and economic information for the northeast as a whole would be more cost effective when compared to independent collection systems.

On the return rate of economic data that was mentioned during the presentation. Do you get a sense that this is apathy or lack of mandatory reporting requirements? Staff responded: the FMAT briefly discussed this issue with the NEFSC social scientists. When the economic data collection program started, the return/response rate was about 20% to 25% but has fallen off to 6%. It could be an issue with survey saturation. They are trying to keep the surveys shorter with fewer questions. There may also be an issue with willingness and involvement may also be an issue. In 2015, the response rate was 6% across all the Northeast fisheries. But they indicated that the fleet that had the best response rate was the lobster fishery. The high response rate of lobster fishermen may be due to the fact that they work closely with Gulf of Maine Research Institute and they do survey work together; therefore, fishermen may view this as part of a routine data collection program. The social scientists at the NEFSC indicated that having mandatory surveys programs would be more effective than voluntary surveys.

It does not seem that you could make the surveys fishery specific. So, if you have 10 different fisheries you develop 10 different surveys. Staff responded: this was briefly discussed by the FMAT as well. People have indicated the desire to do this, but there are not resources available to develop, tailor, and implement specific surveys for every fishery. Therefore, standard surveys are developed and implemented. Also, the NEFSC does not survey annually but once every few years. They are currently working on focus group to rollout the 2020 survey (to collect information on costs incurred for 2019).

The discussion we have illustrates the reasons why this social and economic data collection issue is important to bring to the Executive Committee. We need to get some serious thoughts together and expertise regarding what surveys are needed across the board and what is needed routinely. We also need the employment data to better assess potential impacts of management measures implemented by the Council.

Peter deFur, I want to add that one more thing that came out of other discussions regarding the imbalance between the quota level and landings or industry needs. We cannot do anything about aligning the quota with fishery demand/needs based solely on economic factors. You need another technical justification besides just economic factors. Also, the AP was not very enthusiastic about this idea when this issue was discussed this morning as they felt that the problem to be addressed has not been defined.

Surfclam and Ocean Quahog (SCOQ)
Fishery Management Action Team (FMAT)
Meeting Summary
September 4, 2019, 10:00 – 3:00pm
Foxborough, MA

FMAT Members:

Jessica Coakley: MAFMC, FMAT Chair
José Montañez: MAFMC
Doug Potts: Greater Atlantic Regional Fisheries Office (GARFO)
Lisa Colburn: Northeast Fisheries Science Center (NEFSC), Social Sciences Branch (SSB)
Marianne Ferguson: National Environmental Policy Act (NEPA) Coordinator, GARFO
John Walden: NEFSC, SSB
Eric Thunberg: NEFSC, SSB
Tammy Murphy: NEFSC, SSB
Jay Hermsen: GARFO, Analysis and Program Support Division (APSD)

Members of the Public:

Dave Wallace, Wallace and Associates
Guy Simmons, Sea Watch International

Supporting Materials:

1. FMAT Meeting Agenda
2. FMAT – SCOQ Catch Share Next Steps Recommendations Spreadsheet
3. MAFMC Staff Memo to the Council dated 05.22.2019 – SCOQ Catch Share Program Review – Issues and Potential Actions for the Council to Consider
4. Northern Economics, Inc. Review of the Atlantic Surfclam and Ocean Quahog Individual Transferable Quota Program. Prepared for Mid-Atlantic Fishery Management Council. May 2019. Online at: http://www.mafmc.org/council-events/june-2019-council-meeting

Meeting Purpose:

The purpose of this meeting is to provide recommendations to address potential actions from the "Review of the Atlantic Surfclam and Ocean Quahog Individual Transferable Quota Program."

SCOQ Advisory Panel meeting and SCOQ Committee meeting on September 17, 2019 will review and provide comments on the FMAT's technical recommendations. The input from the AP and Committee, along with the FMAT recommendations will be presented to the Council's Executive Committee at the October 2019 Council meeting, when the Council discusses its 2020 Implementation Plan.

Note: The six issues identified from the SCOQ Catch Share Program Review have been bundled under 4 headings here for ease of discussion.

<u>Issue: Discards – Evaluate the possibility of using electronic monitoring to assess discards (co-mingling) in these fisheries</u>

The FMAT discussed this regulatory issue and the fact that you currently cannot land both surfclam and ocean quahog on the same trip. Industry has expressed concern about the commingling of these clams on trips because of potential enforcement concerns. During public comment period, industry noted that they are avoiding areas because of this issue and they would like to fish on surfclams that have set on old quahog beds, but there is not an easy way to separate them. Industry also indicated that large quahog vessels can go deeper to avoid surfclam, but not vice versa.

The FMAT discussed what NMFS could do to allow a mixed trip. For NMFS and enforcement, it would be preferred for cages to be exclusively surfclam or ocean quahog so landings can be accounted for by volume and enforced. However, this would require sorting on deck, which the industry has indicated is time consuming and challenging for the industry. Allowing the cages to be mixed poses issues for both the stock assessment, because it would not allow for accurate accounting of both surfclams and quahogs in each cage, and enforcement.

The FMAT discussed the need to evaluate the efficiency of different approaches versus cost:

a) What would be the cost of having a camera to do electronic monitoring that can distinguish between surfclam and ocean quahog, versus the cost associated with on board sorting? What about dock side sampling?
b) How many cages would need to be monitored electronically?
c) Would electronic monitoring disrupt general on-board operations?
d) What are the costs associated with having someone monitoring/reviewing the tape?
e) What are the tradeoffs of efficiency versus costs?

The FMAT noted that there are several current sources data that should be examined to determine the scope of the current issue and what is being provided through those data streams:

1. Observer Data
2. Processor Reports
3. Dockside sampling
4. Clam survey

In addition, there is some experience looking at electronic monitoring in the Northeast for some NEFMC fisheries and in other regions. The NMFS NEFSC SSB has developed a framework for evaluating costs of electronic monitoring (EM) versus other strategies that could be applied here to understand the tradeoffs. During public comment, industry members indicated they were interested in conducting some research through SCEMFIS on this.

Possible Next Steps: The FMAT recommended this issue could be addressed either through an a) NMFS regulatory action, b) whitepaper to first explore this issue (prior to Council commitment to action), or c) through an Amendment. **See the Excel Matrix for more detail.**

<u>Issue: Improved Social and Economic Data Collection</u>

The FMAT discussed the potential to improve social and economic data collection for SCOQ, to address gaps in this information for the next SCOQ catch share program review. But the FMAT quickly recognized that many of the data gaps identified through the SCOQ Catch Share Program Review apply to all our fisheries in the region. So, there could be opportunity to generally improve information for some or all fisheries given the approach considered.

Mandatory fixed costs surveys, and trip costs (variable): Fishermen participation in the voluntary NEFSC/SSB commercial fishing business cost survey, which to date has collected fixed costs, variable costs, and crew payments for a specific calendar year has declined. This survey is voluntary, and response rate has fallen over the first two phases of data collection. Phase 1 survey in (2006-2008) and Phase 2 survey (2011, 2012, 2015; offered via hard copy and web) for all Northeast fleets had response rates were around 20-25% at the beginning of the phase and fell in subsequent years. <u>In 2015, the response was 6%</u>. For SCOQ, one response was provided in 2015.

The SSB is currently engaged in efforts to try to streamline the survey and boost participation. A presentation to the Councils could be of value on this survey, in terms of outreach when they are conducted. The only other source of cost data in the Northeast is the trip cost information collected by observers on observed trips, but many fisheries have little to no observer coverage (e.g., SCOQ, tilefish). In addition, processor reports used to be mandatory, but now are voluntary, so even less information available on those costs or employment. Additional information on costs would be of great value in terms of evaluating impacts of actions, but in many fleets the samples sizes are too low to be considered reliable. The FMAT suggested these data could be improved through a mandatory process for reporting but could explore options for how that data is collected.

Crew permit or registry: Employment information is one of the most often requested pieces of information requested for our fleets. Those are generally not available or in many cases are not reliable (e.g. output from I/O models require significant assumptions; were not used as risk elements in EAFM risk assessment). In addition, there is limited detail even on the basic demographics of our crews (e.g., age, etc.); aging out of the fleet has been raised as a concern but the data are limited to evaluate. A crew intercept survey is being conducted right now. Intercept surveys are expensive and require meeting vessels when they return to the docks to conduct interviews.

Having information to identify the universe of persons to survey (either through a permit or no-cost registry) would allow for better sampling and may allow for better understanding where crews are fishing for different fleets/boats. For example, Alaska requires a crew license for those harvesting. The only other source of employment information would be the Bureau of Labor Statistics, which contains data only on employment types that can be covered unemployment insurance.

Ownership data collection: As it relates to the excessive share amendment, the Council should be choosing preferred alternatives soon. NMFS intends to review the data collected relative to the preferred models and affiliates.

During public comment, industry noted the Council should consider whether a crew permit system is necessary. It was noted that surfclam boats are having all kinds of crew problems, especially in New Bedford, due to the crew opportunities on scallop boats. The FMAT clarified they were proposing a crew permit or registry system, where an individual would have a permit to be crew on any commercial fishing vessel, not fleet specific.

Possible Next Steps: The FMAT recommended this issue could be addressed by considering 1) mandatory fixed costs surveys and trip cost, 2) a crew permit or registry, and 3) reviewing the SCOQ ownership data collection protocol, through the following mechanisms of either an a) NMFS regulatory action, b) whitepaper to first explore this issue (prior to Council commitment to action), or c) through an Amendment. **See the Excel Matrix for more detail.**

<u>Issue: Decline in Independent Operators & Barriers to New Entry (these two areas are inter-related)</u>

The FMAT noted that some fisheries require established relationships with buyers: (e.g., SCOQ, whiting). This is not unlike other types of industries in that respect. It was suggested that it may worth considering the industrial organization of other fisheries – put barriers to entry in a given fishery in context with barriers to entry in other fisheries. It may also make sense to frame this in terms of "intrinsic" and "extrinsic" barriers to entry. Are we thinking about "barriers to entry" in terms of harvesters or processors – in the NEI report this is focused on both?

A white paper that would synthesize the specific barriers to entry for both the harvesting and processing sectors could be developed that looks at markets, labor, crew, and occupational barriers, etc. Understanding the specifics of the barriers will be a first step in developing potential options that may support entry.

During public comment it was noted that advisors can provide lots of information about the operational nature of the fisheries. They can provide information about product markets in other countries. In addition, one person commented that every processor currently in the business has been there for 4 or 5 generations – have inherited their business because they would never be able to own those businesses otherwise. Notes that you cannot do anything else with but clam with a clam boat – it would cost at least $1 million to re-rig. Processors had to buy the boats – no other choice.

Issue: Imbalance Between Annual Catch Limits and Harvest

The FMAT noted that this issue could be addressed in excessive shares amendment or through an independent Amendment action (e.g. looks at other mechanisms to set quota to more closely align with landings). In addition, the FMAT noted that the Council does not need an Amendment to modify a quota for any of its fisheries.

During public comment it was noted that if you want to consider lowering quota to better match demand, there are unintended consequences – can create a downward spiral. Quota holders may raise their prices, and others are forced to pay it. This will not occur if quota far exceeds the quantity of product demanded.

Possible Next Steps: The FMAT recommended this issue could be addressed through, a) quota specifications or b) through an Amendment. **See the Excel Matrix for more detail.**

Issues for Possible Consideration	Issue Description / Background Information	Potential Action	Action Type	Type of Workgroups Needed	Type of Staff Expertise Needed	Time needed to complete (e.g. years)	Amount of Work Needed	Other Notes
Imbalance between Annual Catch Limits and Harvest	See staff memo dated May 22, 2019	The Council could consider mechanisms suggested in the Excessive Share Amendment or through other means to align supply (quota) and demand (landings levels) to ensure that all allocation holders who own ITQ are afforded an opportunity to utilize their quota shares.	Amendment	FMAT needed; will interact with Council groups through the amendment process: Full Council, SCOQ Committee, SCOQ Advisory Panel, etc.	FMAT will need Council staff, staff from GARFO SFD and NEPA, and NEFSC SSB.	1 to 3 yrs	Moderate	Mechanisms to ensure that the quota is more closely aligned with demand (landings) could be considered.
		The Council could consider mechanisms suggested in the Excessive Share Amendment or through other means to align supply (quota) and demand (landings levels) to ensure that all allocation holders who own ITQ are afforded an opportunity to utilize their quota shares.	Other	Council action through routine quota setting process (specifications).	Council staff develop annual specifications Environmental Assessment (EA).	up to 1 yr	A little	This is a change to how the quota has been set in past years, but this does not require an amendment process and can be modified directly through specifications. The Council retains the ability to modify quotas for all its fisheries, including the SCOQ ITQ Program.
Decline in Independent Operators & Barriers to New Entry (these two areas are inter-related)	See staff memo dated May 22, 2019	a) If independent participation in the harvesting sector is important, the Council could examine ways to promote the participation of independent harvesters in this fishery & b) the Council could consider what the specific impediments are to entry into these fisheries and consider how changes to the ITQ program itself or other programs could improve opportunity and assist new entrants into the harvesting sector and/or processing sector.	White Paper	FMAT needed to report out to Full Council and SCOQ Committee.	FMAT will need Council staff, staff from GARFO SFD, and NEFSC SSB.	up to 1 yr	Moderate	A white paper that would synthesize the specific barriers to entry for both the harvesting and processing sectors could be developed that looks at markets, labor, crew, and occupational barriers, etc.. Understanding the specifics of the barriers will be a first step in developing potential options that may support entry.
Improved Social and Economic Data Collection	See staff memo dated May 22, 2019	Mandatory fixed costs surveys, and trip costs (variable) for SCOQ or SCOQ+Tilefish or all MAFMC Fisheries.	Amendment	FMAT needed; will interact with Council groups through the amendment process: Full Council, SCOQ Committee, SCOQ Advisory Panel, etc.	FMAT will need Council staff, GARFO AFD, APSD (data), and NEPA, and NEFSC SSB and database experts.	1 to 3 yrs	Moderate	This action will be more administrative in nature (from a NEPA perspective), but higher on the social impacts and economics analysis. Some approaches to collect this data have been added on to logbook collections, observer data (although not useful for low sample fisheries such as SCOQ), or through eVTRs. Other regions (e.g., SAFMC) require mandatory reporting, but only a survey small portion of the fleet each year (e.g., 1/3 of vessel permit holders).
		Mandatory fixed costs surveys, and trip costs (variable) for all Northeast Fisheries (MAFMC and NEFMC-managed) - because of extensive overlap between fisheries.	Amendment	FMAT needed; will interact with Council groups through the amendment process: Full Council, SCOQ Committee, SCOQ Advisory Panel, etc.	Same expertise as above in cell F5, but with a NEFMC staff.	1 to 3 yrs	Moderate	See comments in cell I5 above. Note that if NEFMC is not included, it would require development of parallel systems, which would likely be more work/confusion than addressing this for all fleets in the region.
Improved Social and Economic Data Collection	See staff memo dated May 22, 2019	Crew permit or registry to create framework for information collection on crew employment (e.g., age, basic demographics), remuneration, and job satisfaction from the human dimensions perspective. This could be done for the SCOQ or SCOQ+Tilefish or all MAFMC Fisheries, or all Northeast Fisheries (MAFMC and NEFMC-managed) - because of extensive overlap between fisheries.	White Paper	FMAT needed to report out to Full Council and SCOQ Committee.	FMAT will need Council staff, staff from NEFSC SSB, GARFO AFD and APSD (permit expertise), S&T national perspective, AFSC (familiarity with crew license requirements for fishing); Info on EU system (may not be EU wide).	up to 1 yr	Moderate	This data collection approach could provide basic, quantitative information on fisheries crew, demographics, and employment information, which is not currently available for our regions fisheries. The white paper would synthesize information on current available sources of data (e.g., observer data, VTR/operator permit data) and also explore different approaches for tackling either a crew permit or crew registry. Employment is one of the most commonly requested pieces of information, and is not available for our fisheries.
		Crew permit or registry to create framework for information collection on crew employment (e.g., age, basic demographics), remuneration, and job satisfaction from the human dimensions perspective, for SCOQ or SCOQ+Tilefish or all MAFMC Fisheries.	Amendment	FMAT needed; will interact with Council groups through the amendment process: Full Council, SCOQ Committee, SCOQ Advisory Panel, etc.	FMAT will need Council staff, staff from GARFO SFD and NEPA, plus expertise described in cell F7 above.	1 to 3 yrs	Moderate	See cell I7 above.
		Crew permit or registry to create framework for information collection on crew employment (e.g., age, basic demographics), remuneration, and job satisfaction from the human dimensions perspective, for all Northeast Fisheries (MAFMC and NEFMC-managed) - because of extensive overlap between fisheries.	Amendment	FMAT needed; will interact with Council groups through the amendment process: Full Council, SCOQ Committee, SCOQ Advisory Panel, etc.	FMAT will need Council staff, staff from GARFO SFD and NEPA, plus expertise described in cell F7 above.	1 to 3 yrs	Moderate	See cell I7 above.
Improved Social and Economic Data Collection	See staff memo dated May 22, 2019	Review of SCOQ ownership data collection protocol information.	NMFS Action (regulatory)	As part of implementation and deeming of the SCOQ Excessive Shares Amendment, NMFS would review the ownership data being collected relative to the ownership tracking model/affiliates preferred by the Council.	GARFO staff in consulation with Council.	up to 1 yr	A little	This would be handled when the SCOQ Excessive Shares Amendment is implemented.
Discards	See staff memo dated May 22, 2019	Evaluate the possibility of using electronic monitoring (EM) to assess discards (commingling) in these fisheries.	White Paper	FMAT needed to report out to Full Council and SCOQ Committee.	FMAT will need MAFMC staff, NEFSC stock assessment and FMRD program (Observer/Cooperative Research; with familiarity in EM; cooperative research), GARFO SFD, APSD (data), and OSED (port agents), S&T EM national level expertise.	up to 1 yr	Moderate	A white paper would synthesize information on the scale and scope of the problem. It should evaluate current sources of data (i.e., observer, shoreside, dockside, clam survey) and should solicit industry input on this issue. This paper should summarize information available on electronic monitoring and dockside reporting options as well as some of the potential costs.
			Amendment	FMAT needed; will interact with Council groups through the amendment process: Full Council, SCOQ Committee, SCOQ Advisory Panel, etc.	FMAT expertise from cell F11 plus staff from GARFO NEPA, and possibly additional NEFSC SSB (economists, social scientists to evaluate costs).	3+ yrs	Moderate	If the Council chose the white paper route first (see cell I11), the timeline would be shortened a bit if the Council then chose to do an amendment. A framework for examining the costs/mix of costs for EM versus dockside monitoring is being developed under NEFMC Groundfish Am. 23 and for Atlantic Herring, so an analysis of tradeoffs of options may be streamlined for this action due to that foundational SSB work.
			NMFS Action (regulatory)	GARFO.	This could be a streamlined action just focused on the reporting/sorting aspect of the commingling surfclam and ocean quahog issue.	1 to 3 yrs	Moderate	IF NMFS goes through and requires board sorting, would not need the white paper. However, this may not address the issues for industry.

WP: D. Monk (7/23/2019)

D. Monkfish Operational Assessment for 2019

Northeast Fisheries Science Center

Executive Summary

Assessment data for northern and southern management units of monkfish were updated with minmal changes to the approaches of the previous index-based assessment (NEFSC 2016). No age data are available for monkfish, and the assessment does not include analytic models.

TOR 1. Update fishery-dependent and fishery-independent data from previous assessment.
Commercial fishery statistics for monkfish were updated for 2015-2018. In the north, landings and catch have fluctuated around a steady level since 2009, but increased after 2015. In the south, landings and catch had been declining since around 2000, but catch increased after 2015 due to discarding of a strong 2015 year class.

Survey data updated through 2018 indicate an increasing trend in biomass in both management areas since 2014; exploitable biomass (43+cm total length) indices have more than doubled in both areas since 2015, reflecting growth of the strong 2015 year class. Abundance also increased, and remains relatively high but has been decreasing in most series since 2016. Recruitment indices were high in the north in 2015 and 2016, and in the south in 2015.

New estimates of area-swept minimum biomass and abundance were developed using results from a study of relative efficiency of chain and rock-hopper sweeps on the net used for NEFSC bottom trawl surveys.The area-swept estimates are approximately 5 times higher than the un-adjusted estimates, but follow the same trends.

TOR 2. Prepare an approach to providing scientific advice to management in the absence of an analytical model.
The monkfish assessment does not include an analytical model because the aging method has been invalidated, thus invalidating the growth model that is the foundation for the previously-approved model.

A simple model-free method previously used to derive Georges Bank cod catch limits was applied to current monkfish data. The method calculates the proportional rate of change in smoothed survey indices over the most recent 3 years for potential application to revising catch limits. In the NMA, the estimated rate of change was 1.2-1.3 depending on which surveys were included, and in the SMA, the estimated rate of change was 0.96-1.04.

TOR 3. Update the values of biological reference points (BRPs) for this stock.
BRPs defined in the management plan are dependent on output from the now-invalidated population model, therefore they have not been updated.

TOR 4. Include qualitative descriptions of stock status based on simple indicators/metrics.
Strong recruitment in 2015 fueled an increase in stock biomass in 2016-2018, though abundance has since declined as recruitment returned to average levels. Biomass increases were greater in the northern area than in the southern area, and biomass has declined somewhat in the south.

TOR 5. Perform short-term (2-year) population projections.

Not relevant to this assessment.

6. Comment on research areas or data issues that might lead to improvements in future stock assessments.
Development of a growth curve and/or an accurate aging method would allow application of age-based models. A better understanding of stock structure and movement patterns, especially mxing between management areas, would be helpful.

Introduction

Life History

The monkfish (*Lophius americanus*), also called goosefish, is distributed in the Northwest Atlantic from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina (Collette and Klein-Macphee 2002). Monkfish may be found from inshore areas to depths of at least 900 m (500 fathoms). Seasonal onshore-offshore migrations occur and appear to be related to spawning and possibly food availability (Collette and Klein-MacPhee 2002).

Monkfish rest partially buried on soft bottom substrates and attract prey using a modified first dorsal fin ray that resembles a fishing pole and lure. Monkfish are piscivorous and can eat prey as large as themselves. Despite the behavior of monkfish as a demersal 'sit-and-wait' predator, recent information from electronic tagging suggests seasonal off-bottom movements which may be related to migration (Rountree et al. 2006).

Growth rates of monkfish are not well understood and recent studies call into question the growth curves used in prior assessments (2007, 2010, 2013). One recent study has shown that the method currently used to age monkfish in the U.S. (counting rings on vertebrae) does not consistently identify the correct number of presumed-annual rings at the margin of the vertebra (Bank 2016). Further work conducted at the NEFSC has confirmed this using samples from the strong 2015 yearclass at presumed ages 1, 2 and 3 (Sandy Sutherland, NEFSC, personal communication). In addition, it appears that growth of immature monkfish may be much faster than previously understood. Growth estimated by modal progression of the 2015 yearclass suggests that monkfish may grow to ~25 cm by age 1 and reach the size at maturity (approximately 40 cm) by age two (Figure 1).

The estimated size at 50% maturity of monkfish is 41 cm for females and 37 cm for males (Richards et al. 2008). Few males are found larger than 70 cm, but females can reach sizes greater than 130 cm. Spawning takes place from spring through early autumn, progressing from south to north, with most spawning occurring during the spring and early summer (Richards et al. 2008). Females lay a buoyant mucoid egg raft or veil which can be as large as 12 m long and 1.5 m wide and only a few mm thick. The eggs are arranged in a single layer in the veil, and the larvae hatch after about 1-3 weeks, depending on water temperature. Females likely produce more than one egg veil per year (McBride et al. 2017). The larvae and juveniles spend several months in a pelagic phase before settling to a benthic existence at a size of about 8 cm (Collette and Klein-MacPhee 2002).

Stock Structure
The Fishery Management Plan (FMP) defines two management areas for monkfish (northern management area (NMA) and southern management area (SMA)), divided roughly by a line bisecting Georges Bank (Figure 2). The two assessment and management areas for monkfish were defined in the 1999 FMP based on differences in temporal patterns of recruitment (estimated from NEFSC surveys), perceived differences in growth patterns, and differences in the contribution of fishing gear types (mainly trawl, gill net, and dredge) to the landings. Since then, genetic studies using mitochondrial DNA have suggested a homogeneous population of monkfish off the U.S. east coast (Chikarmane et al. 2000; Johnson et al. in prep.); however research in progress using microsatellite DNA suggests a possible delination off Delaware Bay in the Mid-Atlantic Bight (Housbrouck et al. 2015).

Monkfish larvae are distributed over deep (< 300 m) offshore waters of the Mid-Atlantic Bight in March-April, and across the continental shelf (30 to 90 m) later in the year, but relatively few larvae have been sampled in the northern management area (Steimle et al. 1999). NEFSC surveys continue to indicate different recruitment patterns in the two management units in recent years.

The perceived differences in growth in the two management areas were based on studies about 10 years apart and under different stock conditions (Armstrong et al. 1992: Georges Bank to Mid-Atlantic Bight, 1982-1985; Hartley 1995: Gulf of Maine, 1992-1993). Age, growth, and maturity information from the NEFSC surveys and the 2001, 2004 and 2009 cooperative monkfish surveys indicated only minor differences in age, growth, and maturity between the areas (Richards et al., 2008; Johnson et al., 2008). However these growth studies used the vertebral aging method which is now called into question.

The southern deepwater extent of the range of American monkfish (*L. americanus*) overlaps with the northern extent of the range of blackfin monkfish (*L. gastrophysus*; Caruso 1983). These two species are morphologically similar, which may create a problem in identification of survey catches and landings from the southern extent of the range of monkfish. The potential for a problem however is believed to be small. The NEFSC closely examined winter and spring 2000 survey catches for the presence of blackfin monkfish and found none. The cooperative monkfish survey conducted in 2001 caught only eight blackfin monkfish of a total of 6,364 monkfish captured in the southern management area.

Fisheries Management
Commercial fisheries for monkfish occur year-round using gillnets, trawls and scallop dredges. No significant recreational fishery exists. The primary monkfish products are tails, livers and whole gutted fish. Peak fishing activity occurs during November through June, and value of the catch is highest in the fall due to the high quality of livers during this season.

U.S. fisheries for monkfish are managed in the Exclusive Economic Zone (EEZ) through a joint New England Fishery Management Council - Mid-Atlantic Fishery Management Council Monkfish Fishery Management Plan (FMP). The primary goals of the Monkfish FMP are to end and prevent overfishing and to optimize yield and economic benefits to various fishing sectors involved with the monkfish fisheries (NEFMC and MAFMC 1998; Haring and Maguire 2008).

Current regulatory measures vary with type of permit but include limited access, limitations on days at sea, mesh size restrictions, trip limits, minimum size limits and annual catch limits (Tables 1 and 2).

Biological reference points for monkfish were established in the original Fishery Management Plan (FMP), but were revised after SAW 34 (NEFSC 2002), after the Data Poor Stocks Working Group (DPSWG) in 2007 (NEFSC 2007a), and after SAW 50 in 2010. The overfishing definition on record is F_{max}. Prior to 2007, $B_{threshold}$ was defined as one-half of the median of the 1965-1981 3-year average NEFSC autumn trawl survey catch (kg) per tow). After acceptance of an analytical assessment in 2007 (NEFSC 2007a), B_{target} was redefined as the average of total biomass for the model time period (1980-2006) and $B_{threshold}$ as the lowest observed value in the total biomass time series from which the stock had then increased (termed "B_{Loss}"). According to the earlier (survey index-based) reference points, monkfish were overfished and overfishing status could not be determined (NEFSC 2005); however, with adoption of the analytical assessment in 2007, monkfish status was changed to no longer overfished and overfishing was not occurring. Assessments in 2010 and 2013 (NEFSC 2010; 2013) also concluded that both stocks were not overfished and overfishing was not occurring, while recognizing the continuing significant uncertainty in the determination. With the invalidation of the growth curve and analytic assessment model, the estimated BRPs are no longer relevant.

TOR 1.

TOR 1. Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment.

Fishery-Dependent Data

Landings

Landings of monkfish tails are converted from landed weight to live weight, because a substantial fraction of the landings occur as tails only (or other parts). The conversion of landed weight of tails to live weight of monkfish in the NEFSC weigh-out database is made by multiplying landed tail weight by a factor of 3.32.

Early catch statistics (before ~1980) are uncertain, because much of the monkfish catch was sold outside of the dealer system or used for personal consumption until the mid-1970s. For 1964 through 1989, there are two potential sources of landings information for monkfish; the NEFSC 'weigh-out' database, which consists of fish dealer reports of landings, and the 'general canvass' database, which contains landings data collected by NMFS port agents (for ports not included in the weigh-out system) or reported by states not included in the weigh-out system (Table 3). All landings of monkfish are reported in the general canvass data as 'unclassified tails.' Consequently, some landed weight attributable to livers or whole fish in the canvass data may be inappropriately converted to live weight. This is not an issue for 1964-1981 when only tails were recorded in both databases. For 1982-1989, the weigh-out database contains market category information that allows for improved conversions from landed to live weight. The two data sources produce the same trends in landings, with general canvass landings slightly greater than weigh-out landings. It is not known which of the two measures more accurately reflects landings, but the additional data sources suggest that the general canvass is most reliable for 1964-1981 landings, whereas the availability of market category details suggests that the weigh-out database is most reliable for 1982-1989.

Beginning in 1990, most of the extra sources of landings in the general canvass database were incorporated into the NEFSC weigh-out database. However, North Carolina reported landings of monkfish to the Southeast Fisheries Science Center and until 1997 these landings were not added to the NEFSC general canvass database. Since these landings most likely come from the southern management area, they have been added to the weigh-out data for the southern management area for 1977-1997 for the landings statistics used for stock assessment.

Beginning in July 1994, the NEFSC commercial landings data collection system was redesigned to consist of vessel trip reports (VTR) and dealer weigh-out records. The VTRs include area fished for each trip which is used to apportion dealer-reported landings to statistical areas. The northern management area includes statistical areas 511-515, 521-523 and 561; and the southern management area includes areas 525-526, 562, 537-543 and 611-636 (Figure 2).

Total U.S. landings (live weight) remained at low levels until the mid-1970s, increasing from less than 1,000 mt to around 6,000 mt in 1978 (Table 3, Figure 3). Annual landings remained stable at between 8,000 and 10,000 mt until the late 1980s. Landings increased from the late 1980s to over 20,000 mt per year during 1992-2004, peaking at 28,500 mt in 1997. Landings declined steadily after 2003, and stabilized around an average of 8,600 mt during 2009-2015. During 2008-2015, fishing year landings in the NMA remained well below the TAL, but during 2016-2018 were close to or higher than the TAL (Table 2). In the SMA, fishing year landings have been below the TAL since 2009. The most recent TALs are ~50% higher in the SMA than in the NMA.

Monkfish landings began to increase in the northern management region in the mid-1970s and in the late 1970s in the southern area. Most of the increase in landings during the late 1980s through mid-1990s was from the southern area. Historical under-reporting of landings should be considered in the interpretation of this series.

Trawls, scallop dredges and gill nets are the primary gear types that land monkfish (Table 4, Figure 4). Trawls have been the predominant gear in the north, accounting for approximately 75% of the landings on average. In the south, trawls and dredges dominated the landings before about 2002, but were subsequently replaced by gillnets as regulations changed. Gillnets accounted for about 75% of the landings from the southern management area during 2016-2018. Until the late 1990s, total U.S. landings were dominated by landings of monkfish tails. From 1964 to 1980 landings of tails rose from 19mt to 2,302mt, and peaked at 7,191mt in 1997 (Tables 5, 6). Landings of tails declined after 1997, but are still an important component of the landings. Landings of gutted whole fish have increased steadily since the early 1990s and are now the largest market category on a landed-weight basis. On a regional basis, more tails were landed from the northern area than the southern area prior to the late 1970s (Tables 5 and 6). From 1979 to 1989, landings of tails were about equal from both areas. In the 1990's, landings of tails from the south predominated, but since 2000, landings of tails have been greater in the north. Beginning in 1982, several market categories were added to the system (Tables 5, 6). Tails were broken down into large (> 2.0 lbs), small (0.5 to 2.0 lbs), and unclassified categories and the liver market category was added. In 1989, unclassified round fish were added, in 1991 peewee tails (<0.5 lbs) and cheeks, in 1992 belly flaps, and in 1993 whole gutted fish were added. Landings of unclassified round (whole) or gutted whole fish jumped in 1994 to 2,045 mt and 1,454 mt, respectively; landings of gutted fish continued to increase through 2003. The tonnage of peewee tails landed increased through 1995 to 364 mt and then declined to 153 mt in 1999 and 4 mt in 2000 when the category was essentially eliminated by regulations.

Foreign Landings

Landings (live wt) from NAFO areas 5 and 6 by countries other than the US are shown in Table 3 and Figure 3. Reported landings were high but variable in the 1960s and 1970s with a peak in 1973 of 6,818 mt. Landings were low but variable in the 1980s, declined in the early 1990s, and have generally been below 300 mt since 1996. NAFO data for monkfish were not updated for this assessment update.

Discard Estimates

Catch data from the fishery observer, dealer and VTR databases were used to investigate discarding frequencies and rates using standardized bycatch reporting methodology (SBRM, Rago et al. 2005; Wigley et al. 2007). The number of trips with monkfish discards available for analysis varied widely among management areas and gear types (Tables 7, 8). As in previous monkfish assessments (NEFSC 2007a, NEFSC 2010, NEFSC 2013, NEFSC 2016), monkfish discards were estimated on a gear, half-year and management area basis using observed discard-per-kept-monkfish to expanded to total discards for otter trawls and gillnets, and observed discard-per-all-kept-catch to expand for scallop dredges and shrimp trawls. Discards for 1980-1988 (before observer sampling) were estimated by applying average discard ratios by management area and gear type (trawl, shrimp trawl, gillnet, dredge) from 1989-1991 to landings for 1980-1988 as follows:

Area	Shrimp Trawls	Trawls	Gillnets	Dredges
North				
Years included	1989-1991	1989-1991	1989-1991	1992-1997
Number of trips	124	253	1191	54
South				
Years included	n/a	1989-1991	1991-1992	1991-1993
Number of trips		334	177	32

The proportion of discards in the northern area catch was about 13% in the 1980s, 7% during 2002-2006, became slightly higher on average (12%) during 2007-2009, was 14% for 2010-2015 and 18% during 2016-2018 (Table 9, Figures 5, 6). The proportion of discards in the southern area catch has generally increased since the 1980s (average 16% 1980-1989), with an annual average of 29% during 2002-2006, 24% during 2007-2009, and 27% in 2010-2015 (Table 9, Figures 5 and 6). During 2016-2018, the proportion of discards in the catch was 51%, and estimated discards (mt) exceeded landings in 2017 and 2018. These high discard rates are due primarily to regulatory discards in the scallop dredge fishery (Table 8). Gill nets consistently have had the lowest discard ratios in both areas.

Overall, discarding has increased steadily in both management areas since 2015 (Table 9). In 2015, a large increase in discarding of small fish was observed in southern area dredge and trawl fisheries (Figure 8), reflecting the strong 2015 recruitment event. This yearclass now appears to have grown into the exploitable size range (43+cm) (Figure 1).

Size Composition of U.S. Catch

Tail lengths were converted to total lengths using relations developed by Almeida et al. (1995). As in previous assessments, (NEFSC 2007a and later), length composition of landings and discard were estimated from fishery observer samples by management area, gear-type (trawls, dredges and gillnets), catch disposition (kept or discarded) and variable time periods (Table 11). Landings in unknown gear categories were allocated proportionately to the 3 major gear types before assigning lengths. The estimated length composition of landings and discard is shown in Figures 7-10. Age composition of the catch was not estimated.

Effort and CPUE

Evaluating trends in effort or catch rates in the monkfish fishery is difficult for several reasons. Much of the catch is taken in multi-species fisheries, and defining targeted monkfish trips is difficult. There have been programmatic changes in data collection from port interviews (1980-1993) to logbooks (1994-2009), and comparison of effort statistics among programs is difficult. Catch rates may not reflect patterns of abundance, because they have been affected by regulatory changes (e.g., 1994 closed areas, 2000 trip limits, 2006 reductions in trip limits).

CPUE data have not been used in the assessment model for monkfish, therefore they were not examined for this assessment update.

Fishery-Independent Data

Resource surveys used in the 2016 assessment were updated, including NEFSC spring and autumn offshore surveys, ASMFC northern shrimp surveys (NFMA only), ME/NH spring and fall inshore surveys, and scallop dredge surveys conducted by NEFSC and Viginia Institute of Marine Science (VIMS) (SMA only). Very few strata in the SMA were sampled during the 2017 fall survey, so indices were not calculated for the 2017 fall survey in the SMA.

The NEFSC survey strata used to define the northern and southern management areas are:

Survey	Northern Area	Southern Area
NEFSC offshore bottom trawl	20-30, 34-40	1-19, 61-76
ASMFC Shrimp	1,3,5-8	
Shellfish		6,7,10,11,14,15,18,19,22-31,33-35,46,47,55,58-61,621,631

NEFSC spring and autumn bottom trawl survey indices for 1963-2008 were standardized to adjust for statistically significant effects of trawl type (Sissenwine and Bowman 1977) on catch rates. The trawl conversion coefficients apply only to the spring survey during 1973-1981.

NEFSC indices derived from surveys on the FSV Henry Bigelow (starting spring 2009) were adjusted using calibration coefficients estimated during experimental work (Miller et al. 2009). The FSV *Henry B. Bigelow,* which became the main platform for NEFSC research surveys in spring 2009, has significantly different size, towing power, and fishing gear characteristics than the previous survey platform (*Albatross IV)*, resulting in different fishing power and catchability for most species. Calibration experiments to estimate these differences were conducted during 2008 (Brown 2009, NEFSC 2007b,). Following guidelines developed by a peer-review panel (Anonymous 2009), monkfish catches were converted using a simple ratio estimator without a seasonal (spring vs. fall) or length-specific correction. The low catch rates of monkfish in the Albatross series made development of more detailed coefficients infeasible. The overall coefficients for monkfish were 7.1295 for numbers and 8.0618 for biomass (kg) (Anonymous 2009; Miller et al. 2009). The Bigelow time series is also presented as an independent, uncalibrated series.

NEFSC spring and fall survey estimates of minimum biomass and abundance were derived using relative efficiency estimates for monkfish from a set of paired-tow experiments comparing chain sweep (industry standard on soft bottom) vs. rock hopper gear (used on all tows on the FSV Bigelow) (Miller et al. 2017a, 2017b, 2018).

Northern Management Area (NMA)

Biomass indices from NEFSC autumn and spring research trawl surveys fluctuated without trend between 1963 and 1975, increased briefly in the late 1970's, but declined thereafter to near historic lows during the 1990's (Tables 12-13, Figures 11 and 12). From 2000 to 2003, indices increased, reflecting recruitment of a relatively strong 1999 yearclass. Subsequently, biomass indices declined and remained relatively low until 2016, when both biomass and abundance began to increase. Abundance declined slightly in 2017 and 2018 but biomass indices continued to increase in the fall survey (Figure 12). Exploitable biomass (43+cm) has increased steadily since 2014 (fall survey) or 2016 (spring survey) (Figure 13). ME-NH survey data has shown similar trends in total biomass and abundance as the NEFSC surveys (Figure 14).

Length composition of NEFSC and ME/NH fall survey catches (Figures15 and 18) suggest production of relatively strong yearclasses in 2015 and 2016; however, strong recruitment was not apparent in the spring or summer shrimp surveys (Figures 16 and 17).

Recruitment indices (abundance) were estimated for monkfish of lengths corresponding to presumed young-of-year (YOY, age 0). The size ranges used were based on length frequencies observed for the strong 2015 yearclass, and were adopted in the 2016 assessment, as follows:

North	2013 Putative age	cm range	2016 Putative age	cm range
Fall NEFSC	1	11-19	0	6-18
Fall ME-NH	1	11-19	0	8-18
South				
Spring/summer scallop	1	11-19	0	7-18
Fall NEFSC	1	11-17	0	12-28

Based on the recruitment indices (Figure 20), the frequency of recruitment events in the northern area has increased since the late 1980s, with strong yearclasses produced in 1993, 1994, 2000, 2015 and 2016. There appears to be a negative relationship between recruitment and size of monkfish in the NMA (Figure 20). One possible interpretation is that that cannibalism plays a role in stock dyanmics. Armstrong et al (1996) and Johnson et al. (2008) both found higher rates of cannibalism in relatively large monkfish.

Additional surveys that catch monkfish in portions of the northern area include the ASMFC shrimp survey, the Massachusetts Division of Marine Fisheries fall and spring surveys, and ME/NH inshore surveys (Table 15, Figures 11, 14, 17-19). The shrimp survey samples the western Gulf of Maine during summer and caught more monkfish than the spring or fall surveys prior to 2009 (when the FSV Bigelow survey series began). Patterns of abundance and biomass have been relatively consistent among the NEFSC spring and fall, ME-NH, and shrimp surveys (Figure 21). The Massachusetts surveys catch few monkfish and were not considered to reflect patterns of abundance for the entire management area (NEFSC 2007a); therefore have not been included in recent assessments.

Figure 22 shows the distribution of monkfish in surveys in the northern management area.

Southern Management Area

Inconsistent geographic coverage should be considered in the interpretation of southern survey indices. The NEFSC fall survey did not sample south of Hudson Canyon until 1967. The NEFSC scallop dredge survey has been limited to the southern flank of Georges Bank since 2014, and NEFSC sampling intensity over the entire mid-Atlantic Bight declined starting in 2011. The Virginia Institute of Marine Science VIMS is now conducting the scallop dredge survey in the areas south of Georges Bank (beginning in 2012), but the data are not incorporated into the NEFSC survey data base. In addition, the timing of the scallop dredge survey shifted in 2009 from mid-summer to late spring. NEAMAP inshore surveys in the Mid-Atlantic catch relatively few monkfish, so are not included here.

Biomass and abundance indices from NEFSC spring and autumn research surveys were high during the mid-1960s, fluctuated around an intermediate level during the 1970s-mid 1980s, and have been relatively low since the late 1980s (Tables 16-17, Figures 23 and 24). A sharp increase in abundance was observed in the 2015 scallop and fall surveys and in the 2016 spring survey (Tables 16-18 Figure 23), reflecting an apparent recruitment event in 2015. Exploitable biomass

(43+cm) increased in the spring survey in 2017 and 2018, likely as a result of the growth of the 2015 yearclass (Figure 25). The fall survey also showed elevated exploitable biomass in 2018 (no survey in 2017).

Length distributions from the southern area show truncation over time but somewhat less dramatically than in the north (Figures 25-27). As in the northern area, fish greater than 60 cm have been rare since the 1980s, especially when compared to the 1960s. Recruitment indices (presumed YOY) (Figure 29) indicate two exceptional recruitment events in the south, occurring in 1972 and 2015. The negative relationship between median size in the population and recruitment seen in the north is not evident in the SMA (Figure 29); however, the median size has generally been lower in the south than in the north. Distribution plots suggest that the 2015 recruits were broadly distributed in the SMA (Figure 32).

TOR 2a.

TOR 2a.) Estimate annual fishing mortality, recruitment, and stock size for the time series ("Plan A"). Include estimates of uncertainty, retrospective analyses (both historical and within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

In the absence of an approved model, this TOR was not addressed through modeling efforts; however relative exploitation rates were calculated from landings or catch and survey estimates of minimum area-swept abundance or biomass estimated using adjustments for the rockhopper sweep (Miller et al. 2017a, 2017b, 2018) (Table 19, Figures 33-34). The area-swept estimates do not account for missed strata and assume that 100% of the monkfish encountered by the trawl are captured. Missing strata in monkfish assessment areas and total area of sampled strata during 2009-2018 were the following:

North	Missing strata	Area surveyed nmi2	South Missing strata	Area surveyed nmi2
2009		26,265	68	37,029
2010		26,265		37,081
2011	20, 25	24,654	17, 66	36,166
2012	25	25,875		37,081
2013	25	25,875	18	36,909
2014	20, 40	24,466	8	36,851
2015		26,265		37,081
2016		26,265		37,081
2017		26,265	1-12, 61-76	9,226
2018	30, 34, 351,39	22,617		37,081

TOR 2b.

TOR 2b.) Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "PlanA" assessment were to not pass review.

A model-free method used to derive Georges Bank cod catch limits in 2015 (NEFSC 2015) was applied to monkfish in the northern and southern management areas in the 2016 assessment (NEFSC 2016) and is updated here. The method calculates the rate and direction of change in survey indices using the slope of a log-linear regression of LOESS-smoothed survey indices during the most recent three years. In the case of cod, the proportional change in the indices (re-transformed slope, "catch multiplier") was applied to average cod catch in the three previous years to derive new cod catch limits.

The monkfish analysis calculated the catch multiplier using biomass indices from either the NEFSC fall survey only or the average of the NEFSC spring and fall surveys. The missing 2017 fall survey index for the south was interpolated by averaging 2016 and 2018 biomass indices for the south. The spring survey may be affected more strongly than the fall survey by availability of monkfish to the gear due to timing of seasonal migrations. Biomass indices for 1986-2018 in each area were LOESS-smoothed (smoothing parameter=0.30, 9.9 year smoothing window) before being entered into a log-linear regression to estimate the proportional change during 2016-2018. The estimated proportional change (catch multiplier) for monkfish in the north was 1.26 (fall survey only, 26% increase) or 1.22 (spring and fall surveys combined, 22% increase). In the south, the proportional change was 0.96 (fall survey only, 4% decrease) or 1.04 (spring and fall surveys combined, 4% increase) (Figure 35).

TOR 3. Update the values of biological reference points (BRPs) for this stock.

Biological reference points specified in the management plan are no longer relevant due to invalidation of the growth model, therefore they were not updated for this assessment update.

TOR 4a.
TOR 4a. Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

This TOR was not addressed because monkfish BRPs have been invalidated.

TOR 4b.
TOR 4b. Include qualitative descriptions of stock status based on simple indicators/metrics (e.g.,age- and size-structure, temporal trends in population size or recruitment indices, etc.).

Based on trends in survey results, monkfish stock status has been improving (north) or remained steady (south) in both management regions in the past three years, likely due primarily to the 2015 recruitment event. Biomass continued to increase in the north in 2018 while abundance dropped, reflecting an increase in the proportion of large individuals in the population (likely of the 2015 year class). In the south, biomass increased after the 2015 recruitment event, but was lower in 2018 (fall 2017 data missing), as abundance of the 2015 year class declined.

Recruitment has returned to average levels in the south, and in the north, to average levels observed since the late 1980s. Abundance and biomass patterns may be influenced by movement of monkfish between the management areas, which is poorly understood.

TOR 5.

TOR 5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at FMSY or at an FMSY proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

Not relevant to this assessment.

TOR 6.

TOR 6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

A benchmark assessment should consider the feasibility of using both observer and port samples in estimating length composition of commercial landings.

Ongoing research on age and growth of monkfish may lead to an acceptable growth curve, even if not an aging method that could be used for routine aging. If so, age structured models could be explored assuming static growth.

A better understanding of monkfish movements and stock structure would be helpful to interpretation of monkfish population data.

Future modeling efforts may want to consider the possible role of cannibalism in stock dynamics of monkfish in light of the strong negative relationship observed in the north between median size of monkfish in the population and recruitment indices.

References:

Almeida FP, Hartley DL, Burnett J. 1995. Length-weight relationships and sexual maturity of monkfish off the northeast coast of the United States. N Am J Fish Manage. 15:14-25.

Anonymous. 2009. Independent Panel review of the NMFS Vessel Calibration analyses for FSV/ Henry B. Bigelow/ and R/V/ Albatross IV/. August 11-14, 2009. Chair's Consensus report. 10 p.

Armstrong MP, Musick JA, Colvocoresses JA. 1992. Age, growth and reproduction of the monkfish *Lophius americanus* (Pisces:Lophiiformes). Fish Bull. 90: 217-230.

Armstrong, M. P., Musick, J. A., and Colvocoresses, J. A. 1996. Food and ontogenetic shifts in feeding of the goosefish, Lophius americanus. Journal of Northwest Atlantic Fishery Science, 18: 99–103.

Azarovitz TR. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. Pages 62-67 in W.G. Doubleday and D. Rivard, editors. Bottom trawl surveys. Can Spec Pub Fish Aquat Sci. 58.

Bank, C. 2016. Validation of age determination methods for monkfish (*Lophius americanus*). Master of Science Thesis, School of Marine Science and Technology, Univ. Mass.

Brown R. 2009. Design and field data collection to compare the relative catchabilities of multispecies bottom trawl surveys conducted on the NOAA ship *Albatross* IV and the FSV *Henry B. Bigelow*. NEFSC Bottom Trawl Survey Calibration Peer Review Working Paper. NEFSC, Woods Hole, MA. 19 p.

Caruso JH. 1983. The systematics and distribution of the lophiid angler fisher: II. Revision of the genera *Lophiomus* and *Lophius*. Copeia 1: 11-30.

Collette B, Klein-MacPhee G, (eds). 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, Third edition. Smithsonian Institution Press. 748 p.

Chikarmane HM, Kuzirian A, Kozlowski R, Kuzirian M, Lee T. 2000. Population genetic structure of the monkfish, *Lophius americanus*. Biol Bull. 199: 227-228.

Cook RM. 1997.Stock trends in six North Sea stocks as revealed by an analysis of research vessel surveys. ICES J Mar Sci. 54: 924-933.

Durbin EG, Durbin AG, Langton RW, Bowman RE. 1983. Stomach contents of silver hake, *Merluccius bilinearis*, and Atlantic cod, *Gadus morhua*, and estimation of their daily rations. Fish Bull. 81: 437-454.

Eggers DM. 1977. Factors in interpreting data obtained by diel sampling of fish stomachs. J Fish Res Board Can. 34: 290-294.

Elliot JM, Persson L. 1978. The estimation of daily rates of food consumption for fish. J Anim Ecol. 47: 977-991.

Haring P, Maguire JJ, 2008. The monkfish fishery and its management in the northeastern USA. ICES J Mar Sci. 65: 1370 – 1379.

Hartley D. 1995. The population biology of the monkfish, *Lophius americanus*, in the Gulf of Maine. M. Sc. Thesis, University of Massachusetts, Amherst. 142 p.

Hasbrouck, E., J. Scotti, T. Froehlich, K. Gerbino, J. Stent, J. Costanzo, I. Wirgin. 2015. Coastwide stock structure of monkfish using microsatellite DNA analysis. Completion report, Monkfish RSA Grant NA12NMF4540095.

Johnson AK, Richards RA, Cullen DW, Sutherland SJ, 2008. Growth, reproduction, and feeding of large monkfish, *Lophius americanus*. ICES J Mar Sci. 65: 1306 – 1315.

Johnson, A.K., Allen R. Place, Belita S. Nguluwe, R. Anne Richards, Ernest Williams. In prep. Stock Discrimination of American Monkfish using a Mitochondrial DNA Marker.

Kleisner KM, Fogarty MJ, McGee S, Barnett A, Fratantoni P, Greene J, et al. (2016) The Effects of Sub-Regional Climate Velocity on the Distribution and Spatial Extent of Marine Species Assemblages. PLoS ONE 11(2): e0149220. doi:10.1371/journal.pone.0149220

Link JS, Col L, Guida V, Dow D, O'Reilly J, Green J, Overholtz W, Palka D, Legault C, Vitaliano J, Griswold C, Fogarty M, Friedland K. 2009. Response of Balanced Network Models to Large-Scale Perturbation: Implications for Evaluating the Role of Small Pelagics in the Gulf of Maine. Ecol Model. 220: 351-369.

Link J, Overholtz W, O'Reilly J, Green J, Dow D, Palka D, Legault C, Vitaliano J, Guida V, Fogarty M, Brodziak J, Methratta E, Stockhausen W, Col L, Waring G, Griswold C. 2008. An Overview of EMAX: The Northeast U.S. Continental Shelf Ecological Network. J Mar Sys. 74: 453-474.

Link JS, Griswold CA, Methratta EM, Gunnard, J. (eds). 2006. Documentation for the Energy Modeling and Analysis eXercise (EMAX). NEFSC Ref Doc. 06-15: 166 p.

Link JS, Sosebee K. 2008. Estimates and implications of Skate Consumption in the northeastern US continental shelf ecosystem. N Amer J Fish Manage. 28: 649-662.

Link JS, Idoine J. 2009. Predator Consumption Estimates of the northern shrimp *Pandalus borealis*, with Implications for Estimates of Population Biomass in the Gulf of Maine. N. Am J Fish Manage. 29:1567-1583.

Link JS, Garrison LP. 2002. Changes in piscivory associated with fishing induced changes to the finfish community on Georges Bank. Fish Res. 55: 71-86.

Link JS, Garrison LP, Almeida FP. 2002. Interactions between elasmobranchs and groundfish species (*Gadidae and Pleuronectidae)* on the Northeast U.S. Shelf. I: Evaluating Predation. N Am J Fish Manage. 22: 550-562.

Link JS, Almeida FP. 2000. An overview and history of the food web dynamics program of the Northeast Fisheries Science Center, Woods Hole, Massachusetts. NOAA Tech Memo. NMFS-NE-159. 60 p.

McBride, R., A. Johnson, E. Lindsay, H. Walsh, A. Richards. 2017. Goosefish Lophius americanus fecundity and spawning frequency, with implications for population reproductive potential. Journal of Fish Biology 90(5): 1861-1882. doi:10.1111/jfb.13272

Miller TJ, Das C, Politis P, Long A, Lucey S, Legault C, Brown R, Rago P. 2009. Estimation of */Henry B. Bigelow/* calibration factors. NEFSC Bottom Trawl Survey/ /Calibration Peer Review Working Paper. NEFSC, Woods Hole, MA. 376 p.

Miller, T. J., Richardson, D. E., Politis, P. Blaylock, J. 2017a. NEFSC bottom trawl catch efficiency and biomass estimates for 2009-2017 for 8 flatfish stocks included in the 2017 North-east Groundfish Operational Assessments. Working paper. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. September 11-15, 2017.

Miller, T. J., Martin, M. Politis, P., Legault, C. M., Blaylock, J. 2017b. Some statistical approaches to combine paired observations of chain sweep and rockhopper gear and catches from NEFSC and DFO trawl surveys in estimating Georges Bank yellowtail flounder biomass. TRAC Working Paper 2017/XX. 36. pp.

Miller, T. J., Politis, P., Blaylock, J., Richardson, D., Manderson, J., Roebuck, C. 2018. Relative efficiency of a chain sweep and the rockhopper sweep used for the NEFSC bottom trawl survey and chainsweep-based swept area biomass estimates for 11 flatfish stocks. SAW 66 summer flounder Data/Model/Biological Reference Point (BRP) meeting. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. September 17-21, 2018.

Moustahfid H, Tyrrell MC, Link JS. 2009a. Accounting explicitly for predation mortality in surplus production models: an application to longfin inshore squid. N Am J Fish Manage. 29: 1555-1566.

Moustahfid H, Link JS, Overholtz WJ, Tyrell MC. 2009b. The advantage of explicitly incorporating predation mortality into age-structured stock assessment models: an application for Northwest Atlantic mackerel. ICES J Mar Sci. 66: 445-454.

NEFC (Northeast Fisheries Center). 1988. An evaluation of the bottom trawl survey program of the Northeast Fisheries Center.NOAA Technical Memorandum NMFS-F/NEC52.83 pp.

NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 1998. Monkfish Fishery Management Plan. http://www.nefmc.org/monk/index.html

NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 2003. Framework Adjustment 2 to the Monkfish Fishery Management Plan. http://www.nefmc.org/monk/index.html

NEFSC [Northeast Fisheries Science Center]. 2002. [Report of the] 34th Northeast Regional Stock Assessment Workshop (34th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. NEFSC Ref Doc. 02-06: 346p

NEFSC [Northeast Fisheries Science Center]. 2005. 40th Northeast Regional Stock Assessment Workshop (40th SAW) Assessment Report. NEFSC Ref Doc. 05-04:146 p

NEFSC [Northeast Fisheries Science Center]. 2006. 42nd Northeast Regional Stock Assessment Workshop. (42nd SAW) stock assessment report, part B: Expanded Multispecies Virtual Population Analysis (MSVPA-X) stock assessment model. NEFSC Ref Doc. 06-09b: 308 p.

NEFSC [Northeast Fisheries Science Center]. 2007a. Northeast Data Poor Stocks Working Group Monkfish assessment report for 2007. NEFSC Ref Doc. 07-21: 232 p.

NEFSC [Northeast Fisheries Science Center]. 2007b. Proposed vessel calibration studies for NOAA Ship *Henry B. Bigelow*. NEFSC Ref. Doc. 07-12: 26 p.

NEFSC [Northeast Fisheries Science Center]. 2007c. Assessment Report (45th SARC/SAW). Section A.10. [TOR 6]. NEFSC Ref Doc. 07-16: 13-138.

NEFSC [Northeast Fisheries Science Center]. 2007d. Assessment Report (44th SARC/SAW). Section B.8. [TOR 6]. NEFSC Ref Doc. 07-10: 332-344, 504-547.

NEFSC [Northeast Fisheries Science Center]. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007 Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. Section 2.1. NEFSC Ref Doc. 08-15: 855-865.

NEFSC [Northeast Fisheries Science Center]. 2010. Assessment Report (50th SARC/SAW). NEFSC Ref Doc. 10-17: 15-392.

NEFSC [Northeast Fisheries Science Center]. 2013. 2013 Monkfish Operational Assessment. NEFSC Ref Doc. 13-23: 116 p.

NEFSC [Northeast Fisheries Science Center]. 2015. Operational Assessment of 20 Northeast Groundfish Stocks, Updated Through 2014. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-24; 251 p.

NEFSC [Northeast Fisheries Science Center]. 2016. 2016 Monkfish Operationsl Assessment. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-09; 109 p.

Overholtz WJ, Link JS. 2009. A simulation model to explore the response of the Gulf of Maine food web to large scale environmental and ecological changes. Ecol Model. 220: 2491-2502.

Overholtz WJ, Jacobson LD, Link JS. 2008. Developing an ecosystem approach for assessment advice and biological reference points for the Gulf of Maine-Georges Bank herring complex: adding the impact of predation mortality. N Am J Fish Manag. 28: 247-257.

Overholtz WJ, Link JS. 2007. Consumption impacts by marine mammals, fish, and seabirds on the Gulf of Maine-Georges Bank Atlantic Herring (*Clupea harengus*) complex during 1977-2002. ICES J Mar. Sci. 64: 83-96.

Overholtz W, Link JS, Suslowicz LE. 2000. The impact and implications of fish predation on pelagic fish and squid on the eastern USA shelf. ICES J Mar Sci. 57: 1147-1159.

Overholtz W, Link JS, Suslowicz LE. 1999. Consumption and harvest of pelagic fishes in the Gulf of Maine-Georges Bank ecosystem: Implications for fishery management. Proceedings of the 16th Lowell Wakefield Fisheries Symposium-Ecosystem Considerations in Fisheries Management. AK-SG-99-01:163-186.

Overholtz WJ, Murawski SA, Foster KL. 1991. Impact of predatory fish, marine mammals, and seabirds on the pelagic fish ecosystem of the northeastern USA. ICES Mar Sci Symposia 193: 198-208.

Pennington M. 1985. Estimating the average food consumption by fish in the field from stomach contents data. Dana 5: 81-86.

Pennington, M. 1986. Estimating the mean and variance from highly skewed marine data. Fishery Bulletin 47: 1623-1624.

Rago PJ, Wigley SE, Fogarty MJ. 2005. NEFSC bycatch estimation methodology: allocation, precision, and accuracy. NEFSC Ref Doc. 05-09: 44 p

Rago PJ, Weinberg JR, Weidman C. 2006. A spatial model to estimate gear efficiency and animal density from depletion experiments. Can J Fish Aquat Sci: 63: 2377–2388.

Raymond M, Glass C. 2006. A Project to define monkfish trawl gear and areas that reduce groundfish bycatch and to minimize the impacts of monkfish trawl gear on groundfish habitat. Final Report, NOAA NERO CRPP Contract EA-133-F-03-CN-0049.

Richards A. 2006. Goosefish (*Lophius americanus*). In Status of Fishery Resources off the Northeastern US (www.nefsc.noaa.gov/sos/spsyn/og/goose).

Richards RA, Nitschke P, Sosebee K. 2008. Population biology of monkfish *Lophius americanus*. ICES J Mar Sci. 65: 1291-1305.

Richards, RA, Grabowski, J and Sherwood, G. 2012. Archival Tagging Study of Monkfish, *Lophius americanus*. Final Report to Northeast Consortium, Project Award 09-042.

Rountree RA, Gröger JP, Martins D. 2006. Extraction of daily activity pattern and vertical migration behavior from the benthic fish, *Lophius americanus*, based on depth analysis from data storage tags. ICES CM 2006/Q:01.

Sissenwine MP, Bowman EW. 1977. Fishing power of two bottom trawls towed by research vessels off the northeast coast of the USA during day and night. ICES CM. 1977: B30.

Steimle FW, Morse WW, Johnson DL. 1999. Essential fish habitat source document: monkfish, *Lophius americanus*, life history and habitat characteristics. NOAA TechMemoNMFS-NE-127.

Syrjala, S. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. ICES J. Mar. Sci. 57:831-842.

Taylor MH, Bascuñán C, Manning JP. 2005. Description of the 2004 Oceanographic Conditions on the Northeast Continental Shelf. NEFSC Ref Doc. 05-03: 90 p.

Tsou TS, Collie JS. 2001a. Estimating predation mortality in the Georges Bank fish community. Can J Fish Aquat Sci. 58: 908-922.

Tsou TS, Collie JS. 2001b. Predation-mediated recruitment in the Georges Bank fish community. ICES J Mar Sci. 58: 994-1001.

Tyrrell MC, Link JS, Moustahfid H, Overholtz WJ. 2008. Evaluating the effect of predation mortality on forage species population dynamics in the Northwest Atlantic continental shelf ecosystem: an application using multispecies virtual population analysis. ICES J Mar Sci. 65: 1689-1700.

Tyrrell MC, Link JS, Moustahfid H, Smith BE. 2007. The dynamic role of goosefish (*Pollachius virens*) as a predator in the Northeast US Atlantic ecosystem: a multi-decadal perspective. J Northwest Atl Fish Sci. 38: 53-65.

Ursin E, Pennington M, Cohen EB, Grosslein MD. 1985. Stomach evacuation rates of Atlantic cod (*Gadus morhua*) estimated from stomach contents and growth rates. Dana 5: 63-80.

Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design, and Estimation of Precision and Accuracy. NEFSC Ref Doc. 07-09: 156 p

Weinberg KL, Kotwicki S. 2008. Factors influencing net width and sea floor contact of a survey bottom trawl. Fish Res. 93: 265-279.

Tables

Table 1. Timeline of fishery management actions for monkfish.

(http://www.greateratlantic.fisheries.noaa.gov/sustainable/species/monkfish/)

1999 – Monkfish FMP was implemented which included a limited access permit program, a DAS management system, trip limits, and minimum size limits.

1999 – Amendment 1 (FR Notice) approved to ensure compliance with essential fish habitat requirements of the Magnuson-Stevens Act.

2002 – Framework Adjustment 1 (FR Notice) was disapproved by NMFS. NMFS instead published an emergency rule that implemented measures based upon the best available science to temporarily suspend the restrictive Year 4 default management measures that would have become effective May 1, 2002.

2003 –Framework Adjustment 2 (FR Notice) modified the overfishing definition and implemented annual adjustments to the management measures.

2003 - Final rule implemented a series of seasonal closures that prohibited the use of large mesh gillnets in Federal waters off the coast of Virginia and North Carolina to reduce the impact of the monkfish fishery on endangered and threatened species of sea turtles.

2005 – Amendment 2 (FR Notice) addressed essential fish habitat, bycatch concerns, and issues raised by public comments.

2006 – Framework Adjustment 3 (FR Notice) implemented to prohibit targeting monkfish on Multispecies B-regular DAS.

2007 – Interim management measures Framework 4 (FR Notice) adopted in May to address overfishing while NMFS conducted a stock assessment. Framework 4 was implemented in October to establish 3-year target total allowable catches (TACs), a target TAC backstop provision, and adjustments to DAS allocations and trip limits.

2007 – Amendment 3 (FR Notice) was implemented as an Omnibus Amendment to standardize bycatch reporting methodology for monkfish and other fisheries.

2008 – NMFS implemented Framework 5 (FR Notice) to ensure the Monkfish FMP succeeds in keeping landings within the target total allowable catch levels. Measures include reduction in carryover DAS, reduction in bycatch or incidental catch limits, and revision in the biological reference points used to determine if the stock is overfished.

2008 – Framework 6 (FR Notice) eliminated the backstop provision adopted in Framework Adjustment 4 to the FMP, October 2007.

Table 1, continued.

2011 – Amendment 5 (FR Notice) implemented a suite of measures including annual catch limits and accountability measures, measures to promote efficiency and reduce waste, and bring the biological reference points into compliance.

2011 – Framework Adjustment 7 (FR Notice) implemented measures that were disapproved in Amendment 5 due to newly available science. Specifically, DAS allocations, trip limits, and an annual catch target for the Northern Area.

2012 – Amendment 6 is still being developed in considering a catch shares management system for the fishery. Information on Amendment 6 is located here.

2013 - NMFS implements an emergency action (FR Notice) to suspend the monkfish possession limits in the Northern Fishery Management Area for monkfish permit categories C and D under a monkfish DAS.

2014 - Framework Adjustment 8 (FR Notice) implemented measures to incorporate results of latest stock assessment, increase monkfish day-at-sea allocations and landing limits to better achieve optimum yield, and increase operational flexibility by allowing all limited access monkfish vessels to use an allocated monkfish-only day-at-sea at any time throughout the fishing year and Category H vessels to fish throughout the Southern Fishery Management Area.

2016 – Framework Adjustment 9 (FR Notice) implemented measures to increase landings in the NFMA by eliminating the possession limit while fishing under both a NE multispecies and monkfish day-at-sea and increasing flexibility in the SFMA by reducing the minimum mesh size for roundfish gillnets.

2017 – Framework Adjustment 10 (FR Notice) implemented measures to incorporate results of the 2016 operational assessment, increase monkfish day-at-sea allocations and possession limits.

Table 2. Management measures for monkfish, fishing years 2000-2018. Regulations pertain to fishing years (FY, May 1- April 30), thus landings do not correspond to calendar year landings in Table 3. Trip limits apply to vessels fishing on declared monkfish days at sea.

Northern Fishery Management Area

		Trip Limits*	Trip Limits*			
Fishing Year	Target TAC/TAL	Cat. A & C	Cat. B & D	DAS Restrict	FY Landings (mt)	Percent of TAC
2000	5,673	n/a	n/a	40	11,859	209%
2001	5,673	n/a	n/a	40	14,853	262%
2002	11,674	n/a	n/a	40	14,491	124%
2003	17,708	n/a	n/a	40	14,155	80%
2004	16,968	n/a	n/a	40	11,750	69%
2005	13,160	n/a	n/a	40	9,533	72%
2006	7,737	n/a	n/a	40	6,677	86%
2007	5,000	1,250	470	31	5,050	101%
2008	5,000	1,250	470	31	3,528	71%
2009	5,000	1,250	470	31	3,344	67%
2010	5,000	1,250	470	31	2,834	57%
2011	5,854	1,250	600	40	3,699	63%
2012	5,854	1,250	600	40	3,920	67%
2013	5,854	1,250	600	40	3,596	61%
2014	5,854	1,250	600	45	3,403	58%
2015	5,854	1,250	600	45	4,080	70%
2016	5,854	1,250	600	45	5,447	93%
2017	6,338	1,250	600	45	6,807	107%
2018	6,338	1,250	600	45	6,168	97%

Southern Fishery Management Area

		Trip Limits*	Trip Limits*			
Fishing Year	Target TAC/TAL	Cat. A,C,G	Cat. B, D, H	DAS Restrict	FY Landings (mt)	Percent of TAC
2000	6,024	1,500	1,000	40	7,960	132%
2001	6,024	1,500	1,000	40	11,069	184%
2002	7,921	550	450	40	7,478	94%
2003	10,211	1,250	1,000	40	12,198	119%
2004	6,772	550	450	28	6,223	92%
2005	9,673	700	600	39.3	9,656	100%
2006	3,667	550	450	12	5,909	161%
2007	5,100	550	450	23	7,180	141%
2008	5,100	550	450	23	6,751	132%
2009	5,100	550	450	23	4,800	94%
2010	5,100	550	450	23	4,484	88%
2011	8,925	550	450	28	5,801	65%
2012	8,925	550	450	28	5,184	58%
2013	8,925	550	450	28	5,088	57%
2014	8,925	610	500	32	5,415	61%
2015	8,925	610	500	32	4,733	53%
2016	8,925	700	575	37	4,345	49%
2017	9,011	700	575	37	3,802	42%
2018	9,011	700	575	37	4,600	51%

Table 3. Landings (calculated live weight, mt) of monkfish as reported in NEFSC weigh-out data base (1964-1993) and vessel trip reports (1994-2014) (North = SA 511-523, 561; South = SA 524-639 excluding 551-561 plus landings from North Carolina for years 1977-1995); General Canvas database (1964-1989, North = ME, NH, northern weigh out proportion of MA; South = Southern weigh-out proportion of MA, RI-VA); Foreign landings from NAFO database areas 5 and 6. Shaded cells denote suggested source for landings which are used in the total column at the far right (see text for details).

	Weigh Out Plus NC			General Canvas				
Year	US North	US South	US Total	US North	US South	US Total	Foreign	Total
1964	45	19	64	45	61	106	0	106
1965	37	17	54	37	79	115	0	115
1966	299	13	312	299	69	368	2,397	2765
1967	539	8	547	540	59	598	11	609
1968	451	2	453	449	36	485	2,231	2716
1969	258	4	262	240	43	283	2,249	2532
1970	199	12	211	199	53	251	477	728
1971	213	10	223	213	53	266	3,659	3925
1972	437	24	461	437	65	502	4,102	4604
1973	710	139	848	708	240	948	6,818	7766
1974	1,197	101	1,297	1,200	183	1,383	727	2110
1975	1,853	282	2,134	1,877	417	2,294	2,548	4842
1976	2,236	428	2,663	2,256	608	2,865	341	3206
1977	3,137	830	3,967	3,167	1,314	4,481	275	4756
1978	3,889	1,384	5,273	3,976	2,073	6,049	38	6087
1979	4,014	3,534	7,548	4,068	4,697	8,765	70	8835
1980	3,695	4,232	7,927	3,623	6,035	9,658	132	9790
1981	3,217	2,380	5,597	3,171	4,142	7,313	381	7694
1982	3,860	3,722	7,582	3,757	4,492	8,249	310	7,892
1983	3,849	4,115	7,964	3,918	4,707	8,624	80	8,044
1984	4,202	3,699	7,901	4,220	4,171	8,391	395	8,296
1985	4,616	4,262	8,878	4,452	4,806	9,258	1,333	10,211
1986	4,327	4,037	8,364	4,322	4,264	8,586	341	8,705
1987	4,960	3,762	8,722	4,995	3,933	8,926	748	9,470
1988	5,066	4,595	9,661	5,033	4,775	9,809	909	10,570
1989	6,391	8,353	14,744	6,263	8,678	14,910	1,178	15,922
1990	5,802	7,204	13,006				1,557	14,563
1991	5,693	9,865	15,558				1,020	16,578
1992	6,923	13,942	20,865				473	21,338
1993	10,645	15,098	25,743				354	26,097
1994	10,950	12,126	23,076				543	23,619
1995	11,970	14,361	26,331				418	26,749
1996	10,791	15,715	26,507				184	26,691
1997	9,709	18,462	28,172				189	28,361
1998	7,281	19,337	26,618				190	26,808
1999	9,128	16,085	25,213				151	25,364
2000	10,729	10,147	20,876				176	21,052
2001	13,341	9,959	23,301				142	23,443
2002	14,011	8,884	22,896				294	23,190
2003	14,991	11,095	26,086				309	26,395
2004	13,209	7,978	21,186				166	21,352
2005	10,140	9,177	19,317				206	19,523
2006	6,974	7,980	14,955				279	15,234
2007	4,953	7,388	12,341					12,341
2008	3,942	7,250	11,192					11,192
2009	3,210	5,532	8,742					8,742
2010	2,424	4,996	7,420					7,420
2011	3,227	5,371	8,599					8,599
2012	4,033	5,724	9,757					9,757
2013	3,332	5,253	8,586					8,586
2014	3,402	5,135	8,537					8,537
2015	4,027	4,609	8,636					8,636
2016	4,633	4,422	9,055					9,055
2017	7,008	3,893	10,901					10,901
2018	5,954	4,465	10,419					10,419

Table 4. U.S. landings of monkfish (calculated live weight, mt) by gear type.

	North					South					Regions Combined				
Year	Trawl	Gill Net	Scallop Dredge	Other	Total	Trawl	Gill Net	Scallop Dredge	Other	Total	Trawl	Gill Net	Scallop Dredge	Other	Total
1964	45	0			45	19				19	64	0			64
1965	36	0			37	17				17	53	0			53
1966	299	0		0	299	13			0	13	311	0		0	312
1967	532		8		539	8				8	540		8		547
1968	447		4		451	2				2	449		4		453
1969	253	1	4		258	4				4	257	1	4		262
1970	198	0		0	199	12				12	210	0		0	211
1971	213		0		213	10				10	223		0		223
1972	426	8	1	2	437	24				24	451	8	1	2	461
1973	661	29	12	8	710	132		5	1	137	794	29	17	9	848
1974	1,060	105	7	25	1,197	98			0	98	1,160	105	7	25	1,297
1975	1,712	123	10	9	1,853	265	0	2	2	269	1,990	123	12	10	2,135
1976	2,031	143	47	15	2,236	333		7	0	340	2,459	143	54	15	2,670
1977	2,737	230	142	28	3,137	508		57	26	591	3,487	230	202	53	3,973
1978	3,255	368	212	54	3,889	605	0	507	26	1,138	4,016	368	774	80	5,238
1979	2,967	393	584	71	4,014	944	6	1,015	16	1,981	3,989	399	2,070	87	6,545
1980	2,526	518	596	56	3,696	1,139	10	1,274	7	2,429	3,723	528	2,276	62	6,589
1981	2,266	461	443	47	3,217	1,100	16	782	105	2,003	3,483	477	1,399	152	5,512
1982	3,040	421	367	32	3,860	1,806	12	1,507	27	3,352	4,998	433	2,061	60	7,551
1983	3,233	314	266	37	3,849	1,819	11	2,119	17	3,966	5,166	325	2,431	56	7,977
1984	3,648	315	196	43	4,202	1,714	15	1,704	18	3,452	5,513	330	1,968	61	7,871
1985	3,982	315	264	55	4,616	1,739	17	2,347	3	4,106	5,757	332	2,611	58	8,758
1986	3,412	326	553	36	4,327	1,841	32	2,068	12	3,954	5,318	358	2,621	48	8,345
1987	3,853	374	695	38	4,960	1,680	26	1,997	3	3,707	5,561	400	2,692	41	8,694
1988	3,554	304	1,172	36	5,066	1,828	58	2,594	3	4,483	5,399	363	3,765	39	9,567
1989	3,429	349	2,584	30	6,391	3,240	17	5,036	3	8,297	6,679	366	7,620	33	14,698
1990	3,298	338	2,141	25	5,802	2,361	32	4,744	5	7,142	5,697	372	6,885	30	12,984
1991	3,299	338	2,033	24	5,694	5,515	363	3,907	16	9,800	8,847	700	5,941	39	15,528
1992	4,330	359	2,211	24	6,923	6,528	977	6,409	11	13,925	10,860	1,336	8,619	35	20,850
1993	5,890	695	4,034	26	10,645	5,987	1,722	7,158	192	15,059	11,879	2,417	11,192	218	25,707
1994	7,574	1,571	1,808	86	11,039	5,233	2,342	3,995	556	12,126	12,707	3,884	5,759	638	22,988
1995	9,119	1,531	1,266	54	11,970	5,785	3,800	4,030	746	14,361	14,905	5,331	5,296	800	26,331
1996	8,445	1,389	913	45	10,791	7,141	4,211	4,330	33	15,715	15,586	5,599	5,243	78	26,507
1997	7,363	988	1,318	40	9,709	8,161	5,203	4,890	208	18,462	15,524	6,192	6,208	249	28,172
1998	5,421	885	948	27	7,281	7,815	6,198	5,190	134	19,337	13,236	7,083	6,138	161	26,618
1999	7,037	1,470	598	24	9,128	6,364	6,187	3,481	54	16,085	13,401	7,656	4,079	78	25,213
2000	8,234	2,102	316	76	10,729	4,018	4,005	1,975	150	10,147	12,252	6,107	2,291	226	20,876
2001	9,990	2,959	381	11	13,341	3,091	5,119	1,719	30	9,959	13,081	8,078	2,100	41	23,301
2002	10,839	2,978	181	13	14,011	1,584	5,410	1,847	43	8,884	12,423	8,389	2,028	56	22,896
2003	12,028	2,488	222	254	14,991	2,034	7,262	1,717	83	11,095	14,062	9,750	1,939	336	26,086
2004	9,918	2,866	14	411	13,209	1,228	4,605	671	1,474	7,978	11,145	7,471	685	1,885	21,186
2005	6,876	2,567	99	598	10,140	1,706	4,673	1,581	1,216	9,177	8,582	7,241	1,680	1,814	19,317
2006	5,054	1,573	185	162	6,974	1,457	3,970	1,532	1,022	7,980	6,511	5,542	1,717	1,184	14,955
2007	3,482	1,172	243	56	4,953	1,084	3,782	1,594	928	7,388	4,566	4,954	1,837	984	12,341
2008	3,055	802	52	34	3,942	1,041	4,098	1,370	741	7,250	4,095	4,900	1,422	775	11,192
2009	2,491	651	21	47	3,210	721	3,117	826	868	5,532	3,212	3,768	847	915	8,742
2010	1,947	460	12	6	2,424	590	2,738	579	1,089	4,996	2,537	3,198	590	1,094	7,420
2011	2,696	482	45	5	3,227	1,178	3,480	565	149	5,371	3,874	3,962	609	153	8,599
2012	3,551	347	134	1	4,033	1,144	3,688	739	153	5,724	4,695	4,035	873	154	9,757
2013	2,799	421	112	0	3,332	1,112	3,366	599	176	5,253	3,911	3,787	711	176	8,586
2014	2,950	418	33	0	3,402	1,028	3,142	879	86	5,135	3,978	3,560	912	87	8,537
2015	3,256	670	100	1	4,027	673	3,308	538	91	4,610	3,929	3,978	638	92	8,637
2016	3,937	608	86	2	4,633	578	3,332	349	162	4,421	4,515	3,940	435	164	9,054
2017	6,030	946	32	0	7,008	550	2,832	400	112	3,894	6,580	3,778	432	112	10,902
2018	4,935	860	151	8	5,954	496	3,404	471	93	4,464	5,431	4,264	622	101	10,418

Table 5. Landed weight (mt) of monkfish by market category for the northern management area.

Year	Belly Flaps	Cheeks	Livers	Head on, Gutted	Round	Dressed	Heads	Tails Unc.	Tails Large	Tails Small	Tails Peewee	All Tails
1964	0	0	0	0	0	0	0	14	0	0	0	14
1965	0	0	0	0	0	0	0	11	0	0	0	11
1966	0	0	0	0	0	0	0	90	0	0	0	90
1967	0	0	0	0	0	0	0	163	0	0	0	163
1968	0	0	0	0	0	0	0	136	0	0	0	136
1969	0	0	0	0	0	0	0	78	0	0	0	78
1970	0	0	0	0	0	0	0	60	0	0	0	60
1971	0	0	0	0	0	0	0	64	0	0	0	64
1972	0	0	0	0	0	0	0	132	0	0	0	132
1973	0	0	0	0	0	0	0	214	0	0	0	214
1974	0	0	0	0	0	0	0	360	0	0	0	360
1975	0	0	0	0	0	0	0	558	0	0	0	558
1976	0	0	0	0	0	0	0	673	0	0	0	673
1977	0	0	0	0	0	0	0	945	0	0	0	945
1978	0	0	0	0	0	0	0	1,171	0	0	0	1,171
1979	0	0	0	0	0	0	0	1,209	0	0	0	1,209
1980	0	0	0	0	0	0	0	1,113	0	0	0	1,113
1981	0	0	0	0	0	0	0	969	0	0	0	969
1982	0	0	10	0	0	0	0	1,146	15	2	0	1,163
1983	0	0	9	0	0	0	0	1,152	5	2	0	1,159
1984	0	0	15	0	0	0	0	1,262	4	0	0	1,266
1985	0	0	11	0	0	0	0	1,386	2	3	0	1,390
1986	0	0	14	0	0	0	0	1,303	0	0	0	1,303
1987	0	0	24	0	0	0	0	1,492	2	1	0	1,494
1988	0	0	47	0	0	0	0	1,517	6	3	0	1,526
1989	0	0	59	0	11	0	0	1,465	327	130	0	1,922
1990	0	0	78	0	30	0	0	1,174	411	154	0	1,738
1991	0	3	70	0	0	0	0	1,014	539	153	9	1,715
1992	0	1	83	0	0	0	0	911	590	505	79	2,085
1993	0	1	208	98	351	0	0	1,034	868	1,062	103	3,067
1994	0	1	208	533	981	0	0	403	1,206	1,075	136	2,820
1995	0	1	46	1,224	1,113	0	0	362	1,180	1,003	304	2,850
1996	0	0	65	1,116	745	0	0	90	930	1,399	224	2,643
1997	0	0	51	634	244	0	0	26	1,126	1,361	119	2,633
1998	0	0	24	551	144	0	0	16	1,055	810	79	1,960
1999	0	0	40	1,701	511	0	0	28	996	848	139	2,012
2000	0	0	94	3,213	912	0	0	17	783	1,050	3	1,853
2001	0	0	93	3,084	231	0	0	128	1,115	1,647	0	2,890
2002	0	0	75	3,789	24	0	0	80	1,055	1,777	0	2,912
2003	0	0	61	2,364	14	0	0	95	1,573	2,032	0	3,699
2004	0	0	56	647	960	0	0	3	1,883	1,580	1	3,467
2005	0	0	42	1,706	22	0	0	3	1,440	1,017	2	2,462
2006	0	0	22	1,622	20	0	0	9	899	627	3	1,538
2007	0	0	13	682	0	0	1	9	870	378	1	1,258
2008	0	0	5	391	0	4	0	1	739	311	0	1,051
2009	0	0	2	290	0	11	0	2	560	299	0	861
2010	0	0	1	208	0	0	0	2	396	261	0	658
2011	0	17	72	187	44	0	8	1	527	367	1	896
2012	0	24	89	142	0	0	3	1	609	556	2	1,168
2013	0	0	76	137	0	0	4	1	549	407	3	960
2014	0	0	71	117	0	0	25	2	560	423	4	988
2015	0	0	73	179	0	0	31	2	594	556	0	1,151
2016	0	0	86	105	0	0	127	4	672	683	0	1,359
2017	0	0	114	151	0	0	140	13	1006	1041	0	2,060
2018	0	0	73	195	1		174	3	931	792	0	1,726

Table 6. Landed weight (mt) of monkfish by market category for the southern management area.

Year	Belly Flaps	Cheeks	Livers	Head on, Gutted	Round	Dressed	Heads	Tails Unc.	Tails Large	Tails Small	Tails Peewee	All Tails
1964	0	0	0	0	0	0	0	6	0	0	0	6
1965	0	0	0	0	0	0	0	5	0	0	0	5
1966	0	0	0	0	0	0	0	4	0	0	0	4
1967	0	0	0	0	0	0	0	2	0	0	0	2
1968	0	0	0	0	0	0	0	1	0	0	0	1
1969	0	0	0	0	0	0	0	1	0	0	0	1
1970	0	0	0	0	0	0	0	4	0	0	0	4
1971	0	0	0	0	0	0	0	3	0	0	0	3
1972	0	0	0	0	0	0	0	7	0	0	0	7
1973	0	0	0	0	0	0	0	42	0	0	0	42
1974	0	0	0	0	0	0	0	30	0	0	0	30
1975	0	0	0	0	0	0	0	85	0	0	0	85
1976	0	0	0	0	0	0	0	129	0	0	0	129
1977	0	0	0	0	0	0	0	250	0	0	0	250
1978	0	0	0	0	0	0	0	403	0	0	0	403
1979	0	0	0	0	0	0	0	1,016	0	0	0	1,016
1980	0	0	0	0	0	0	0	1,189	0	0	0	1,189
1981	0	0	0	0	0	0	0	685	0	0	0	685
1982	0	0	0	0	0	0	0	912	138	51	0	1,102
1983	0	0	2	0	0	0	0	858	237	136	0	1,231
1984	0	0	10	0	0	0	0	860	183	45	0	1,087
1985	0	0	17	0	0	0	0	1,081	85	71	0	1,237
1986	0	0	23	0	0	0	0	1,063	76	52	0	1,191
1987	0	0	330	0	0	0	0	972	138	6	0	1,116
1988	0	0	65	0	0	0	0	1,129	190	32	0	1,350
1989	0	0	88	0	5	0	0	2,037	230	230	0	2,498
1990	0	0	102	0	187	0	0	1,428	443	223	0	2,095
1991	0	5	200	0	415	0	0	1,215	1,123	461	28	2,827
1992	0	3	239	0	386	0	0	1,868	1,318	788	104	4,078
1993	0	1	252	0	178	0	0	2,469	1,065	789	159	4,483
1994	0	4	251	921	1,064	0	0	854	1,025	989	122	2,989
1995	2	0	451	1,529	1,539	0	0	518	1,341	1,419	59	3,337
1996	0	0	504	2,352	318	0	0	996	1,160	1,629	46	3,830
1997	0	0	577	2,559	551	0	0	647	1,924	1,913	32	4,516
1998	0	0	582	3,036	438	0	0	842	1,952	1,840	16	4,650
1999	0	0	558	4,047	621	0	0	509	1,393	1,352	14	3,268
2000	0	4	530	3,701	179	0	0	276	797	657	2	1,732
2001	0	0	466	3,944	300	0	0	217	844	494	0	1,555
2002	0	0	433	4,013	551	0	0	167	629	336	0	1,132
2003	0	1	426	4,959	667	0	0	242	790	405	1	1,438
2004	0	2	355	2,758	1,066	8	0	186	671	274	0	1,130
2005	0	55	330	3,695	187	18	0	105	771	550	2	1,428
2006	0	108	293	3,351	27	20	5	69	658	506	1	1,233
2007	0	44	258	3,030	107	12	0	88	727	329	1	1,145
2008	0	5	253	3,008	44	13	1	61	768	300	0	1,130
2009	1	0	199	2,540	4	9	11	47	505	235	0	788
2010	0	0	188	2,117	9	4	27	61	476	235	0	772
2011	0	0	154	2,195	491	6	31	47	422	243	0	713
2012	0	0	110	2,921	0	4	40	44	405	269	1	720
2013	1	0	130	2,247	5	4	106	58	462	286	2	809
2014	0	0	111	2,049	2	14	116	45	540	250	3	837
2015	0	0	99	2,339	2	18	96	43	358	174	0	574
2016	0	0	86	2,399	`1	10	104	56	295	151	0	502
2017	0	0	72	2020	6	10	83	45	246	180	0	471
2018	0	0	93	2022	10	10	105	84	406	152	0	642

Table 7. Estimated monkfish discards (live weight) in the northern management region. Dredge and shrimp trawl discards are based on SBRM monkfish discards relative to kept of all species; trawl and gillnet are based on monkfish discards relative to monkfish kept.

North		Trawl					Gillnet					Scallop Dredge					Shrimp Trawl				
Year	Half	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)
1989	1	30	0.037	0.58	1,550	58	1	0.036		84	3		0.001		18,213	17	31	0.002	0.33	3,412	5.5
	2	63	0.141	0.44	1,830	257	103	0.027	0.32	265	7		0.008		24,053	185	9	0.001	0.62	931	1.2
1990	1	16	0.082	0.60	1,562	128	73	0.036	0.41	121	4		0.001		9,864	9	27	0.002	0.34	4,494	8.1
	2	36	0.039	0.45	1,690	66	65	0.029	0.37	219	6		0.008		19,293	149	4	0.058	1.01	620	35.8
1991	1	27	0.042	0.45	1,233	52	191	0.030	0.47	120	4		0.001		16,608	16	46	0.004	0.19	3,536	12.8
	2	81	0.167	0.25	1,999	334	758	0.036	0.10	213	8	1	0.002		21,312	40	7	0.046	0.40	340	15.7
1992	1	51	0.122	0.30	1,674	203	403	0.065	0.16	105	7	3	0.000	0.98	14,179	1	76	0.003	0.23	3,285	9.6
	2	35	0.224	0.43	2,624	587	618	0.040	0.24	248	10	6	0.001	0.41	20,033	26	6	0.003	0.28	161	0.4
1993	1	19	0.067	0.30	2,821	189	271	0.086	0.21	119	10	7	0.002	0.26	13,702	25	78	0.001	0.26	1,890	2.5
	2	19	0.084	0.26	3,032	254	338	0.032	0.24	560	18	4	0.018	0.45	12,674	230	4	0.001	0.70	316	0.3
1994	1	18	0.035	0.29	3,273	115	65	0.065	0.29	270	18	2	0.001	1.21	5,486	5	71	0.002	0.38	2,443	5.9
	2	6	0.024	0.59	4,385	107	44	0.055	0.19	779	43	5	0.010	0.38	6,230	59	6	0.001	0.44	906	0.7
1995	1	30	0.164	0.36	4,643	762	38	0.141	0.30	469	66	1	0.014		2,318	32	64	0.000	0.23	4,452	1.8
	2	48	0.090	0.31	4,478	403	69	0.088	0.23	1,023	90	5	0.018	0.50	6,544	119	9	0.001	0.43	1,377	0.7
1996	1	21	0.190	0.23	4,294	814	28	0.137	0.43	340	47	8	0.003	0.94	5,338	14	30	0.000	0.34	7,580	0.8
	2	49	0.132	0.57	4,057	534	34	0.132	0.19	934	123	5	0.022	0.40	11,375	246	5	0.000	0.79	1,418	0.4
1997	1	13	0.100	0.49	3,795	378	19	0.036	0.32	329	12	4	0.004	0.48	10,567	42	17	0.000	0.61	5,416	0.9
	2	7	0.076	0.23	3,225	244	26	0.194	0.84	742	144	4	0.020	0.76	9,148	180		0.001		649	0.4
1998	1	7	0.124	0.37	3,150	392	39	0.028	0.41	238	7	2	0.004	0.32	7,482	28		0.001		3,095	2.7
	2	3	0.093	0.10	2,398	223	72	0.043	0.28	606	26	7	0.014	0.16	6,400	90		0.001		168	0.1
1999	1	3	0.098	0.04	3,947	388	36	0.067	0.65	282	19	2	0.004	0.65	8,347	29		0.001		1,407	1.2
	2	42	0.069	0.21	3,011	207	66	0.036	0.51	1,051	38	6	0.004	0.44	6,797	30		0.001		33	0.0
2000	1	80	0.069	0.32	3,916	271	58	0.041	0.30	501	21		0.004		6,993	31		0.001		2,068	1.8
	2	61	0.088	0.31	3,798	333	65	0.077	0.24	2,033	157	95	0.004	0.13	13,019	56		0.001		35	0.0
2001	1	61	0.102	0.20	5,088	518	41	0.061	0.69	880	53	17	0.003	0.42	14,926	41	3	0.000	0.14	813	0.1
	2	113	0.066	0.10	4,588	303	33	0.108	0.93	2,208	238		0.005		11,525	60		0.001			0.0
2002	1	47	0.076	0.25	5,634	428	33	0.045	0.39	760	34		0.005		8,712	45		0.001		308	0.3
	2	274	0.100	0.10	4,532	455	67	0.053	0.27	2,230	118	10	0.008	0.97	11,533	88		0.001			0.0
2003	1	206	0.101	0.14	6,642	671	112	0.037	0.24	628	23	5	0.001	0.89	16,053	9	15	0.000	1.01	855	0.0
	2	218	0.055	0.12	4,721	261	273	0.058	0.13	1,570	91	8	0.015	0.41	10,361	157		0.001			0.0
2004	1	163	0.042	0.12	5,307	225	212	0.021	0.22	739	16	3	0.000	0.69	5,633	0	12	0.000	0.25	1,069	0.1
	2	377	0.036	0.10	4,039	147	728	0.059	0.09	1,788	105	19	0.096	0.48	3,705	355		0.001		44	0.0
2005	1	500	0.047	0.07	3,971	187	153	0.098	0.26	516	51	20	0.001	0.57	5,745	6	17	0.000	0.52	836	0.1
	2	601	0.057	0.10	3,038	174	660	0.074	0.12	1,450	108	39	0.008	0.21	23,131	184		0.001		40	0.0
2006	1	292	0.055	0.08	2,852	158	93	0.063	0.41	262	17	5	0.001	0.42	20,833	14	17	0.000	0.56	847	0.0
	2	201	0.071	0.11	2,285	162	80	0.080	0.17	1,025	82	39	0.021	0.32	14,291	305	3	0.000	0.10	449	0.2
2007	1	221	0.050	0.10	2,075	104	42	0.061	0.32	228	14	28	0.002	0.22	11,600	26	14	0.001	0.72	1,899	1.0
	2	303	0.072	0.10	1,448	104	190	0.062	0.16	693	43	68	0.021	0.18	23,644	487		0.001		333	0.2
2008	1	277	0.088	0.10	1,821	160	61	0.076	0.28	141	11	25	0.001	0.22	7,065	11	16	0.000	0.77	1,834	0.9
	2	383	0.082	0.10	1,045	86	156	0.051	0.22	541	28	22	0.011	0.34	3,696	42	3	0.001	0.90	167	0.1
2009	1	351	0.166	0.13	1,666	276	129	0.209	0.46	149	31	7	0.001	0.47	1,960	3	7	0.001	0.61	998	0.8
	2	408	0.079	0.11	832	66	195	0.119	0.27	467	55	22	0.003	0.26	11,642	34	5	0.000	0.92	347	0.0
2010	1	339	0.097	0.08	1,537	149	305	0.056	0.15	112	6	16	0.001	0.80	3,350	4	11	0.000	1.00	2,911	0.1
	2	671	0.090	0.07	857	77	1364	0.102	0.07	303	31	25	0.003	0.31	15,930	50	4	0.000	0.91	780	0.0
2011	1	671	0.120	0.07	1,461	175	554	0.050	0.10	120	6	23	0.002	0.80	6,660	16	1	0.000		3,745	0.0
	2	743	0.058	0.08	1,174	69	1244	0.080	0.10	361	29	81	0.004	0.13	35,600	158		0.001		78	0.0
2012	1	739	0.057	0.06	1901	108	548	0.047	0.17	93	4	54	0.003	0.31	21,717	67	19	0.000	0.49	1,761	0.2
	2	664	0.078	0.05	1446	112	900	0.060	0.07	184	11	90	0.010	0.24	28,609	300				132	0.0
2013	1	471	0.125	0.07	1669	208	172	0.044	0.14	98	4	131	0.003	0.22	43,664	118	24	0.001	0.79	195	0.1
	2	440	0.097	0.10	1073	104	567	0.083	0.11	323	27	67	0.010	0.35	12,980	128					
2014	1	405	0.143	0.07	1908	272	278	0.090	0.30	82	7	66	0.000	0.33	10,688	4					
	2	528	0.100	0.09	927	93	830	0.062	0.11	336	21	61	0.029	0.21	5,406	155					
2015	1	298	0.155	0.10	1891	294	87	0.056	0.21	120	7	77	0.002	0.49	12,489	28					
	2	381	0.117	0.11	1223	143	475	0.063	0.12	549	34	50	0.020	0.16	4,912	96					
2016	1	253	0.121	0.09	2058	249	82	0.064	0.32	94	6	79	0.013	0.37	12,841	170					
	2	237	0.141	0.10	1702	241	201	0.094	0.21	514	48	43	0.038	0.27	4,300	162					
2017	1	186	0.156	0.13	3002	467	36	0.018	0.28	152	3	45	0.000	0.36	10,814	5					
	2	340	0.052	0.12	2814	147	245	0.035	0.15	794	28	19	0.157	0.32	1,502	235					
2018	1	255	0.088	0.11	2841	250	72	0.031	0.35	136	4	78	0.011	0.27	18,115	203					
	2	263	0.072	0.14	1980	142	124	0.079	0.24	719	57	48	0.079	0.17	19,019	1,504					

Table 8. Estimated monkfish discards (live weight) in the southern management region. Dredge discards are based on SBRM monkfish discards relative to kept of all species; trawl and gillnet are based on monkfish discards relative to monkfish kept.

South		Trawl					Gillnet					Scallop Dredge				
Year	Half	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)
1989	1	46	0.709	0.50	2,195	1,556		0.031		12	0		0.010	0.010	59,696	577
	2	53	0.169	0.59	733	124	3	0.054		5	0		0.015	0.015	35,498	528
1990	1	50	0.064	0.26	1,567	100	1	0.031		14	0		0.010		64,314	622
	2	35	0.118	0.32	759	90	13	0.054		18	0		0.015		53,040	789
1991	1	73	0.258	0.30	1,257	324	3	0.031		209	2		0.010		67,829	656
	2	77	0.020	0.39	3,831	78	8	0.000		154	0	2	0.001	0.07	36,015	19
1992	1	62	0.061	0.38	3,947	239	94	0.011	0.31	786	8	7	0.001	0.69	48,686	29
	2	41	0.028	0.83	2,135	60	72	0.020	0.20	176	3	7	0.012	0.50	39,126	460
1993	1	40	0.092	0.68	2,598	238	78	0.034	0.70	1,306	44	12	0.008	0.30	23,971	197
	2	34	0.028	0.49	1,301	36	87	0.061	0.20	341	21	4	0.032	0.53	18,379	587
1994	1	43	0.095	0.29	2,925	277	124	0.079	0.33	1,565	124	10	0.020	0.26	26,657	538
	2	30	0.323	0.56	2,027	655	173	0.056	0.18	967	55	10	0.015	0.29	24,222	370
1995	1	61	0.175	0.55	2,789	488	260	0.044	0.20	2,758	121	14	0.030	0.17	34,108	1,011
	2	103	0.115	0.57	2,946	340	170	0.050	0.34	1,172	59	9	0.050	0.45	18,456	917
1996	1	56	0.164	0.36	3,187	523	226	0.077	0.27	2,615	202	19	0.020	0.23	27,505	547
	2	85	0.095	0.18	4,021	380	134	0.052	0.28	1,434	75	15	0.029	0.26	19,621	562
1997	1	60	0.025	0.47	4,130	102	238	0.067	0.34	3,089	206	16	0.028	0.18	19,067	543
	2	29	0.089	0.15	4,215	374	106	0.015	0.34	1,313	20	8	0.041	0.39	14,997	612
1998	1	31	0.108	0.33	3,991	431	228	0.070	0.20	3,606	252	8	0.008	0.24	17,094	136
	2	28	0.027	0.52	3,946	108	64	0.062	0.44	2,053	128	15	0.012	0.57	15,300	177
1999	1	39	0.045	0.30	4,370	195	52	0.052	0.34	4,207	220	13	0.010	0.26	30,059	291
	2	34	0.214	0.57	2,306	494	35	0.046	0.57	1,917	88	56	0.004	0.16	34,102	150
2000	1	67	0.786	0.32	2,255	1,773	60	0.063	0.30	2,683	170	38	0.014	0.16	47,847	666
	2	47	0.107	0.62	1,709	182	44	0.051	0.81	1,157	59	133	0.009	0.16	43,879	382
2001	1	61	0.946	0.47	1,703	1,611	57	0.030	0.42	2,248	67	42	0.015	0.11	64,029	972
	2	96	0.404	0.73	1,348	545	35	0.033	0.38	2,788	92	48	0.014	0.15	70,044	973
2002	1	50	0.338	0.38	1,123	379	34	0.017	0.80	3,590	61	34	0.019	0.09	83,888	1,571
	2	94	0.327	0.39	566	185	40	0.063	0.44	1,967	124	61	0.018	0.10	81,620	1,475
2003	1	120	0.331	0.36	1,172	388	50	0.016	0.35	4,452	69	46	0.014	0.15	82,660	1,192
	2	99	0.406	0.45	1,177	478	56	0.070	0.31	2,849	199	71	0.017	0.12	91,638	1,542
2004	1	237	0.240	0.44	1,012	243	78	0.073	0.22	3,441	252	82	0.014	0.08	107,728	1,543
	2	436	0.300	0.31	733	220	74	0.089	0.22	1,043	93	193	0.015	0.10	95,117	1,432
2005	1	534	0.175	0.14	945	165	100	0.104	0.22	3,217	334	108	0.014	0.18	99,628	1,419
	2	654	0.064	0.11	1,588	102	82	0.081	0.20	1,372	111	174	0.019	0.19	67,548	1,290
2006	1	327	0.180	0.19	1,008	181	43	0.054	0.19	2,865	155	43	0.009	0.31	87,842	767
	2	277	0.055	0.15	1,010	56	35	0.082	0.32	967	79	166	0.022	0.14	99,456	2,210
2007	1	335	0.125	0.25	741	93	59	0.220	0.37	2,139	471	138	0.010	0.14	103,992	1,083
	2	420	0.159	0.40	657	104	45	0.054	0.33	1,569	84	156	0.013	0.15	68,914	920
2008	1	343	0.098	0.19	744	73	54	0.108	0.25	2,882	311	374	0.006	0.11	106,134	686
	2	316	0.017	0.31	594	10	39	0.104	0.29	993	104	245	0.010	0.13	74,506	717
2009	1	414	0.080	0.30	646	52	62	0.052	0.19	2,438	128	370	0.006	0.08	122,576	725
	2	529	0.088	0.31	280	25	32	0.074	0.24	610	45	103	0.009	0.15	73,175	652
2010	1	569	0.248	0.24	474	118	114	0.060	0.21	2,034	122	132	0.010	0.11	108,617	1,098
	2	545	0.190	0.51	369	70	95	0.077	0.18	695	54	174	0.008	0.12	81,139	648
2011	1	573	0.123	0.13	634	78	178	0.078	0.12	2,357	185	156	0.010	0.13	107,870	1,132
	2	601	0.088	0.11	598	53	84	0.122	0.19	1,066	130	150	0.010	0.12	62,873	623
2012	1	476	0.147	0.13	812	119	203	0.051	0.13	3,015	153	205	0.016	0.08	98,241	1,545
	2	337	0.180	0.18	366	66	32	0.058	0.18	576	33	130	0.017	0.15	46,675	797
2013	1	594	0.117	0.24	720	84	60	0.058	0.15	2,142	124	154	0.017	0.17	49,832	864
	2	500	0.053	0.28	447	24	34	0.101	0.37	1,168	118	177	0.016	0.13	45,168	709
2014	1	633	0.171	0.22	616	105	126	0.056	0.16	2,249	127	174	0.014	0.09	62,720	892
	2	700	0.107	0.15	518	56	131	0.030	0.28	861	26	188	0.012	0.14	44,960	518
2015	1	563	0.179	0.15	487	87	225	0.022	0.16	2,403	52	227	0.008	0.12	56,595	464
	2	527	0.521	0.12	318	165	273	0.027	0.20	823	22	202	0.008	0.14	58,643	444
2016	1	557	0.381	0.26	521	198	361	0.023	0.15	2,627	62	306	0.018	0.1	60,595	1,100
	2	854	0.838	0.24	227	191	343	0.041	0.27	564	23	237	0.017	0.13	69,514	1,204
2017	1	819	1.155	0.25	510	589	448	0.036	0.16	2,211	79	337	0.025	0.12	95,113	2,364
	2	1088	0.402	0.23	245	98	372	0.065	0.24	543	35	253	0.025	0.13	83,173	2,084
2018	1	591	0.594	0.21	395	235	302	0.041	0.16	2,494	102	211	0.030	0.11	91,400	2,759
	2	925	0.774	0.17	198	153	332	0.048	0.44	832	40	241	0.021	0.09	86,776	1,861

Table 9. Estimated annual catch (landings plus discards) of monkfish by management region and combined.

	North			South			Areas Combined				
Year	Landings	Discard	Total (mt)	Landings	Discard	Total (mt)	Landings	Discard	Total (mt)	Foreign	Total (mt)
1980	3,623	635	4,258	6,035	563	6,598	9,658	1,197	10,855	132	10,987
1981	3,171	754	3,925	4,142	451	4,593	7,313	1,204	8,517	381	8,898
1982	3,860	699	4,559	3,722	586	4,308	7,582	1,285	8,867	310	9,177
1983	3,849	664	4,513	4,115	659	4,774	7,964	1,323	9,287	80	9,367
1984	4,202	616	4,818	3,699	684	4,383	7,901	1,301	9,202	395	9,597
1985	4,616	640	5,256	4,262	636	4,898	8,878	1,276	10,154	1,333	11,487
1986	4,327	548	4,875	4,037	618	4,655	8,364	1,166	9,530	341	9,871
1987	4,960	766	5,726	3,762	1,039	4,801	8,722	1,805	10,527	748	11,275
1988	5,066	784	5,850	4,595	1,030	5,625	9,661	1,814	11,475	909	12,384
1989	6,391	534	6,925	8,353	2,786	11,139	14,744	3,320	18,064	1,178	19,242
1990	5,802	406	6,208	7,204	1,602	8,806	13,006	2,008	15,014	1,557	16,571
1991	5,693	481	6,174	9,865	1,080	10,945	15,558	1,561	17,119	1,020	18,139
1992	6,923	844	7,767	13,942	801	14,743	20,865	1,644	22,509	473	22,982
1993	10,645	730	11,375	15,098	1,123	16,221	25,743	1,853	27,596	354	27,950
1994	10,950	353	11,303	12,126	2,019	14,145	23,076	2,372	25,448	543	25,991
1995	11,970	1,475	13,445	14,361	2,935	17,297	26,331	4,410	30,741	418	31,159
1996	10,791	1,780	12,572	15,715	2,289	18,004	26,507	4,069	30,576	184	30,760
1997	9,709	1,002	10,712	18,462	1,856	20,318	28,172	2,858	31,030	189	31,219
1998	7,281	769	8,050	19,337	1,231	20,568	26,618	2,000	28,618	190	28,808
1999	9,128	713	9,841	16,085	1,438	17,523	25,213	2,151	27,364	151	27,515
2000	10,729	871	11,599	10,147	3,232	13,379	20,876	4,103	24,979	176	25,155
2001	13,341	1,213	14,554	9,959	4,260	14,219	23,301	5,473	28,773	142	28,915
2002	14,011	1,169	15,180	8,884	3,796	12,680	22,896	4,964	27,860	294	28,154
2003	14,991	1,212	16,203	11,095	3,869	14,964	26,086	5,080	31,167	309	31,476
2004	13,209	847	14,056	7,978	3,782	11,760	21,186	4,629	25,816	166	25,982
2005	10,140	711	10,851	9,177	3,421	12,597	19,317	4,132	23,449	206	23,655
2006	6,974	738	7,712	7,980	3,448	11,428	14,955	4,186	19,140	279	19,419
2007	4,953	778	5,732	7,388	2,755	10,143	12,341	3,533	15,875	8	15,883
2008	3,942	338	4,280	7,250	1,901	9,151	11,192	2,240	13,432	2	13,434
2009	3,210	465	3,675	5,532	1,626	7,158	8,742	2,092	10,833		10,833
2010	2,424	317	2,741	4,996	2,109	7,105	7,420	2,426	9,846		9,846
2011	2,362	452	2,814	6,344	2,200	8,545	8,707	2,652	11,359		11,359
2012	4,033	602	4,635	5,724	2,714	8,438	9,757	3,316	13,073		13,073
2013	3,332	589	3,922	5,253	1,922	7,176	8,586	2,512	11,097		11,097
2014	3,402	552	3,954	5,135	1,724	6,859	8,537	2,276	10,813		10,813
2015	4,027	603	4,630	4,609	1,235	5,844	8,636	1,838	10,474		10,474
2016	4,633	875	5,508	4,422	2,777	7,199	9,055	3,652	12,707		12,707
2017	7,008	886	7,894	3,893	5,250	9,143	10,901	6,136	17,037		17,037
2018	5,954	2161	8,115	4,465	5,150	9,615	10,419	7,311	17,730		17,730

Table 10. Number of length samples available for kept and discarded monkfish from observer database.

		North						South					
Trawl		Kept Lengths			Discard Lengths			Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1	16	54	751	24	65	1393	14	27	86	11	22	216
	2	19	57	548	19	46	1046	16	32	306	14	40	181
2001	1	14	41	578	11	40	487	12	26	126	12	56	338
	2	26	74	659	28	45	1621	9	13	42	2	4	103
2002	1	7	28	391	12	32	342	16	37	85	2	4	11
	2	77	274	3452	153	388	7038	22	54	367	10	32	255
2003	1	74	333	4648	100	361	6340	62	196	1397	36	123	975
	2	72	308	4193	81	363	4387	38	141	740	23	43	359
2004	1	67	226	3156	81	294	4278	98	304	2301	66	275	2051
	2	141	505	6122	179	657	5059	129	494	2983	124	444	3406
2005	1	177	751	8255	238	1426	14806	234	794	5760	184	759	8029
	2	214	841	7698	228	827	8134	218	982	9097	203	656	4960
2006	1	100	403	4960	126	672	7238	154	574	5490	126	498	4184
	2	71	333	2828	100	529	5615	92	337	3501	87	299	2330
2007	1	60	257	2580	98	555	4507	121	467	3078	72	426	1648
	2	118	554	3432	140	714	4992	102	236	1658	76	207	1198
2008	1	75	320	2973	121	657	6748	97	291	3024	88	265	2018
	2	98	341	2244	154	664	5705	77	239	2567	36	87	529
2009	1	70	194	1869	113	502	4978	64	190	1286	36	118	694
	2	83	181	1474	99	257	1762	68	161	1036	49	105	629
2010	1	55	224	2875	68	303	3736	65	166	1265	72	187	1777
	2	23	72	906	42	140	960	40	113	585	50	160	694
2011	1	35	83	1076	73	259	3389	47	109	569	66	165	1145
	2	34	82	795	60	147	1311	41	86	823	64	167	2160
2012	1	25	60	853	76	262	2460	36	100	732	65	212	2250
	2	23	44	556	87	203	2270	13	31	176	19	63	342
2013	1	12	31	260	38	102	1253	19	34	411	32	99	823
	2	13	47	307	60	154	1552	17	33	204	33	88	463
2014	1	32	61	596	79	227	2993	28	54	235	69	158	1143
	2	12	20	190	40	103	925	27	60	314	46	144	949
2015	1	8	13	116	73	198	3021	23	44	210	59	125	758
	2	9	30	185	64	173	1244	22	45	200	52	171	1405
2016	1	5	6	42	19	46	853	24	61	224	87	226	1476
	2	11	26	204	24	59	573	23	51	115	82	283	2047
2017	1	8	15	96	39	167	1864	50	104	334	120	284	1944
	2	13	35	435	54	163	1859	46	104	304	82	225	838
2018	1	14	29	429	67	198	3061	60	107	448	113	240	881
	2	10	21	90	32	92	720	45	94	289	115	412	2539
Gillnet													
2000	1	37	49	311	9	14	59	70	94	2854	7	18	95
	2	66	110	2708	8	16	87	22	42	952	3	4	47
2001	1	27	45	362	4	8	12	216	253	8634	3	4	9
	2	50	76	1940	4	12	27	20	38	1543			
2002	1	29	50	976	10	18	60	58	88	2981	2	6	65
	2	60	115	2493	25	47	198	13	15	391	2	3	39
2003	1	51	163	2564	30	72	321	45	112	3937	6	14	35
	2	131	341	5099	58	121	696	60	192	6047	13	35	113
2004	1	70	220	2212	27	49	133	130	335	11691	36	103	747
	2	434	1314	15334	138	243	672	68	195	4337	11	20	174
2005	1	29	54	459	8	10	32	113	253	8853	14	31	215
	2	399	1251	14565	81	129	413	90	253	6705	16	31	120
2006	1	43	102	651	5	8	15	153	216	7833	10	15	30
	2	57	152	1404	12	15	26	25	36	1290	5	7	10
2007	1	14	27	262	4	10	16	115	189	4789	15	35	245
	2	134	415	3442	22	28	45	52	96	1966	2	3	3
2008	1	19	55	320	6	7	22	94	179	3976	9	24	333
	2	75	174	909	13	17	35	40	90	1485	6	9	14
2009	1	9	32	48	4	7	13	89	189	3819	7	13	45
	2	67	128	899	11	12	30	23	62	938	4	11	58
2010	1	31	88	677	8	9	11	69	154	3398	4	4	20
	2	63	120	773	22	32	78	43	95	1883	5	7	9
2011	1	9	13	38	3	4	4	56	125	2775	5	11	29
	2	65	123	583	14	22	37	15	27	605	2	4	75
2012	1	20	44	118	11	18	22	42	78	1304	4	4	14
	2	52	87	331	25	33	58	13	39	425	4	5	7
2013	1	13	29	163	7	8	9	41	75	1480	3	3	5
	2	64	125	469	27	41	64	18	39	414	0	0	0
2014	1	27	72	148	11	25	35	101	205	2463	5	10	30
	2	64	113	542	32	47	72	48	98	819	2	2	6
2015	1	13	26	164	7	10	12	117	244	2903	15	31	84
	2	69	149	1501	19	42	121	51	99	820	4	5	7
2016	1	10	20	142	5	6	8	153	287	3255	8	9	31
	2	52	68	474	8	14	29	75	152	1595	13	15	24
2017	1	6	9	82	2	3	6	180	383	4134	31	49	120
	2	83	162	1306	8	10	14	72	122	1366	4	5	22
2018	1	10	12	66	5	15	30	119	252	2382	12	17	48
	2	50	76	396	6	10	17	44	85	641	3	7	16

Table 10, continued

		North						South					
Dredge		Kept Lengths			Discard Lengths			Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1							12	415	2481	9	340	2317
	2	3	29	89	3	19	29	7	49	186	10	90	464
2001	1	1	2	8	1	3	4	5	52	215	6	65	303
	2							3	14	33	3	14	250
2002	1												
	2	4	66	191	4	9	28	7	60	155	16	141	675
2003	1				1	5	9	16	171	395	24	250	1115
	2	5	48	161	4	49	321	18	100	268	34	270	1215
2004	1				1	2	2	33	449	1205	50	767	5615
	2	4	10	13	11	42	120	63	1010	2962	157	2500	15145
2005	1	1	18	27	5	29	109	51	697	1782	67	901	5268
	2	6	25	113	27	192	979	88	377	1300	111	929	6274
2006	1	2	4	4	2	18	26	12	49	341	26	125	794
	2	15	76	356	29	170	711	57	465	1607	92	741	4625
2007	1	4	20	25	16	58	106	46	318	746	98	804	3384
	2	23	212	1094	50	368	2082	48	308	1144	116	900	4386
2008	1	1	3	3	9	48	70	96	443	1137	272	1492	4593
	2	6	22	96	15	45	158	60	370	1053	175	1131	3702
2009	1				3	7	12	109	727	1796	219	1549	4461
	2	5	9	90	12	77	219	34	235	808	62	502	2364
2010	1				3	7	10	50	360	615	89	915	4094
	2	1	8	12	8	41	100	41	283	703	117	898	3612
2011	1	2	2	3	3	6	27	36	342	940	104	951	5053
	2	14	44	120	57	178	559	38	167	565	110	536	2622
2012	1	1	1	1	24	134	481	58	257	855	162	1160	7150
	2	27	107	294	56	280	1340	28	106	634	75	328	2549
2013	1	3	4	9	44	203	495	41	139	438	91	483	2264
	2	7	24	53	28	73	213	75	286	948	108	531	2398
2014	1	4	4	5	13	25	34	72	255	630	119	704	3868
	2	4	8	23	35	79	349	63	238	746	123	720	3014
2015	1	3	5	11	19	38	105	56	189	463	127	659	2362
	2	9	29	70	34	102	409	46	226	557	134	831	3218
2016	1	7	42	118	7	42	118	59	208	405	59	208	405
	2	10	41	87	10	41	87	36	211	472	36	211	472
2017	1	2	5	7	2	5	7	59	173	441	59	173	441
	2	4	7	26	4	7	26	36	79	244	36	79	244
2018	1	4	5	15	4	5	15	38	105	428	38	105	428
	2	6	14	46	6	14	46	34	68	222	34	68	222

Table 11. Temporal stratification used in expanding landings and discards to length composition of the monkfish catch. Unless otherwise indicated, sampling was expanded within gear type and area.

	Trawl		**Gillnet**		**Dredge**	
North	**Kept**	**Discarded**	**Kept**	**Discarded**	**Kept**	**Discarded**
1994	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1995	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1996	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1997	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1998	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1999	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
2000	annual	annual	annual	2000-2002 N+S	annual N+S	annual N+S
2001	annual	annual	annual	2000-2002 N+S	annual N+S	annual N+S
2002	annual	annual	annual	2000-2002 N+S	annual N+S	annual N+S
2003	half-year	half-year	annual	annual N+S	annual N+S	annual N+S
2004	half-year	half-year	annual	annual N+S	annual N+S	annual N+S
2005	half-year	half-year	annual	annual N+S	annual N+S	annual N+S
2006	half-year	half-year	annual	2006-2008 N+S	annual N+S	annual N+S
2007	half-year	half-year	annual	2006-2008 N+S	annual N+S	annual N+S
2008	half-year	half-year	annual	2006-2008 N+S	annual N+S	annual N+S
2009	half-year	half-year	annual	2009-2011 N+S	annual N+S	annual N+S
2010	half-year	half-year	annual	2009-2011 N+S	annual N+S	annual N+S
2011	half-year	half-year	annual	2009-2011 N+S	annual N+S	annual N+S
2012	half-year	half-year	annual	2012-2014 N+S	annual N+S	annual N+S
2013	half-year	half-year	annual	2012-2014 N+S	annual N+S	annual N+S
2014	half-year	half-year	annual	2012-2014 N+S	annual N+S	annual N+S
2015	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
2016	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
2017	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
2018	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
South						
1994	annual		annual	annual	annual	annual
1995	annual		annual	annual	annual	annual
1996	annual		annual	annual	annual	annual
1997	annual		annual	annual	annual	annual
1998	annual		annual	annual	annual	annual
1999	annual		annual	annual	annual	annual
2000	annual N+S	annual N+S	annual	2000-2002 N+S	annual	annual
2001	annual N+S	annual N+S	annual	2000-2002 N+S	2000-2002	2000-2002
2002	annual N+S	annual N+S	annual	2000-2002 N+S	2000-2002	2000-2002
2003	annual	half-year	annual	annual N+S	annual	annual
2004	annual	half-year	annual	annual N+S	annual	annual
2005	annual	half-year	annual	annual N+S	annual	annual
2006	annual	half-year	annual	2006-2008 N+S	annual	annual
2007	annual	half-year	annual	2006-2008 N+S	annual	annual
2008	annual	half-year	annual	2006-2008 N+S	annual	annual
2009	annual	half-year	annual	2009-2011 N+S	annual	annual
2010	annual	half-year	annual	2009-2011 N+S	annual	annual
2011	annual	half-year	annual	2009-2011 N+S	annual	annual
2012	annual	half-year	annual	2012-2014 N+S	annual	annual
2013	annual	half-year	annual	2012-2014 N+S	annual	annual
2014	annual	half-year	annual	2012-2014 N+S	annual	annual
2015	annual	half-year	annual	annual N+S	annual	annual
2016	annual	half-year	annual	annual N+S	annual	annual
2017	annual	half-year	annual	annual N+S	annual	annual
2018	annual	half-year	annual	annual N+S	annual	annual

Table 12a. Survey results from NEFSC offshore autumn bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1963	3.79	0.17	2.79	4.87	0.81	0.15	0.62	1.02
1964	1.89	0.21	1.30	2.54	0.39	0.20	0.26	0.52
1965	2.52	0.20	1.73	3.41	0.35	0.15	0.26	0.44
1966	3.33	0.15	2.52	4.16	0.51	0.14	0.39	0.64
1967	1.24	0.33	0.65	1.96	0.19	0.26	0.11	0.27
1968	2.05	0.34	1.01	3.41	0.29	0.27	0.17	0.41
1969	3.69	0.23	2.36	5.15	0.42	0.15	0.31	0.53
1970	2.32	0.26	1.33	3.42	0.40	0.20	0.27	0.53
1971	2.90	0.21	1.93	3.93	0.49	0.17	0.36	0.63
1972	1.39	0.25	0.87	2.02	0.32	0.18	0.22	0.42
1973	3.19	0.20	2.16	4.36	0.53	0.19	0.38	0.72
1974	2.02	0.21	1.38	2.78	0.32	0.19	0.22	0.44
1975	1.71	0.19	1.20	2.25	0.30	0.18	0.21	0.39
1976	3.22	0.21	2.16	4.41	0.42	0.20	0.28	0.56
1977	5.43	0.17	3.94	6.99	0.76	0.12	0.50	0.75
1978	4.73	0.13	3.77	5.84	0.70	0.13	0.47	0.71
1979	4.91	0.14	3.83	6.04	0.55	0.11	0.39	0.57
1980	4.04	0.20	2.75	5.48	0.64	0.14	0.41	0.67
1981	1.98	0.18	1.39	2.59	0.45	0.13	0.32	0.49
1982	0.94	0.25	0.57	1.32	0.14	0.22	0.09	0.19
1983	1.61	0.19	1.11	2.13	0.47	0.18	0.34	0.61
1984	2.82	0.20	1.95	3.82	0.49	0.14	0.38	0.59
1985	1.48	0.33	0.75	2.40	0.37	0.22	0.24	0.52
1986	2.23	0.22	1.47	3.10	0.61	0.17	0.45	0.78
1987	0.88	0.33	0.42	1.38	0.26	0.26	0.16	0.38
1988	1.53	0.31	0.78	2.40	0.31	0.27	0.18	0.47
1989	1.32	0.30	0.77	2.03	0.51	0.18	0.31	0.55
1990	1.01	0.28	0.56	1.48	0.71	0.15	0.44	0.74
1991	1.20	0.24	0.75	1.67	0.70	0.17	0.42	0.74
1992	1.12	0.23	0.74	1.57	0.94	0.17	0.67	1.21
1993	1.10	0.34	0.58	1.80	1.23	0.16	0.75	1.31
1994	0.90	0.23	0.58	1.26	1.34	0.12	1.08	1.61
1995	1.60	0.23	1.00	2.20	0.93	0.12	0.74	1.11
1996	1.07	0.25	0.66	1.55	0.63	0.17	0.46	0.81
1997	0.67	0.23	0.43	0.92	0.50	0.18	0.36	0.66
1998	0.96	0.20	0.65	1.26	0.62	0.19	0.44	0.82
1999	0.78	0.22	0.51	1.06	1.08	0.15	0.82	1.36
2000	2.41	0.20	1.66	3.22	2.34	0.14	1.84	2.88
2001	1.84	0.16	1.38	2.33	1.61	0.11	1.31	1.91
2002	1.83	0.17	1.35	2.34	1.28	0.13	1.01	1.56
2003	1.81	0.18	1.30	2.33	1.07	0.12	0.86	1.28
2004	0.64	0.27	0.38	0.96	0.52	0.19	0.36	0.68
2005	1.01	0.23	0.64	1.38	0.60	0.18	0.42	0.79
2006	1.04	0.23	0.66	1.46	0.77	0.15	0.58	0.98
2007	1.08	0.28	0.62	1.62	0.64	0.15	0.48	0.80
2008	0.99	0.29	0.54	1.48	0.79	0.21	0.53	1.10
2009	0.44	0.17	0.32	0.57	0.39	0.10	0.32	0.45
2010	0.64	0.14	0.49	0.78	0.51	0.09	0.44	0.58
2011	0.88	0.15	0.68	1.10	0.67	0.07	0.60	0.74
2012	0.81	0.12	0.65	0.96	0.68	0.07	0.61	0.76
2013	0.62	0.11	0.50	0.73	0.73	0.07	0.65	0.81
2014	0.76	0.08	0.66	0.86	0.95	0.09	0.81	1.09
2015	1.14	0.11	0.92	1.34	1.22	0.09	1.03	1.39
2016	1.50	0.10	1.25	1.76	1.84	0.07	1.63	2.07
2017	1.78	0.09	1.52	2.04	1.47	0.09	1.25	1.68
2018	2.16	0.07	1.92	2.42	1.29	0.06	1.16	1.42

Table 12b. Survey results from NEFSC offshore autumn bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	3.55	0.18	2.51	4.58	2.78	0.10	2.33	3.22
2010	5.13	0.15	3.88	6.38	3.65	0.09	3.13	4.17
2011	7.09	0.15	5.32	8.86	4.77	0.06	4.26	5.28
2012	6.50	0.11	5.33	7.68	4.88	0.07	4.34	5.41
2013	4.97	0.11	4.05	5.90	5.21	0.07	4.64	5.79
2014	6.11	0.09	5.23	6.98	6.79	0.09	5.82	7.76
2015	9.20	0.11	7.47	10.93	8.71	0.09	7.41	10.02
2016	12.11	0.10	10.08	14.14	13.09	0.07	11.52	14.66
2017	14.38	0.09	12.30	16.46	10.45	0.08	9.01	11.88
2018	17.39	0.07	15.33	19.45	9.20	0.06	8.23	10.17

Table 13a. Survey results from NEFSC offshore spring bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1968	1.007	0.33	0.503	1.585	0.168	0.29	0.092	0.252
1969	1.341	0.42	0.536	2.373	0.18	0.36	0.087	0.302
1970	2.02	0.26	1.166	2.943	0.344	0.18	0.243	0.443
1971	1.048	0.29	0.612	1.585	0.162	0.29	0.093	0.249
1972	4.626	0.15	3.445	5.846	0.651	0.15	0.499	0.812
1973	1.885	0.21	1.228	2.53	0.437	0.23	0.274	0.598
1974	1.492	0.20	1.044	1.992	0.44	0.14	0.348	0.55
1975	0.942	0.17	0.687	1.208	0.341	0.15	0.26	0.426
1976	2.507	0.13	1.942	3.017	0.667	0.13	0.531	0.814
1977	0.932	0.18	0.656	1.194	0.259	0.19	0.185	0.342
1978	0.565	0.20	0.38	0.749	0.141	0.16	0.105	0.178
1979	0.671	0.21	0.446	0.917	0.139	0.14	0.109	0.171
1980	1.434	0.18	1	1.868	0.383	0.13	0.296	0.471
1981	1.669	0.20	1.16	2.246	0.376	0.12	0.301	0.444
1982	2.968	0.25	1.802	4.258	0.345	0.25	0.217	0.498
1983	1.53	0.31	0.846	2.383	0.418	0.24	0.269	0.596
1984	1.567	0.27	0.928	2.313	0.331	0.22	0.219	0.459
1985	2.119	0.22	1.388	2.942	0.346	0.20	0.239	0.46
1986	2.128	0.26	1.212	3.094	0.341	0.20	0.238	0.454
1987	1.727	0.27	0.949	2.476	0.245	0.20	0.168	0.33
1988	2.03	0.23	1.297	2.892	0.607	0.17	0.443	0.79
1989	1.604	0.30	0.895	2.462	0.619	0.21	0.413	0.814
1990	1.014	0.30	0.563	1.561	0.283	0.21	0.184	0.384
1991	1.611	0.24	0.986	2.233	0.592	0.18	0.416	0.767
1992	0.886	0.57	0.236	1.916	0.493	0.31	0.267	0.765
1993	1.157	0.19	0.823	1.554	0.681	0.13	0.527	0.822
1994	0.979	0.30	0.505	1.424	0.453	0.18	0.313	0.583
1995	1.835	0.28	1.035	2.721	1.009	0.16	0.753	1.286
1996	0.976	0.24	0.597	1.364	0.666	0.22	0.43	0.918
1997	0.546	0.36	0.248	0.91	0.342	0.25	0.212	0.496
1998	0.445	0.27	0.257	0.652	0.416	0.14	0.318	0.518
1999	1.15	0.19	0.796	1.529	0.827	0.16	0.616	1.039
2000	1.399	0.18	1.026	1.829	1.132	0.12	0.912	1.359
2001	1.851	0.28	1.07	2.83	1.669	0.12	1.358	2.008
2002	1.927	0.13	1.538	2.348	1.743	0.10	1.456	2.039
2003	1.874	0.20	1.295	2.508	0.813	0.20	0.563	1.092
2004	2.263	0.26	1.313	3.307	0.907	0.17	0.667	1.153
2005	1.472	0.21	0.994	2.018	0.718	0.16	0.534	0.918
2006	0.93	0.40	0.393	1.613	0.367	0.27	0.219	0.531
2007	1.047	0.41	0.394	1.815	0.548	0.23	0.355	0.766
2008	1.286	0.30	0.697	1.903	0.674	0.17	0.485	0.864
2009	0.472	0.15	0.361	0.58	0.331	0.10	0.274	0.388
2010	0.631	0.14	0.49	0.778	0.382	0.14	0.301	0.469
2011	0.893	0.15	0.69	1.125	0.465	0.13	0.373	0.571
2012	0.607	0.13	0.475	0.743	0.538	0.14	0.425	0.671
2013	0.583	0.11	0.477	0.691	0.551	0.07	0.488	0.613
2014	0.629	0.16	0.46	0.806	0.614	0.12	0.501	0.737
2015	0.732	0.16	0.555	0.933	0.537	0.09	0.459	0.623
2016	0.744	0.09	0.639	0.845	0.685	0.07	0.612	0.764
2017	1.134	0.13	0.888	1.393	0.681	0.10	0.574	0.793
2018	1.65	0.07	1.474	1.833	1.041	0.08	0.91	1.168
2019	1.323	0.08	1.159	1.511	0.874	0.08	0.759	0.996

Table 13b. Survey results from NEFSC offshore spring bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	3.80	0.14	2.91	4.70	2.36	0.10	1.96	2.76
2010	5.08	0.14	3.89	6.27	2.72	0.13	2.12	3.32
2011	7.20	0.16	5.31	9.08	3.31	0.14	2.55	4.07
2012	4.90	0.14	3.79	6.00	3.83	0.13	3.00	4.67
2013	4.70	0.11	3.82	5.57	3.93	0.07	3.48	4.38
2014	5.07	0.16	3.77	6.38	4.38	0.12	3.52	5.23
2015	5.90	0.16	4.33	7.47	3.83	0.09	3.24	4.41
2016	6.00	0.08	5.21	6.79	4.88	0.06	4.37	5.40
2017	9.14	0.14	7.03	11.25	4.86	0.10	4.08	5.64
2018	13.30	0.07	11.81	14.79	7.42	0.07	6.52	8.32
2019	10.66	0.08	9.26	12.07	6.23	0.08	5.41	7.05

Table 14. Survey results from ASMFC summer shrimp surveys in the northern management region (strata 1, 3, 5, 6-8). Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1991	1.88	0.17	1.40	2.45	2.88	0.10	2.45	3.36
1992	2.69	0.16	2.04	3.46	2.90	0.10	2.45	3.42
1993	3.07	0.25	1.85	4.39	3.70	0.13	2.93	4.52
1994	1.66	0.21	1.11	2.25	3.42	0.13	2.70	4.20
1995	1.55	0.23	0.95	2.15	2.08	0.18	1.44	2.71
1996	3.36	0.31	1.83	5.30	2.99	0.13	2.37	3.69
1997	2.08	0.21	1.36	2.84	1.57	0.14	1.21	1.94
1998	2.27	0.29	1.24	3.36	2.12	0.13	1.70	2.58
1999	6.26	0.09	5.56	7.57	6.75	0.08	6.00	7.89
2000	3.84	0.16	2.87	4.84	5.72	0.13	4.49	7.09
2001	7.27	0.11	6.02	8.58	10.89	0.09	9.29	12.54
2002	12.44	0.10	10.25	14.51	11.65	0.09	9.99	13.33
2003	7.36	0.16	5.68	9.74	5.80	0.12	4.82	7.23
2004	4.45	0.10	3.70	5.17	3.38	0.10	2.85	3.92
2005	7.25	0.13	5.73	8.87	5.25	0.10	4.45	6.08
2006	6.54	0.12	5.29	7.77	4.31	0.07	3.82	4.80
2007	4.10	0.21	2.69	5.52	4.46	0.13	3.53	5.37
2008	3.79	0.19	2.62	5.03	2.82	0.12	2.29	3.37
2009	3.21	0.19	2.23	4.25	3.12	0.11	2.57	3.72
2010	2.76	0.21	1.89	3.76	2.54	0.15	1.96	3.14
2011	2.66	0.15	2.04	3.37	2.25	0.09	1.93	2.62
2012	3.14	0.16	2.34	3.97	3.55	0.12	2.85	4.31
2013	4.07	0.16	3.05	5.20	4.13	0.13	3.30	5.12
2014	3.31	0.15	2.57	4.19	4.94	0.09	4.23	5.68
2015	1.45	0.23	0.91	2.00	2.76	0.21	1.79	3.69
2016	5.01	0.13	3.98	6.17	6.61	0.07	5.83	7.43
2017	4.78	0.16	3.56	5.99	4.63	0.10	3.90	5.39
2018	5.36	0.25	3.34	7.83	4.88	0.13	3.86	6.02

Table 15. Monkfish indices from Maine-New Hampshire inshore surveys, strata 1-4, regions 1-5.

Fall

Year	Mean Weight	CV	L95%	U95%	Mean Number	CV	L95%	U95%
2000	1.6	0.39	1.1	2.2	4.8	0.29	3.6	6.0
2001	4.7	0.20	3.9	5.6	10.7	0.21	8.5	13.0
2002	3.4	0.66	1.2	5.7	4.1	0.56	1.8	6.3
2003	3.6	0.38	2.0	5.2	3.7	0.31	2.4	5.0
2004	3.6	0.41	1.9	5.3	2.9	0.31	1.9	4.0
2005	2.0	0.35	1.1	3.0	1.8	0.22	1.3	2.3
2006	1.8	0.23	1.4	2.2	2.9	0.22	2.3	3.5
2007	2.1	0.32	1.4	2.8	3.1	0.26	2.3	4.0
2008	2.9	0.27	2.1	3.8	4.1	0.33	2.7	5.5
2009	1.9	0.59	0.9	3.0	2.0	0.45	1.2	2.8
2010	0.7	0.35	0.5	0.9	1.0	0.32	0.7	1.4
2011	1.1	0.38	0.7	1.5	1.0	0.37	0.6	1.3
2012	0.5	0.51	0.2	0.8	0.8	0.35	0.5	1.1
2013	0.6	0.59	0.3	1.0	0.8	0.39	0.5	1.1
2014	0.3	0.43	0.2	0.4	1.0	0.32	0.8	1.3
2015	1.6	0.30	1.2	2.1	7.0	0.33	4.9	9.1
2016	1.3	0.33	0.9	1.7	6.8	0.21	5.4	8.1
2017	2.2	0.33	1.6	2.8	4.1	0.30	3.2	5.1
2018	2.3	0.31	1.6	3.1	2.9	0.24	2.2	3.5

Spring

Year	Mean Weight	CV	L95%	U95%	Mean Number	CV	L95%	U95%
2000								
2001	1.0	0.35	0.7	1.3	6.0	0.35	4.2	7.9
2002	1.1	0.37	0.8	1.5	2.4	0.31	1.7	3.0
2003	0.6	0.52	0.3	1.0	1.0	0.26	0.7	1.2
2004	0.4	0.60	0.2	0.6	1.4	0.23	1.1	1.7
2005	0.8	0.35	0.5	1.1	1.1	0.22	0.8	1.4
2006	0.1	0.45	0.1	0.2	0.3	0.42	0.2	0.4
2007	0.4	0.49	0.2	0.6	1.1	0.30	0.8	1.5
2008	0.5	0.30	0.3	0.7	1.4	0.26	1.0	1.7
2009	0.2	0.44	0.1	0.3	0.8	0.31	0.6	1.0
2010	0.2	0.49	0.1	0.3	0.6	0.41	0.4	0.8
2011	0.2	0.69	0.1	0.3	0.3	0.35	0.2	0.4
2012	0.3	0.95	0.0	0.5	0.4	0.36	0.2	0.5
2013	0.2	1.01	0.0	0.3	0.4	0.45	0.2	0.5
2014	0.2	0.97	0.0	0.4	0.9	0.39	0.6	1.1
2015	0.2	0.32	0.1	0.2	1.1	0.28	0.8	1.3
2016	0.5	0.31	0.4	0.6	2.5	0.28	1.9	3.0
2017	0.4	0.64	0.2	0.6	1.2	0.28	0.9	1.4
2018	0.3	0.36	0.2	0.4	1.5	0.27	1.2	1.8

Table 16a. Survey results from NEFSC offshore autumn bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967; survey sampled only a small portion of the southern management area in 2017, therefore indices were not calculated for 2017. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1963	3.60	0.24	2.30	5.09	1.20	0.18	0.87	1.58
1964	5.50	0.17	3.89	7.19	1.64	0.15	1.17	1.98
1965	4.90	0.17	3.60	6.41	1.15	0.15	0.90	1.44
1966	7.01	0.12	5.71	8.61	1.93	0.14	1.53	2.41
1967	1.14	0.22	0.74	1.56	0.52	0.17	0.37	0.66
1968	0.91	0.22	0.60	1.25	0.40	0.21	0.28	0.56
1969	1.34	0.30	0.75	2.06	0.54	0.21	0.37	0.76
1970	1.29	0.22	0.79	1.77	0.35	0.16	0.26	0.44
1971	0.79	0.36	0.38	1.30	0.28	0.21	0.18	0.37
1972	4.89	0.14	3.83	6.05	4.11	0.22	2.48	5.26
1973	1.83	0.16	1.33	2.27	1.18	0.11	0.95	1.35
1974	0.72	0.26	0.43	1.06	0.22	0.21	0.15	0.30
1975	2.00	0.16	1.50	2.54	0.75	0.16	0.50	0.84
1976	1.00	0.18	0.72	1.30	0.31	0.19	0.23	0.43
1977	1.88	0.18	1.37	2.45	0.45	0.14	0.29	0.46
1978	1.40	0.18	1.00	1.83	0.31	0.16	0.19	0.33
1979	1.93	0.16	1.45	2.45	0.84	0.13	0.55	0.85
1980	1.85	0.17	1.35	2.38	0.87	0.16	0.51	0.87
1981	2.26	0.17	1.66	2.90	1.16	0.16	0.72	1.23
1982	0.65	0.21	0.43	0.88	0.61	0.18	0.44	0.79
1983	1.76	0.21	1.18	2.40	0.78	0.17	0.57	0.99
1984	0.77	0.40	0.34	1.36	0.31	0.31	0.17	0.49
1985	1.29	0.19	0.93	1.72	0.62	0.16	0.40	0.68
1986	0.55	0.27	0.33	0.81	0.36	0.23	0.22	0.46
1987	0.28	0.29	0.16	0.42	0.48	0.18	0.35	0.63
1988	0.55	0.28	0.32	0.83	0.23	0.26	0.14	0.33
1989	0.62	0.25	0.37	0.87	0.46	0.22	0.24	0.51
1990	0.37	0.32	0.20	0.58	0.35	0.27	0.17	0.43
1991	0.77	0.29	0.45	1.19	0.83	0.28	0.40	1.08
1992	0.32	0.22	0.22	0.44	0.34	0.16	0.25	0.43
1993	0.27	0.34	0.14	0.44	0.35	0.23	0.19	0.41
1994	0.55	0.23	0.35	0.75	0.60	0.19	0.42	0.79
1995	0.39	0.27	0.23	0.57	0.49	0.21	0.33	0.68
1996	0.39	0.21	0.26	0.53	0.23	0.21	0.16	0.32
1997	0.59	0.19	0.42	0.79	0.31	0.17	0.23	0.39
1998	0.50	0.24	0.32	0.72	0.33	0.24	0.21	0.46
1999	0.30	0.15	0.23	0.38	0.45	0.12	0.36	0.54
2000	0.47	0.20	0.32	0.63	0.42	0.17	0.31	0.54
2001	0.65	0.18	0.47	0.85	0.38	0.17	0.27	0.49
2002	1.25	0.18	0.88	1.61	0.83	0.14	0.64	1.02
2003	0.82	0.15	0.61	1.04	0.95	0.17	0.71	1.24
2004	0.74	0.18	0.53	0.97	0.47	0.20	0.32	0.62
2005	0.77	0.23	0.50	1.09	0.58	0.20	0.41	0.80
2006	0.76	0.24	0.49	1.07	0.45	0.19	0.33	0.60
2007	0.50	0.24	0.31	0.71	0.20	0.22	0.12	0.27
2008	0.41	0.35	0.19	0.68	0.20	0.25	0.12	0.29
2009	0.24	0.12	0.19	0.28	0.22	0.13	0.17	0.27
2010	0.36	0.17	0.27	0.47	0.40	0.19	0.29	0.54
2011	0.30	0.12	0.24	0.36	0.62	0.13	0.48	0.75
2012	0.43	0.14	0.33	0.54	0.28	0.14	0.22	0.34
2013	0.27	0.15	0.21	0.34	0.29	0.17	0.21	0.37
2014	0.15	0.18	0.11	0.19	0.16	0.12	0.13	0.19
2015	0.37	0.22	0.25	0.51	1.96	0.28	1.20	3.05
2016	0.42	0.23	0.27	0.59	0.63	0.20	0.44	0.84
2017								
2018	0.26	0.13	0.21	0.32	0.47	0.17	0.35	0.62

Table 16b. Survey results from NEFSC offshore autumn bottom trawl surveys in the southern management region (strata 1-19, 61-76). Values are indices calculated without adjustment for change in survey methods in 2009. Only a small portion of the southern management area was sampled in 2017, therefore indices were not calculated for 2017. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	1.92	0.13	1.52	2.33	1.56	0.15	1.18	1.93
2010	2.92	0.18	2.04	3.79	2.87	0.21	1.89	3.85
2011	2.42	0.13	1.89	2.95	4.36	0.15	3.27	5.44
2012	3.50	0.18	2.46	4.53	1.96	0.16	1.45	2.47
2013	2.19	0.17	1.58	2.81	2.07	0.18	1.44	2.69
2014	1.20	0.23	0.75	1.65	1.14	0.15	0.86	1.42
2015	2.96	0.23	1.82	4.10	13.96	0.31	6.85	21.06
2016	3.37	0.22	2.14	4.61	4.46	0.19	3.06	5.85
2017								
2018	2.13	0.13	1.66	2.60	3.38	0.17	2.45	4.31

Table 17a. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967. Indices are
Table 17a. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967. Indices are
arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1968	1.16	0.23	0.77	1.61	0.21	0.19	0.15	0.28
1969	0.92	0.23	0.58	1.31	0.23	0.20	0.15	0.30
1970	1.00	0.25	0.58	1.40	0.18	0.19	0.12	0.23
1971	0.76	0.29	0.43	1.15	0.21	0.25	0.13	0.29
1972	1.88	0.18	1.36	2.47	0.36	0.12	0.29	0.44
1973	1.82	0.08	1.59	2.06	1.04	0.08	0.91	1.17
1974	1.16	0.16	0.87	1.47	0.49	0.11	0.40	0.57
1975	0.91	0.15	0.70	1.15	0.44	0.12	0.36	0.54
1976	1.13	0.11	0.91	1.33	0.41	0.12	0.33	0.48
1977	1.16	0.14	0.90	1.45	0.30	0.10	0.25	0.35
1978	0.73	0.13	0.58	0.89	0.34	0.09	0.28	0.39
1979	0.70	0.17	0.51	0.90	0.27	0.15	0.21	0.34
1980	0.74	0.15	0.56	0.92	0.45	0.10	0.38	0.53
1981	1.74	0.15	1.33	2.20	0.77	0.12	0.62	0.92
1982	2.60	0.17	1.92	3.33	0.93	0.12	0.75	1.11
1983	0.95	0.26	0.58	1.35	0.27	0.16	0.20	0.35
1984	0.74	0.31	0.36	1.12	0.18	0.23	0.11	0.25
1985	0.33	0.32	0.17	0.52	0.16	0.25	0.10	0.23
1986	0.83	0.28	0.48	1.23	0.28	0.27	0.18	0.43
1987	0.50	0.48	0.17	0.95	0.11	0.23	0.07	0.15
1988	0.43	0.13	0.34	0.52	0.44	0.16	0.33	0.55
1989	0.36	0.16	0.27	0.47	0.20	0.23	0.13	0.28
1990	1.00	0.20	0.67	1.34	0.21	0.11	0.17	0.24
1991	0.58	0.24	0.37	0.82	0.32	0.25	0.20	0.46
1992	0.22	0.33	0.11	0.34	0.18	0.25	0.11	0.25
1993	0.26	0.28	0.15	0.39	0.20	0.23	0.12	0.28
1994	0.33	0.28	0.19	0.50	0.11	0.23	0.07	0.16
1995	0.52	0.39	0.20	0.90	0.20	0.20	0.13	0.27
1996	0.28	0.20	0.19	0.38	0.14	0.20	0.09	0.18
1997	0.13	0.22	0.09	0.18	0.12	0.21	0.08	0.16
1998	0.28	0.15	0.22	0.35	0.25	0.14	0.20	0.31
1999	0.64	0.20	0.44	0.86	0.34	0.14	0.26	0.42
2000	0.30	0.18	0.21	0.39	0.24	0.17	0.18	0.31
2001	0.26	0.31	0.14	0.41	0.24	0.20	0.16	0.31
2002	0.38	0.30	0.21	0.60	0.32	0.33	0.18	0.52
2003	1.38	0.15	1.03	1.72	0.31	0.16	0.23	0.39
2004	0.18	0.27	0.11	0.27	0.12	0.25	0.07	0.17
2005	0.37	0.16	0.28	0.47	0.26	0.27	0.16	0.39
2006	0.54	0.27	0.32	0.78	0.17	0.20	0.12	0.23
2007	0.55	0.22	0.37	0.77	0.26	0.16	0.20	0.33
2008	0.39	0.31	0.22	0.60	0.19	0.31	0.11	0.29
2009	0.30	0.15	0.23	0.38	0.16	0.14	0.12	0.19
2010	0.22	0.19	0.15	0.29	0.16	0.21	0.11	0.22
2011	0.42	0.11	0.34	0.50	0.28	0.14	0.22	0.34
2012	0.35	0.11	0.29	0.42	0.30	0.09	0.26	0.34
2013	0.34	0.14	0.27	0.44	0.20	0.17	0.15	0.26
2014	0.25	0.19	0.17	0.33	0.14	0.13	0.11	0.17
2015	0.20	0.18	0.14	0.26	0.11	0.16	0.08	0.14
2016	0.28	0.11	0.23	0.32	0.46	0.10	0.38	0.54
2017	0.49	0.16	0.37	0.62	0.46	0.18	0.33	0.59
2018	0.63	0.16	0.46	0.78	0.33	0.16	0.24	0.41
2019	0.36	0.10	0.30	0.42	0.29	0.11	0.24	0.34

Table 17b. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	2.45	0.16	1.81	3.09	1.11	0.15	0.85	1.38
2010	1.73	0.19	1.19	2.28	1.15	0.22	0.73	1.56
2011	3.41	0.11	2.80	4.01	1.99	0.14	1.54	2.44
2012	2.86	0.11	2.36	3.35	2.14	0.09	1.83	2.45
2013	2.76	0.14	2.10	3.42	1.43	0.17	1.03	1.82
2014	2.03	0.19	1.41	2.65	1.03	0.13	0.80	1.25
2015	1.58	0.17	1.14	2.02	0.77	0.15	0.58	0.97
2016	2.22	0.10	1.85	2.59	3.25	0.11	2.68	3.82
2017	3.93	0.16	2.92	4.94	3.25	0.18	2.26	4.24
2018	5.04	0.16	3.72	6.36	2.36	0.16	1.73	2.99
2019	2.89	0.10	2.42	3.36	2.07	0.11	1.70	2.43

Table 18. Survey results from NEFSC (1984-2011) and NEFSC and VIMS (2012-2018) offshore scallop dredge surveys in the southern management region (shellfish strata 6, 7, 10, 11, 14, 15, 18, 19, 22-31, 33-35, 46, 47, 55, 58-61, 621, 631). The survey vessel used by NEFSC and survey timing change in 2009. VIMS conducted an increasing portion of the survey starting in 2012. Indices are arithmetic stratified means with bootstrapped variance estimates (where available).

	Abundance Index			
	Mean	CV	L90%	U90%
1984	1.34	0.1	1.17	1.51
1985	1.57	0.1	1.37	1.79
1986	1.29	0.1	1.12	1.46
1987	3.17	0.1	2.89	3.46
1988	1.69	0.1	1.49	1.89
1989	1.00	0.1	0.88	1.13
1990	1.53	0.1	1.40	1.69
1991	2.26	0.1	2.05	2.46
1992	1.95	0.1	1.75	2.18
1993	2.83	0.0	2.62	3.06
1994	3.33	0.1	3.06	3.62
1995	2.26	0.1	2.03	2.49
1996	2.01	0.1	1.80	2.23
1997	1.12	0.1	0.99	1.26
1998	1.06	0.1	0.95	1.18
1999	2.57	0.1	2.28	2.89
2000	2.29	0.1	2.04	2.58
2001	1.73	0.1	1.56	1.92
2002	1.70	0.1	1.54	1.86
2003	2.75	0.1	2.48	3.01
2004	2.89	0.1	2.59	3.23
2005	2.01	0.1	1.81	2.21
2006	1.44	0.1	1.31	1.57
2007	0.83	0.1	0.73	0.94
2008	1.03	0.1	0.89	1.17
2009	0.78	9.8	0.65	0.92
2010	0.74	9.9	0.61	0.87
2011	0.94	12.5	0.73	1.12
2012	1.00			
2013	0.81			
2014	0.55			
2015	2.29			
2016	2.17			
2017	1.62			
2018	0.99			

Table 19. Area-swept estimates of minimum abundance and biomass, and relative exploitation indices for monkfish from NEFSC fall surveys. Estimates are adjusted for sweep type (adjusted to chain sweep), assume that 100% of monkfish encountered by the trawl are captured and do not account for missed strata in some years.

North	Catch (millions of fish)	Landings (millions of fish)	Catch mt	adjusted AS total abund	adjusted AS 43 cm+ abund	adjusted AS Biomass mt	C/Total N Rel F	L/43+cm Rel F	C mt/ B mt Rel F
2009	1.559	1.066	3,675	36,717,874	8,662,877	32,406	0.04	0.12	0.11
2010	1.169	0.819	2,741	40,524,791	10,999,269	42,178	0.03	0.07	0.06
2011	1.445	0.970	2,814	51,328,487	14,797,117	49,936	0.03	0.07	0.06
2012	1.995	1.390	4,635	57,008,552	13,828,353	51,063	0.04	0.10	0.09
2013	1.724	1.109	3,922	60,967,483	8,414,414	40,838	0.03	0.13	0.10
2014	1.865	1.139	3,954	84,100,939	13,314,746	54,125	0.02	0.09	0.07
2015	2.137	1.395	4,630	105,281,189	17,990,848	77,578	0.02	0.08	0.06
2016	2.552	1.670	5,508	174,643,487	26,516,683	103,686	0.01	0.06	0.05
2017	3.222	2.478	7,894	115,927,590	39,300,789	113,147	0.03	0.06	0.07
2018	3.210	2.090	8,115	100,164,292	35,993,154	140,801	0.03	0.06	0.06

South	Catch (millions of fish)	Landings (millions of fish)	Catch mt	adjusted AS total abund	adjusted AS 43 cm+ abund	adjusted AS Biomass mt	C/Total N Rel F	L/43+cm Rel F	C mt/ B mt Rel F
2009	2.14	1.282	7,158	26,947,935	4,900,883	20,592	0.08	0.26	0.35
2010	2.64	1.095	7,105	47,905,108	8,873,105	32,509	0.06	0.12	0.22
2011	2.66	1.236	8,545	62,976,941	6,254,672	25,878	0.04	0.20	0.33
2012	3.35	1.439	8,438	24,635,364	7,309,501	31,016	0.14	0.20	0.27
2013	2.46	1.398	7,176	36,089,410	7,908,464	23,849	0.07	0.18	0.30
2014	2.49	1.243	6,859	25,860,088	4,769,114	20,359	0.10	0.26	0.34
2015	2.29	1.057	5,844	298,342,595	3,536,976	50,510	0.01	0.30	0.12
2016	4.51	0.971	7,199	77,586,702	5,136,276	52,014	0.06	0.19	0.14
2017	2.96	0.934	9,143						
2018	2.98	1.112	9,615	67,592,308	6,726,308	26,619	0.04	0.17	0.36

Figures

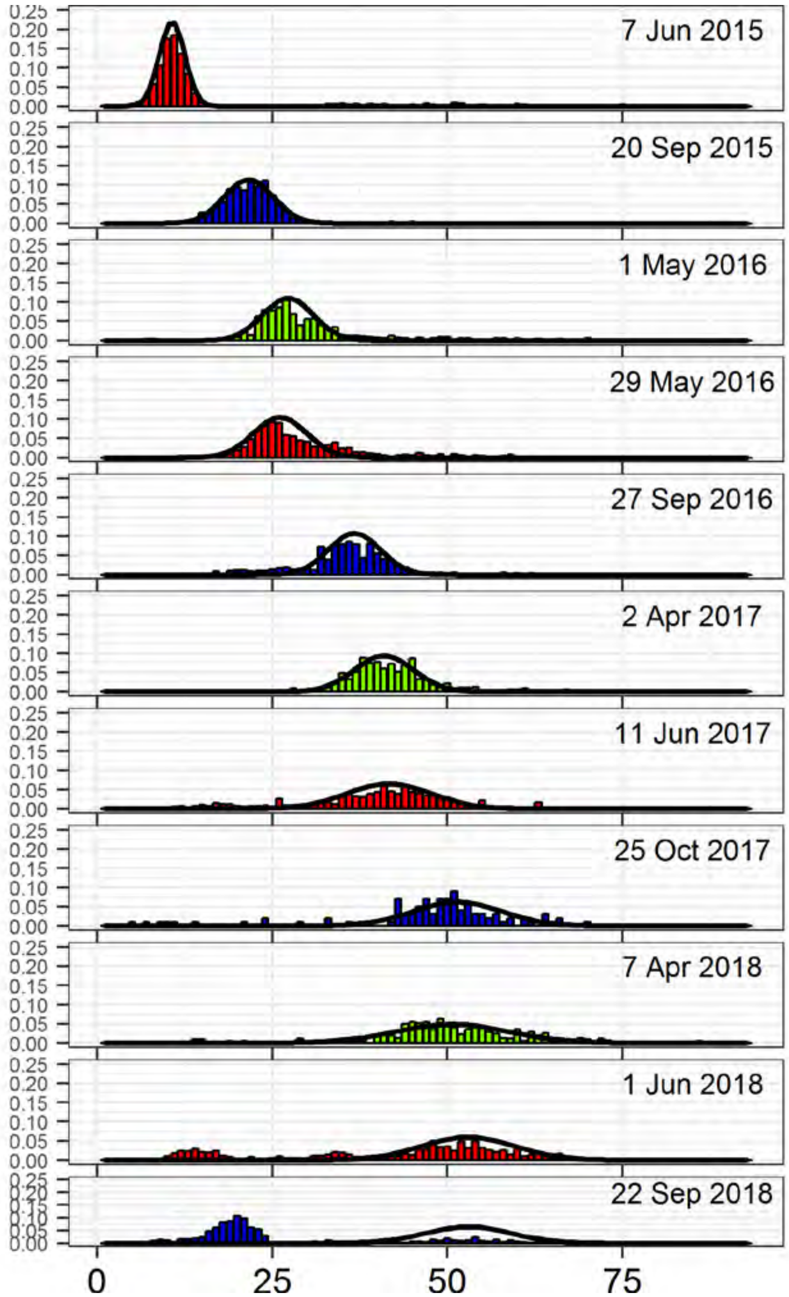


Figure 1. Length frequency distributions of monkfish in southern management area from NEFSC spring (green), scallop dredge (NEFSC and VIMS, red), and NEFSC fall surveys (blue) illustrating growth rates of presumed 2015 year class of monkfish. Normal curves fit using NORMSEP. Monkfish settle to the benthos at about 8 cm. Geographic scope of sampling was limited to southern flank of Georges Bank in fall 2017.

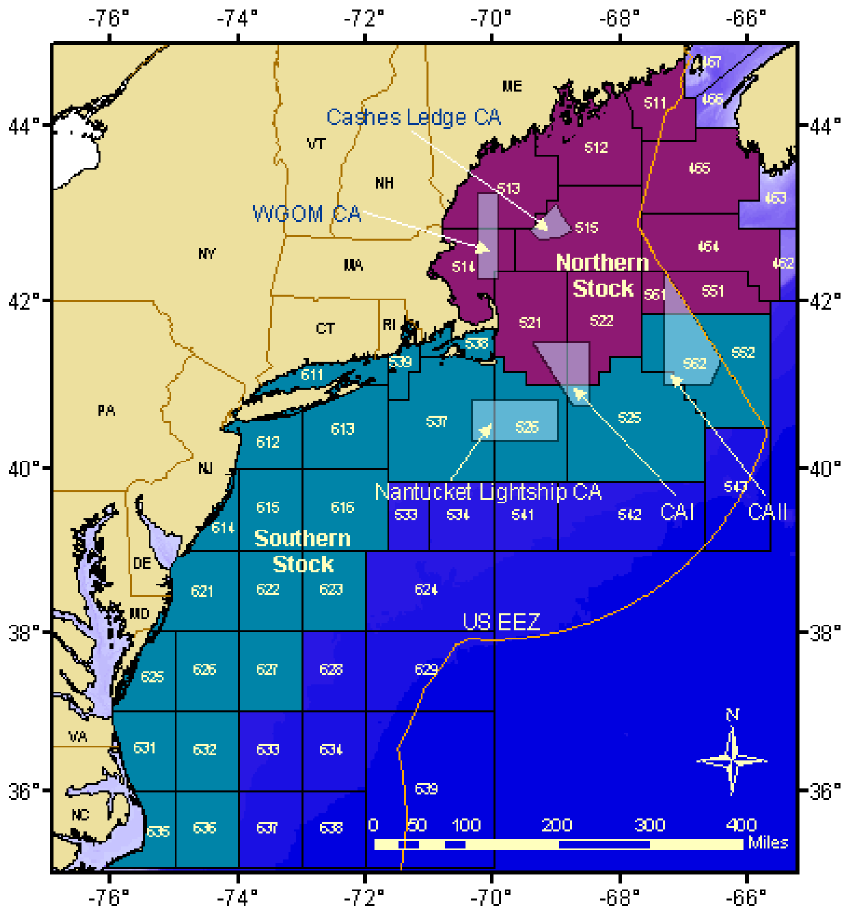


Figure 2. Fishery statistical areas used to define northern and southern monkfish management areas.

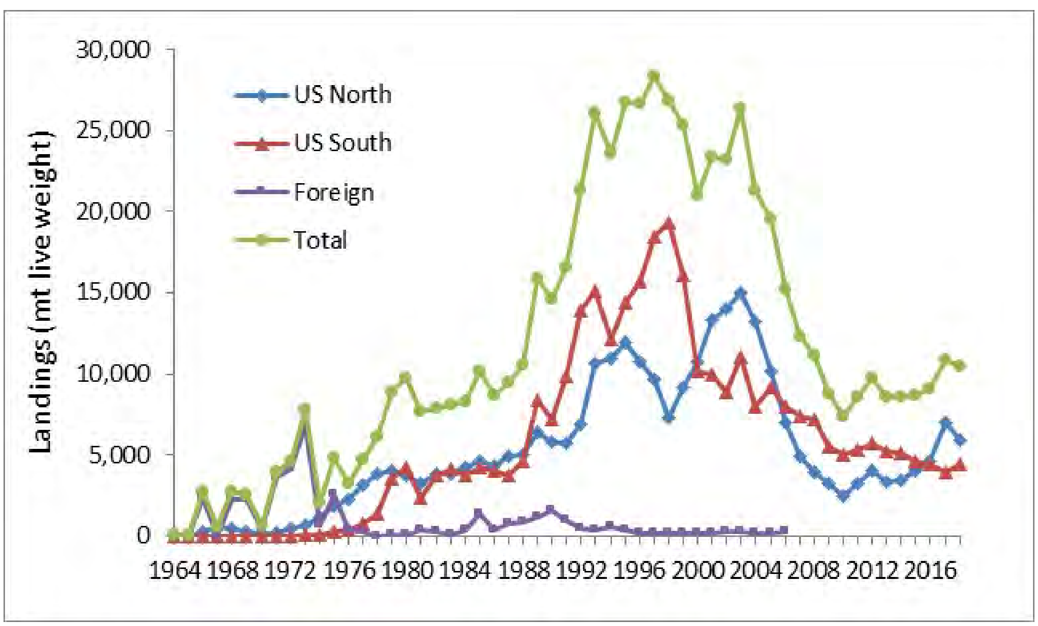


Figure 3. Monkfish landings by management area and combined areas, 1964-2018.

A.

B.

C.

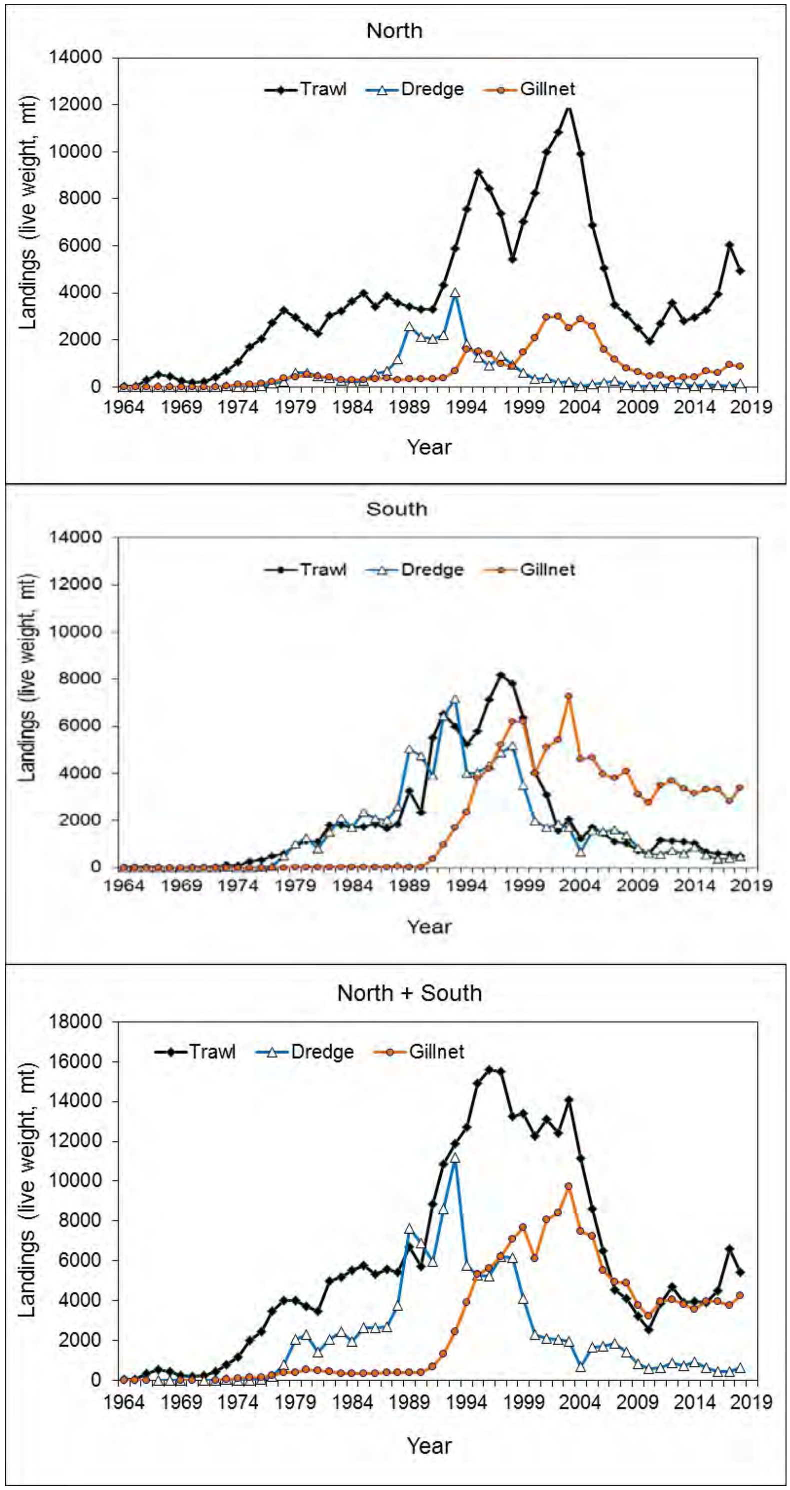


Figure 4. Commercial landings of monkfish by gear type and management area, 1964-2018. A. Northern management area, B. Southern management area, C. Management areas combined.

North South

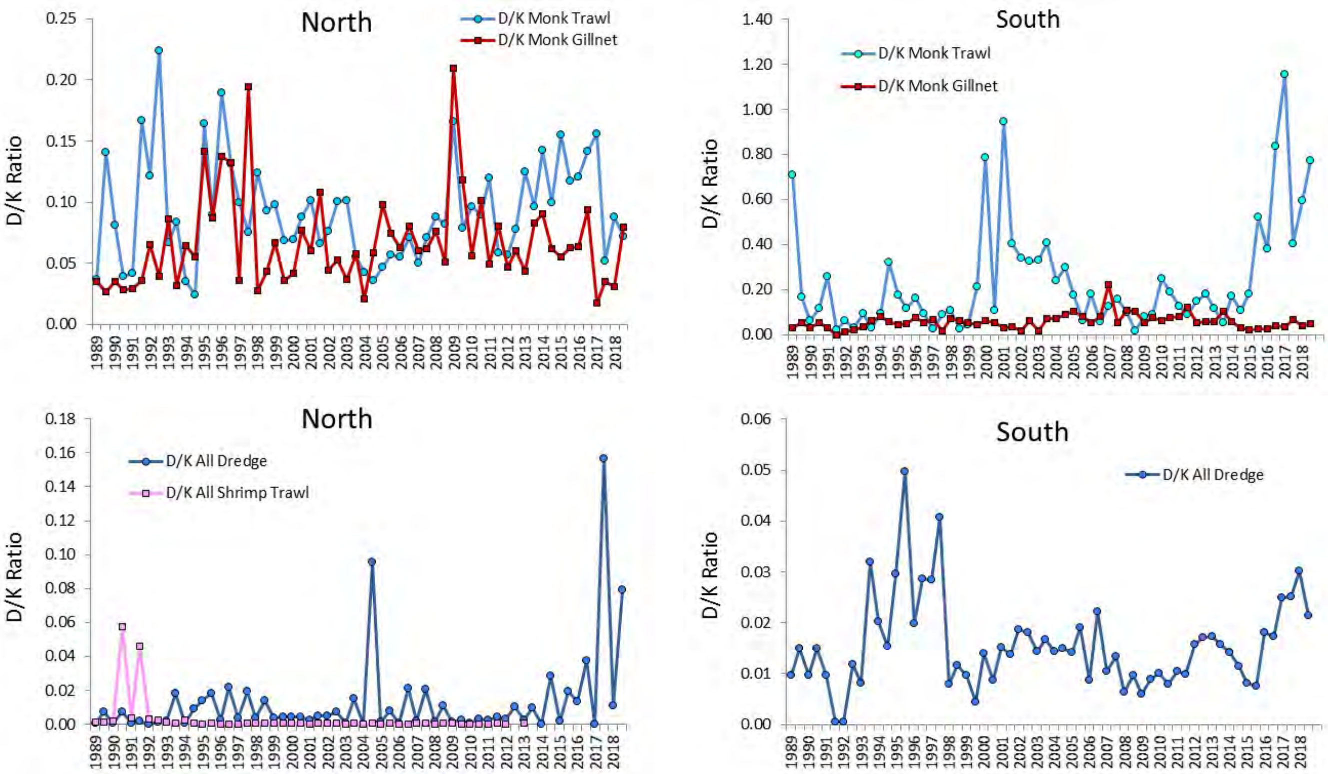


Figure 5. Discard ratios by half year for trawls and gillnets (top panels), and dredges and shrimp trawls (bottom panels) for North (left column) and South (right column). Trawls and gillnets ratios were based on kept monkfish; dredge and shrimp trawl were based on kept of all species.

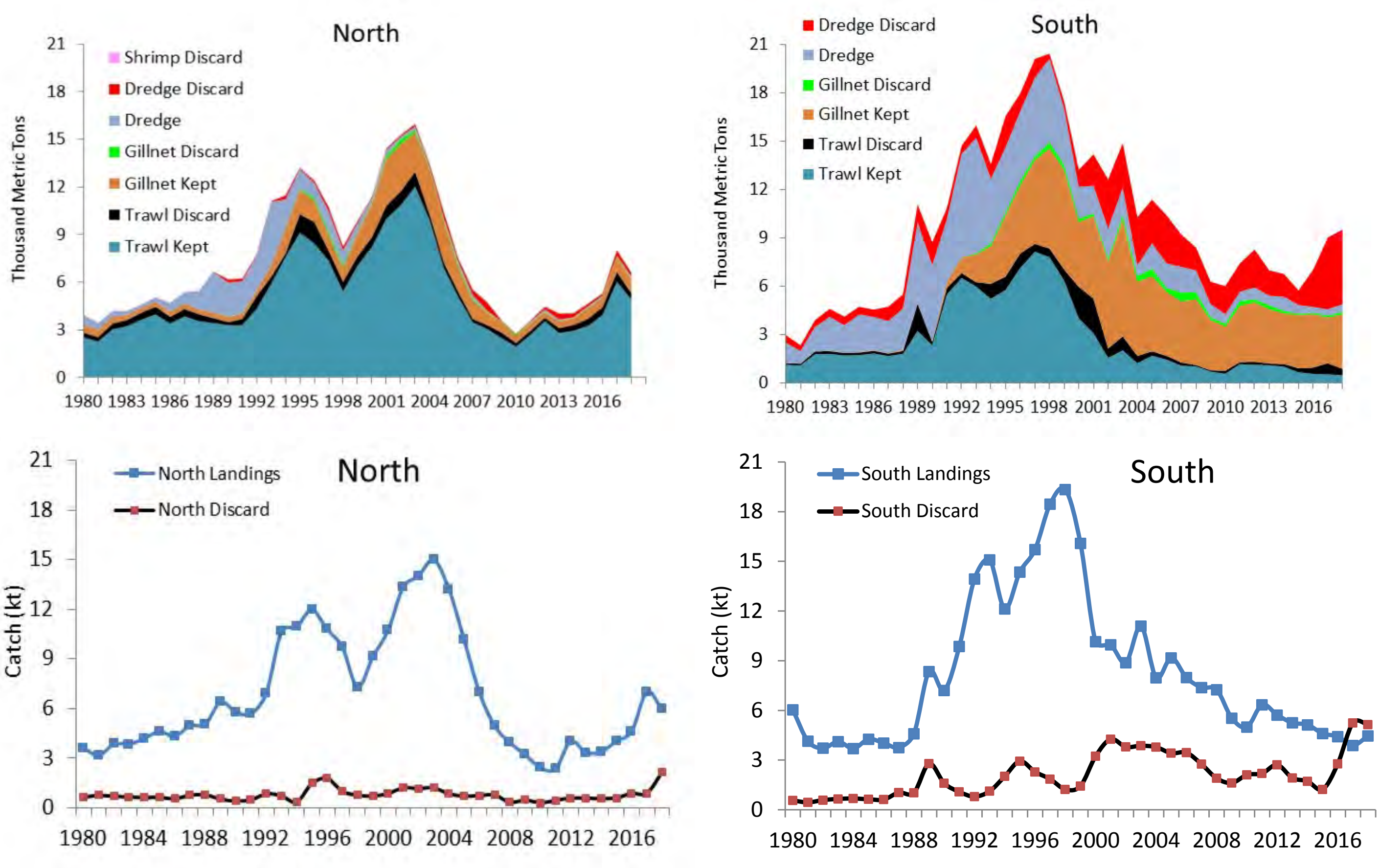


Figure 6. Monkfish landings and discard by gear type (top panels) and total (bottom panels) for North (left) and South (right).

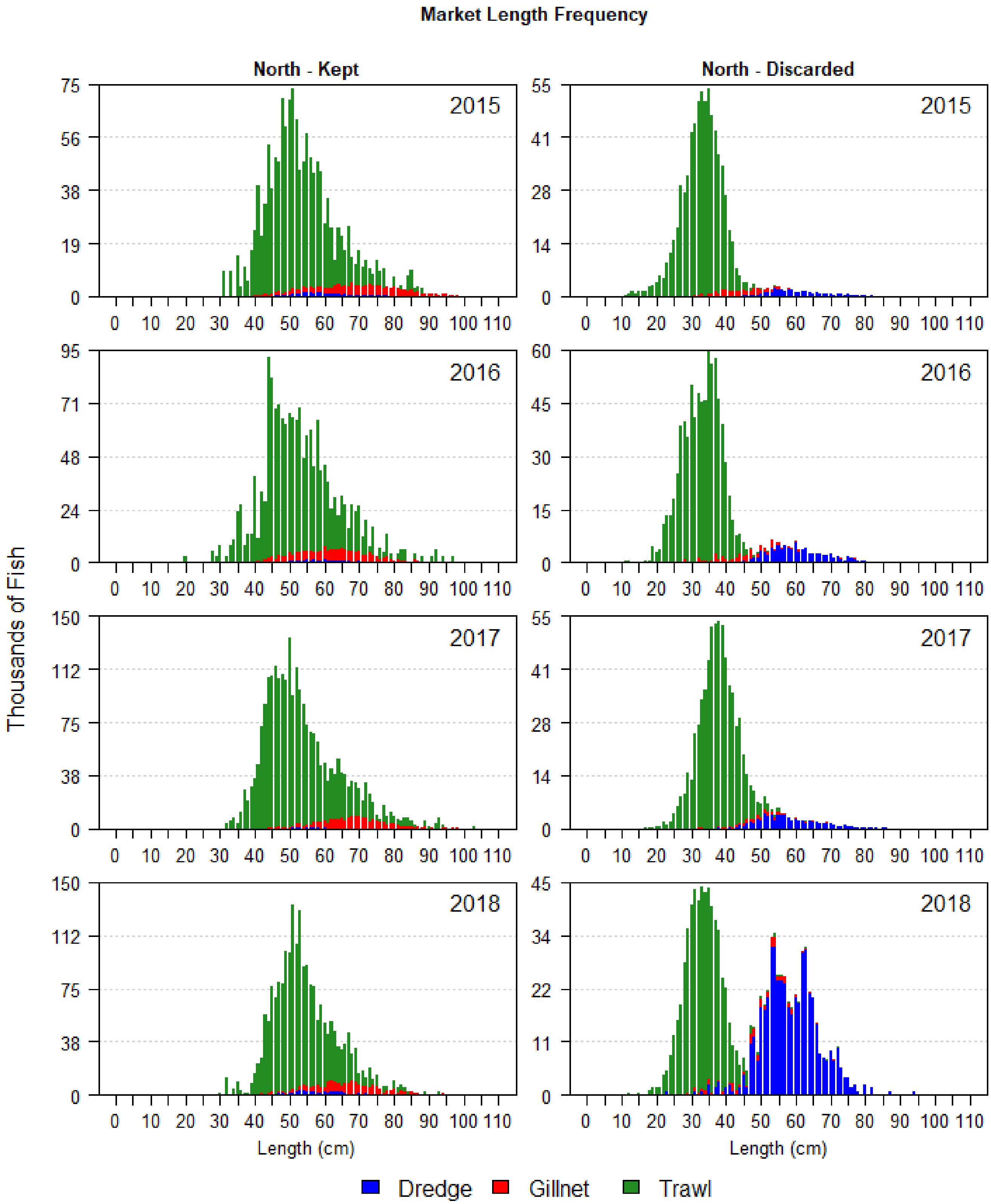


Figure 7. Estimated length composition of kept and discarded monkfish by gear type in the northern management area.

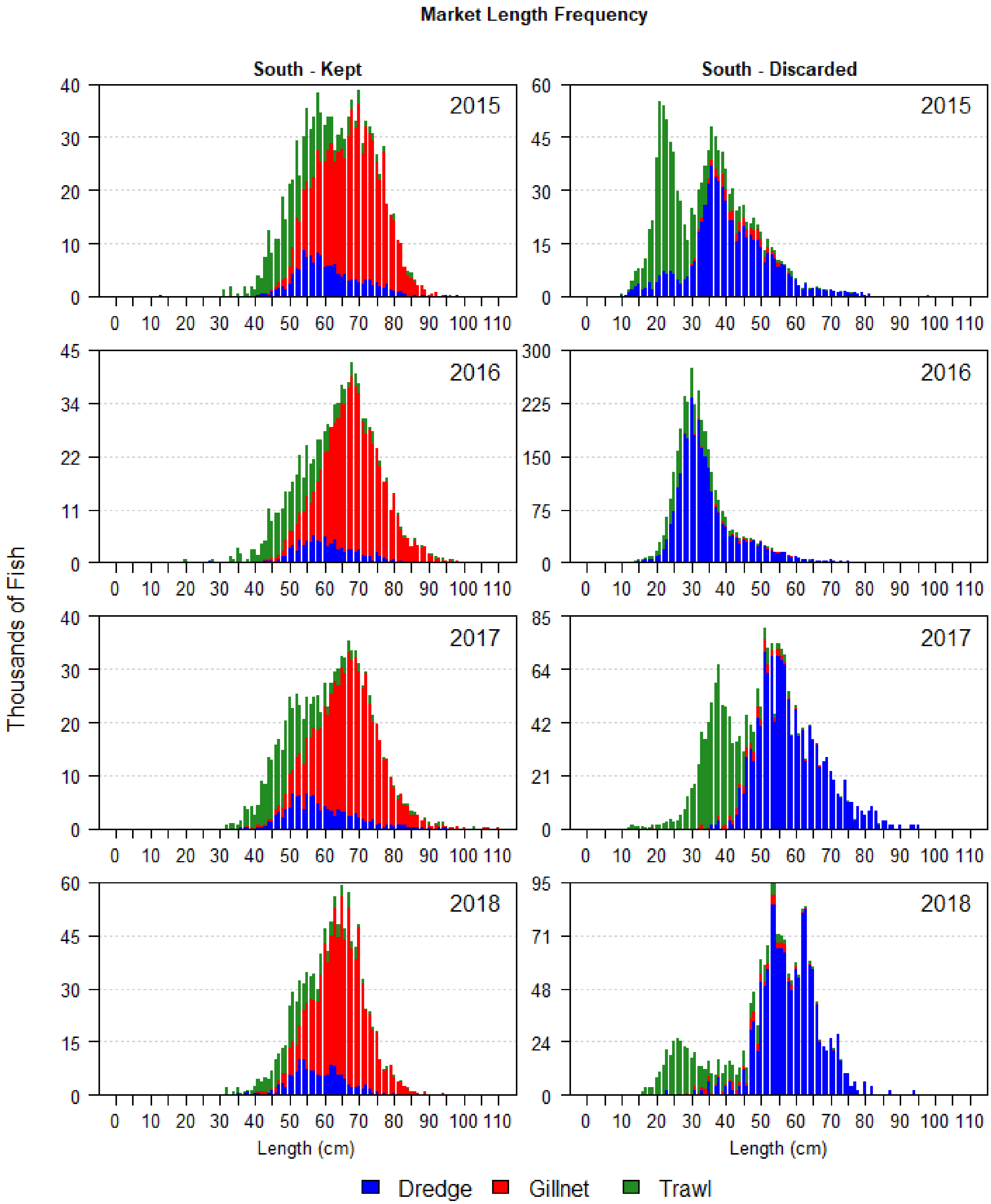


Figure 8. Estimated length composition of kept and discarded monkfish by gear type in the southern management area.

North Y-axis scale variable Y-axis scale standardized

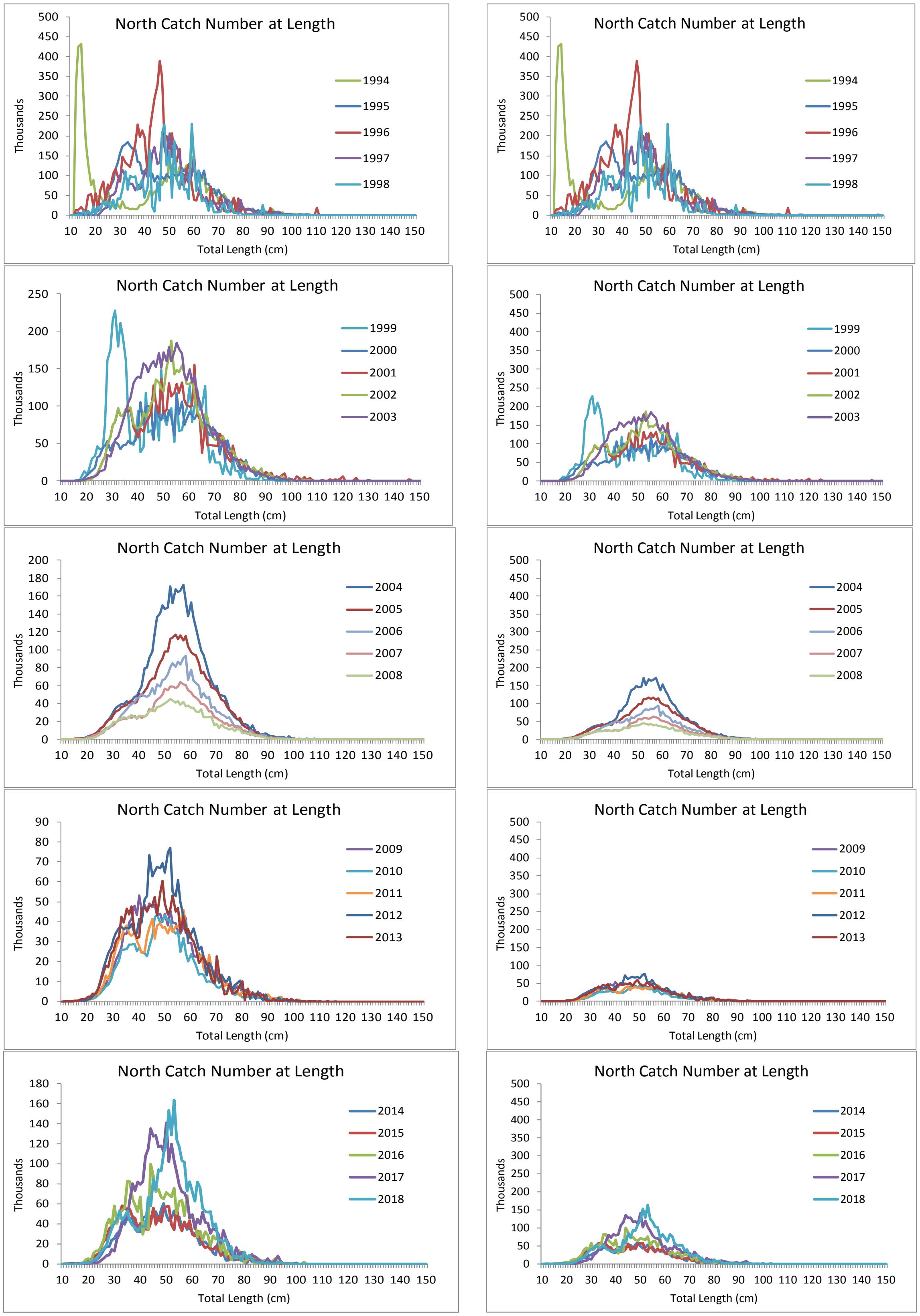


Figure 9. Estimated length composition of commercial monkfish catch, northern management area.

South Y-axis scale variable Y-axis scale standardized

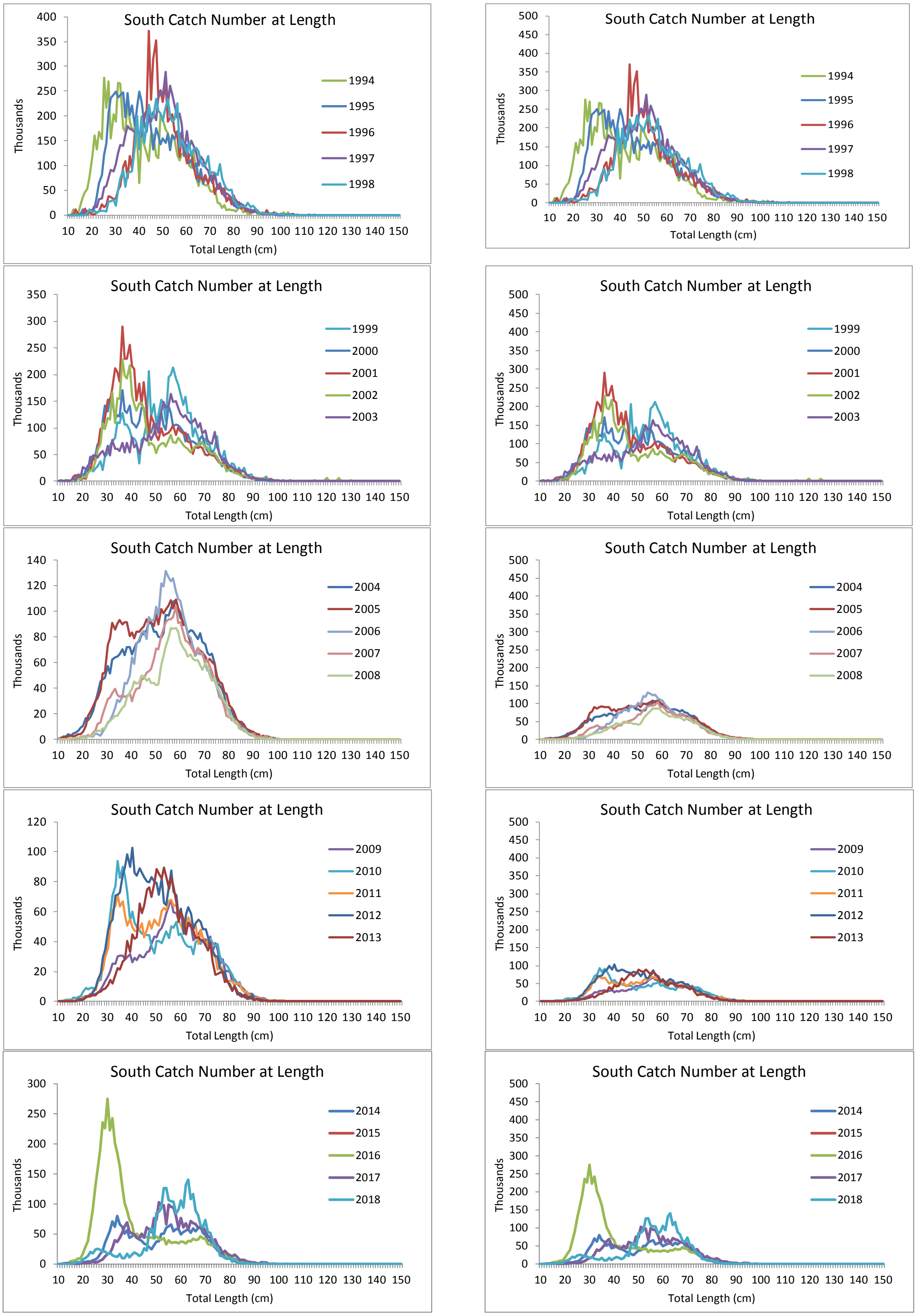


Figure 10. Length composition of monkfish commercial catch estimated using length frequency data collected by fishery observers in the southern management area.

North

Biomass Abundance

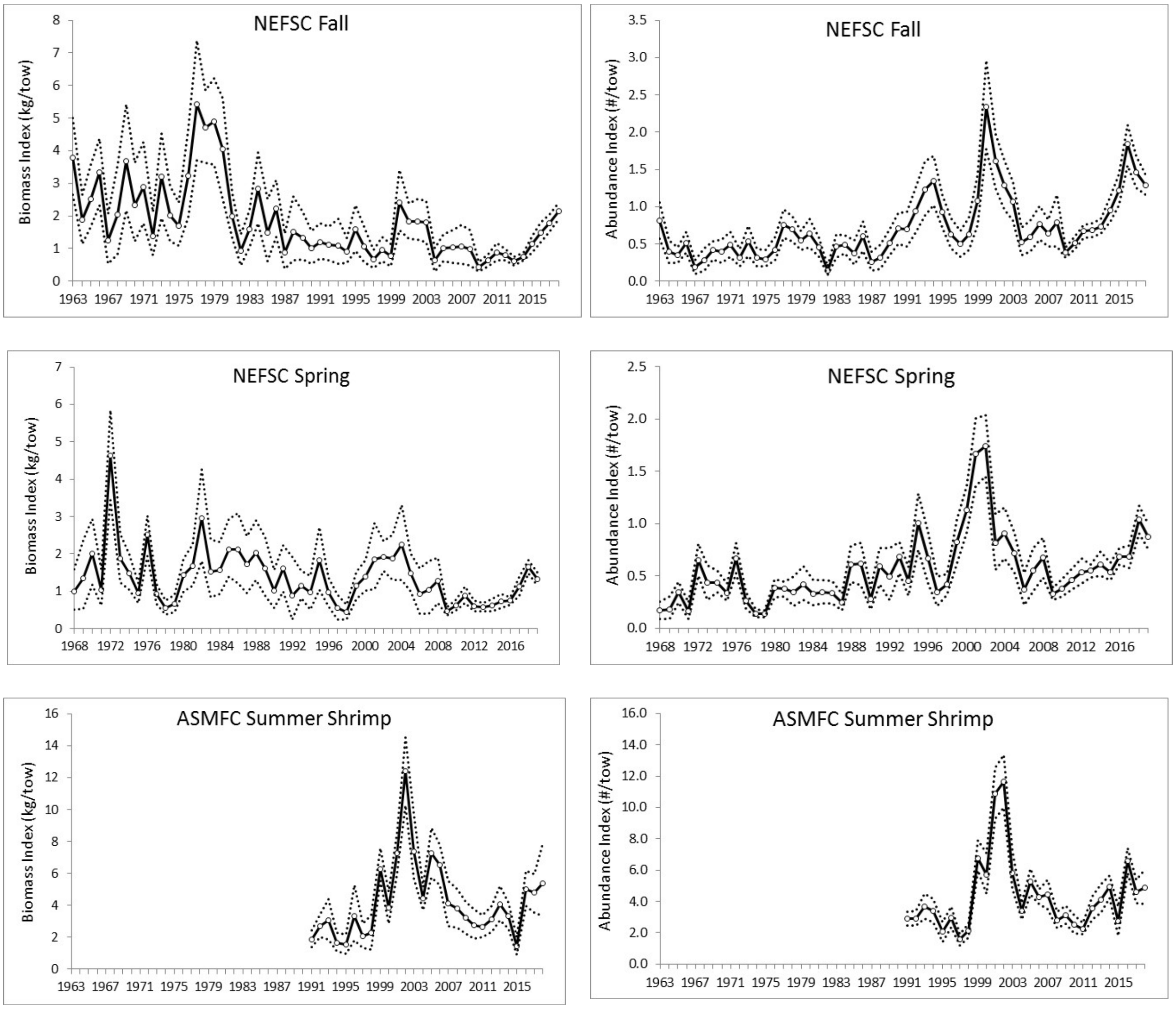


Figure 11. Survey indices for monkfish in the northern management area. Points after 2008 in spring and fall surveys are from surveys conducted on the FSV Bigelow, converted to Albatross units as described in the text.

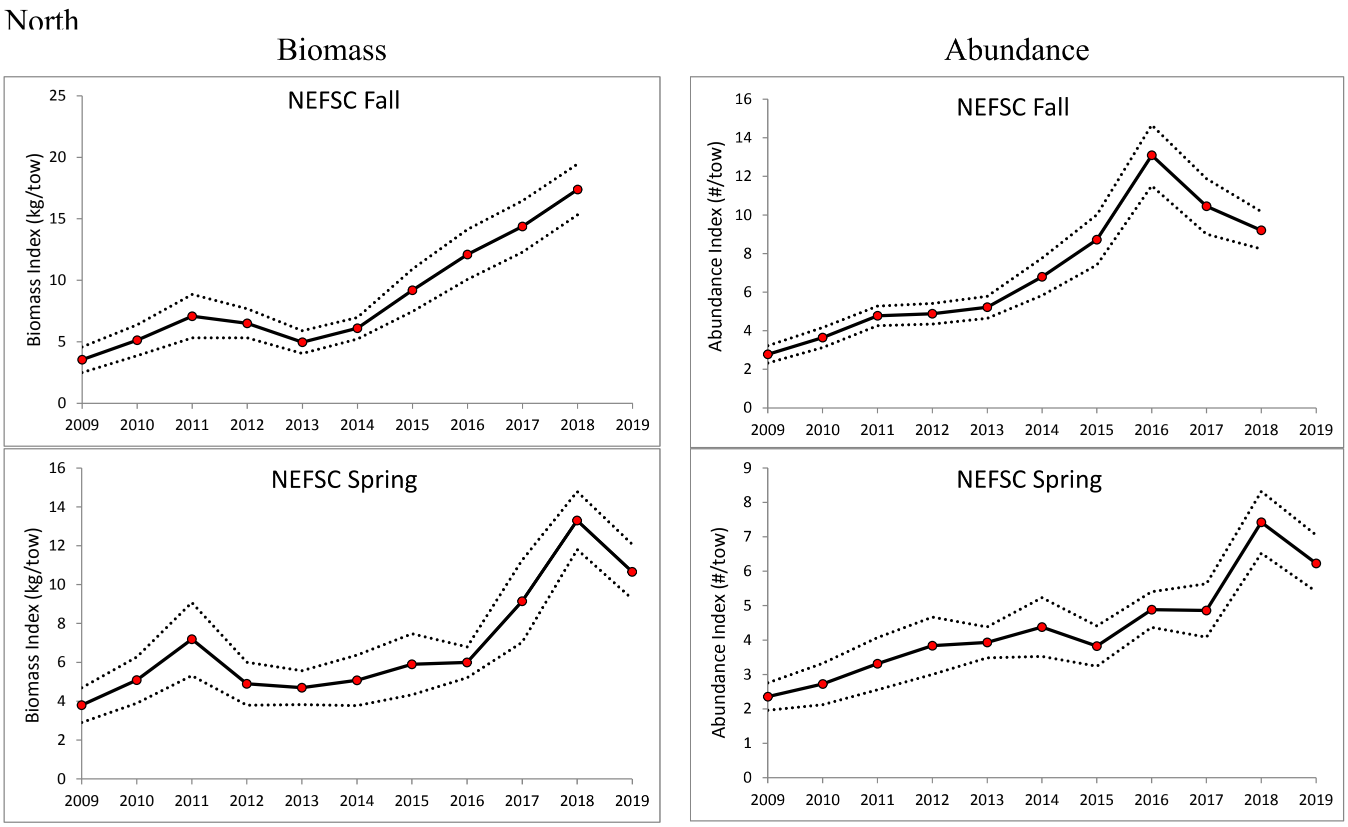


Figure 12. Survey indices from surveys conducted on the FRSV Bigelow in the northern management area, not converted to Albatross units. Note: y-axis scale varies.

Fall Spring

A.

B.

C.

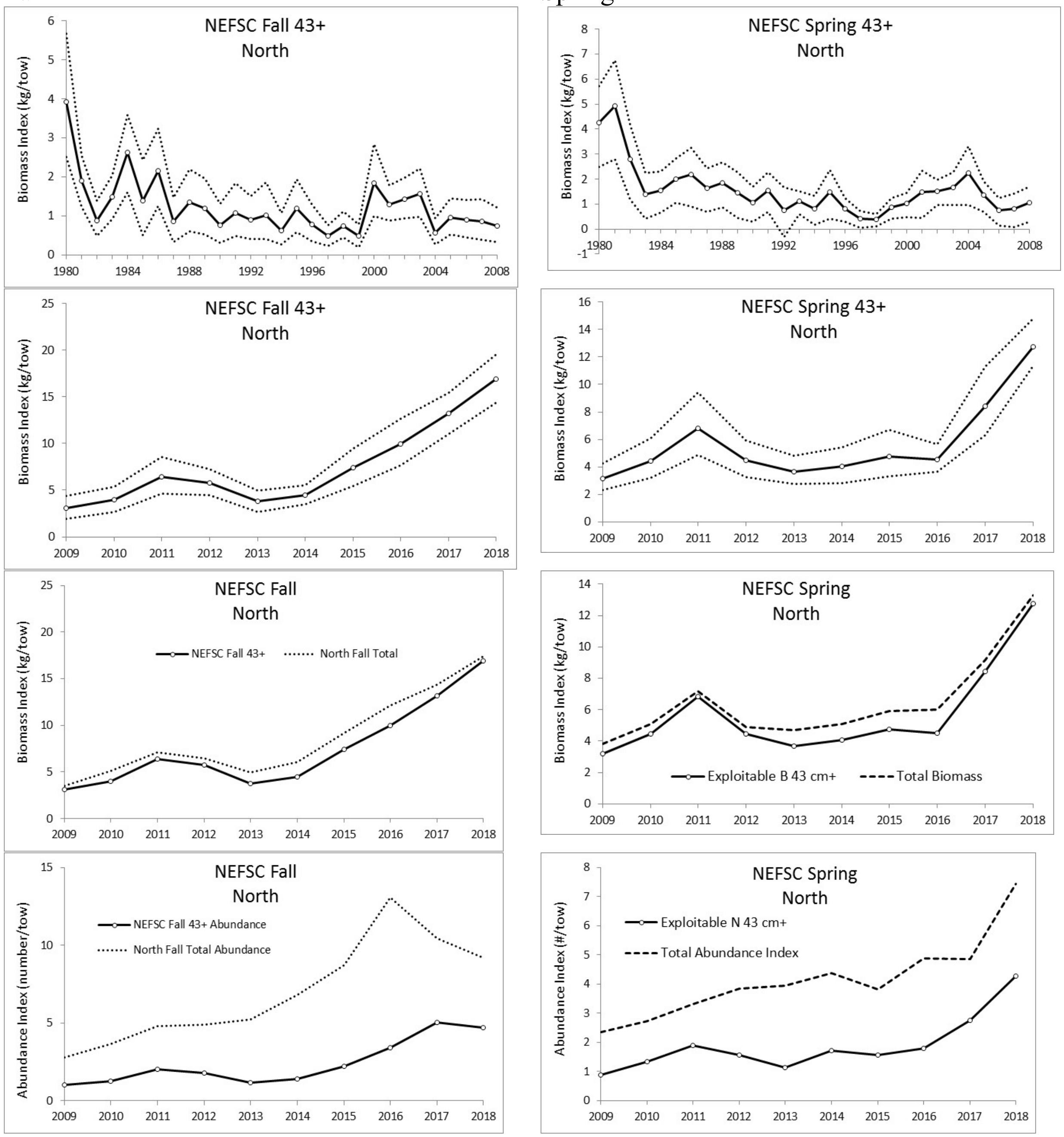


Figure 13. Exploitable biomass (≥ 43 cm total length) indices for monkfish from fall and spring surveys in the NMA. A. Exploitable biomass indices with 95% confidence intervals, 1980-2008 (surveys conducted on RV Albatross). B. Exploitable biomass indices with 95% confidence intervals, 2009-2018 (surveys conducted on RV H.B. Bigelow) C. Total biomass vs. exploitable biomass indices, 2009-2018, D. total abundance vs. exploitable abundance, 2009-2018.

North

Biomass | Abundance

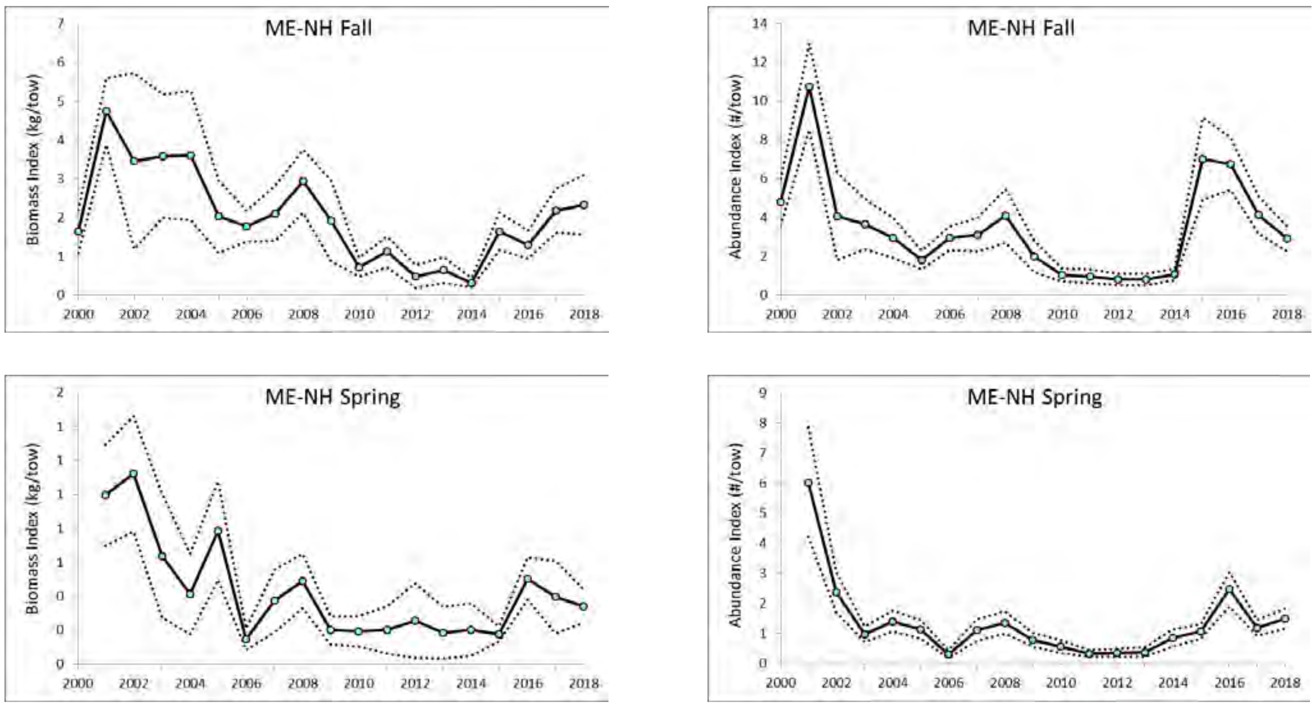


Figure 14. Survey indices for monkfish from Maine-New Hampshire inshore surveys. Data courtesy of Maine Department of Marine Resources.

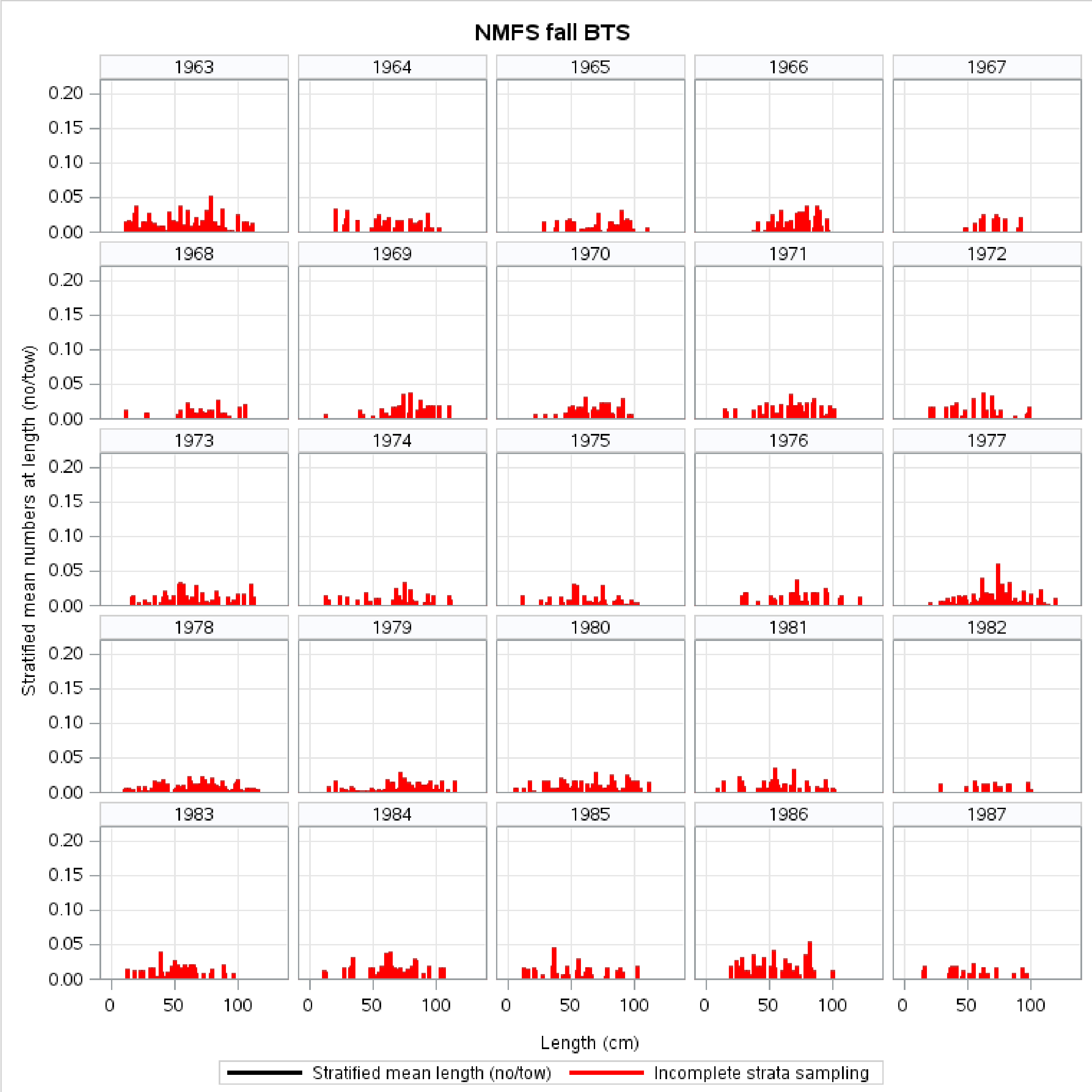


Figure 15. Abundance at length from NEFSC fall surveys in the northern management area.

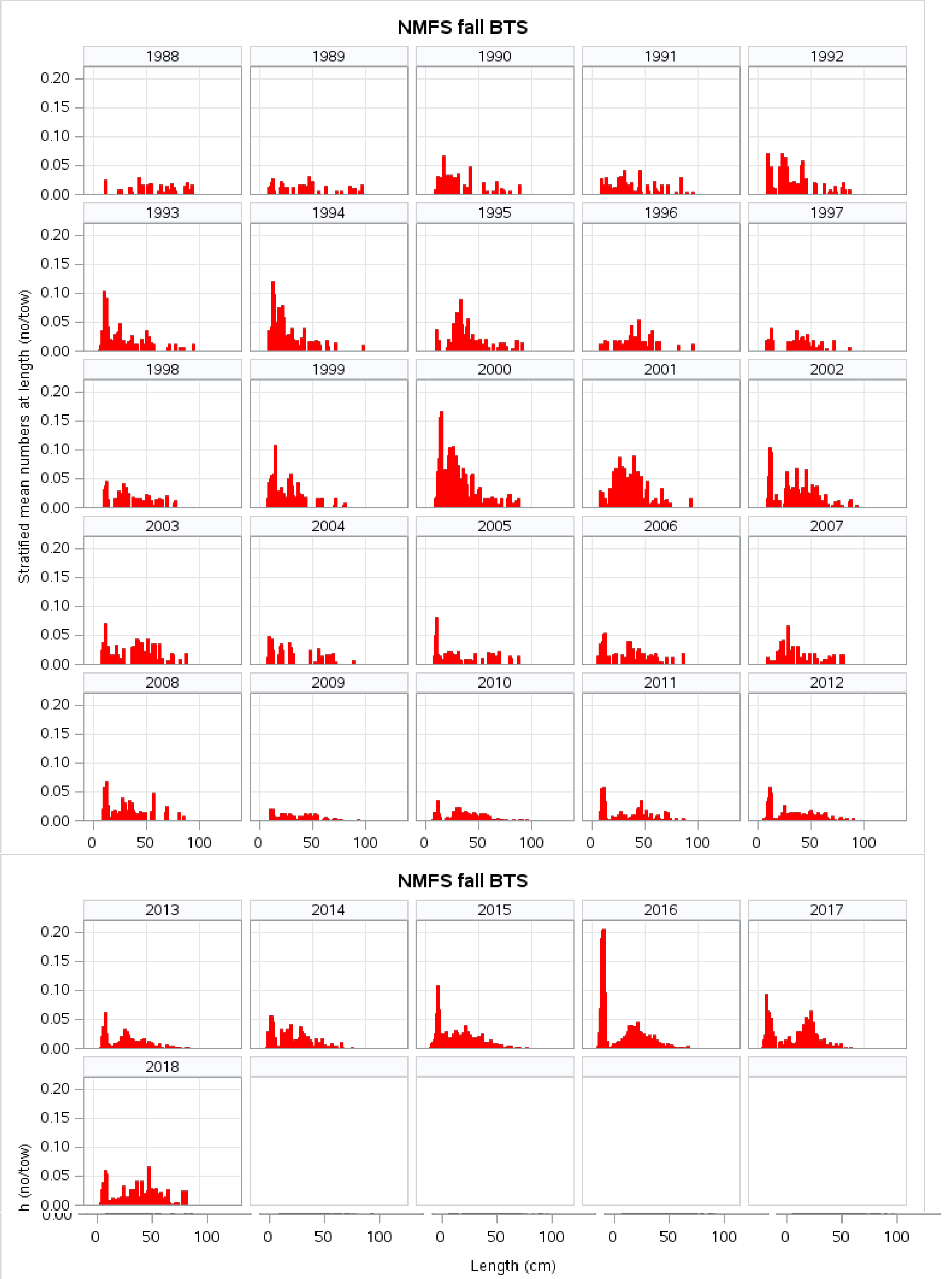


Figure 15, cont’d. (fall surveys, north)

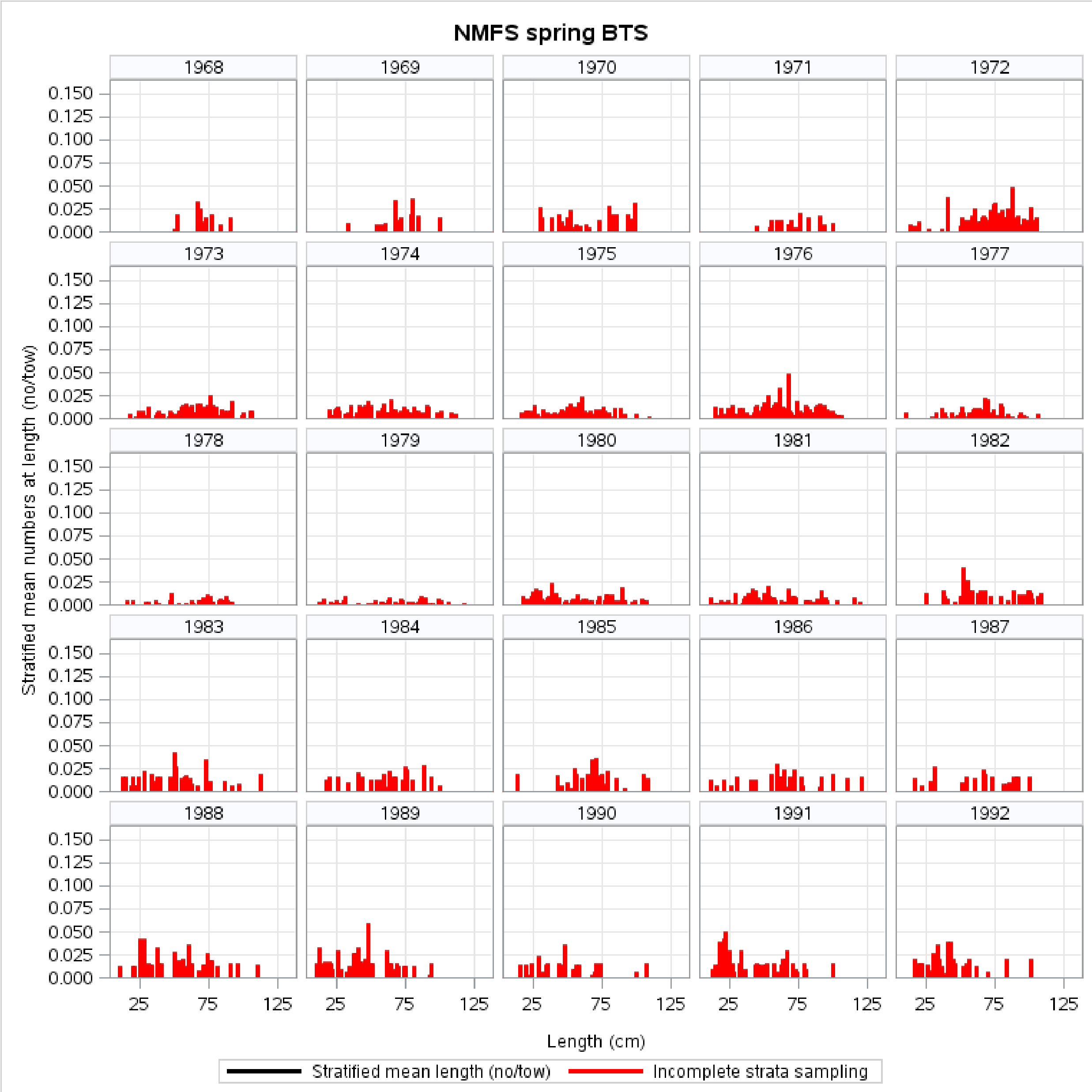


Figure 16. Abundance at length from NEFSC spring surveys in the northern management area.

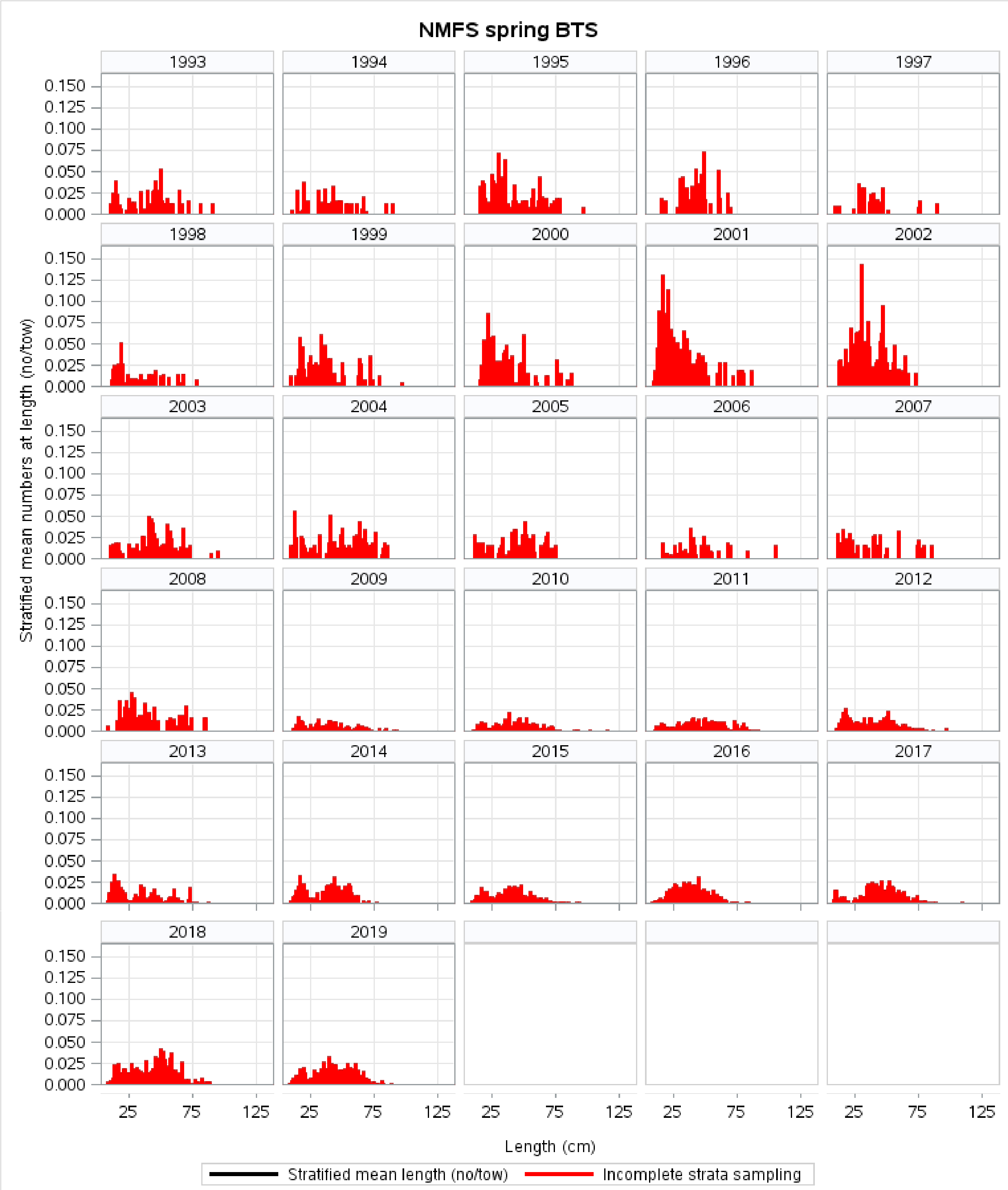


Figure 16, cont'd. (spring surveys, north)

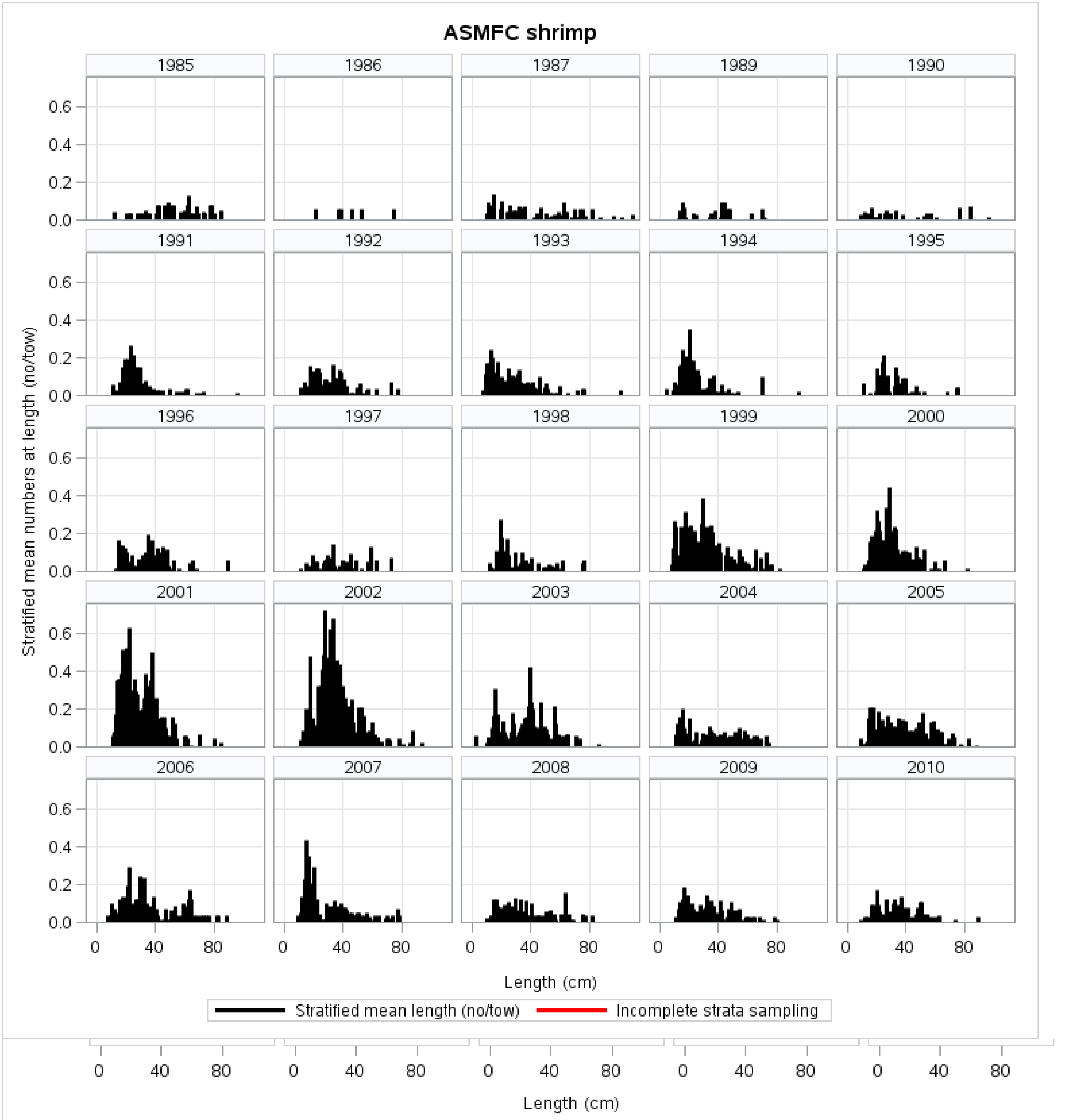


Figure 17. Abundance at length from ASMFC summer shrimp surveys in the northern management area.

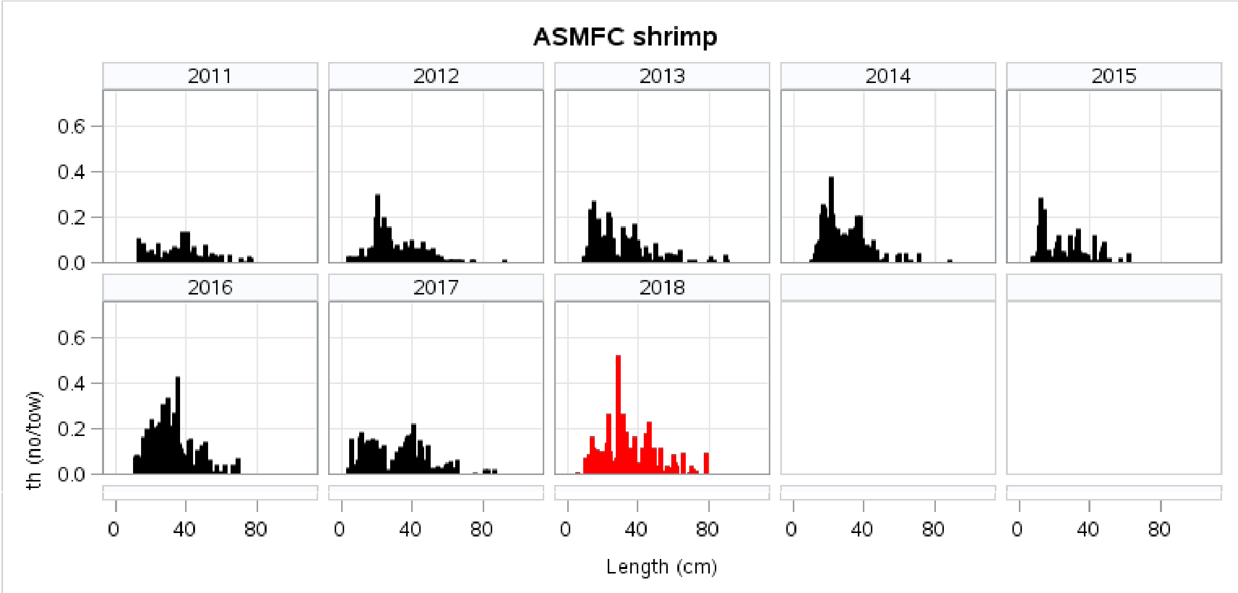


Figure 17, continued (shrimp surveys, north)

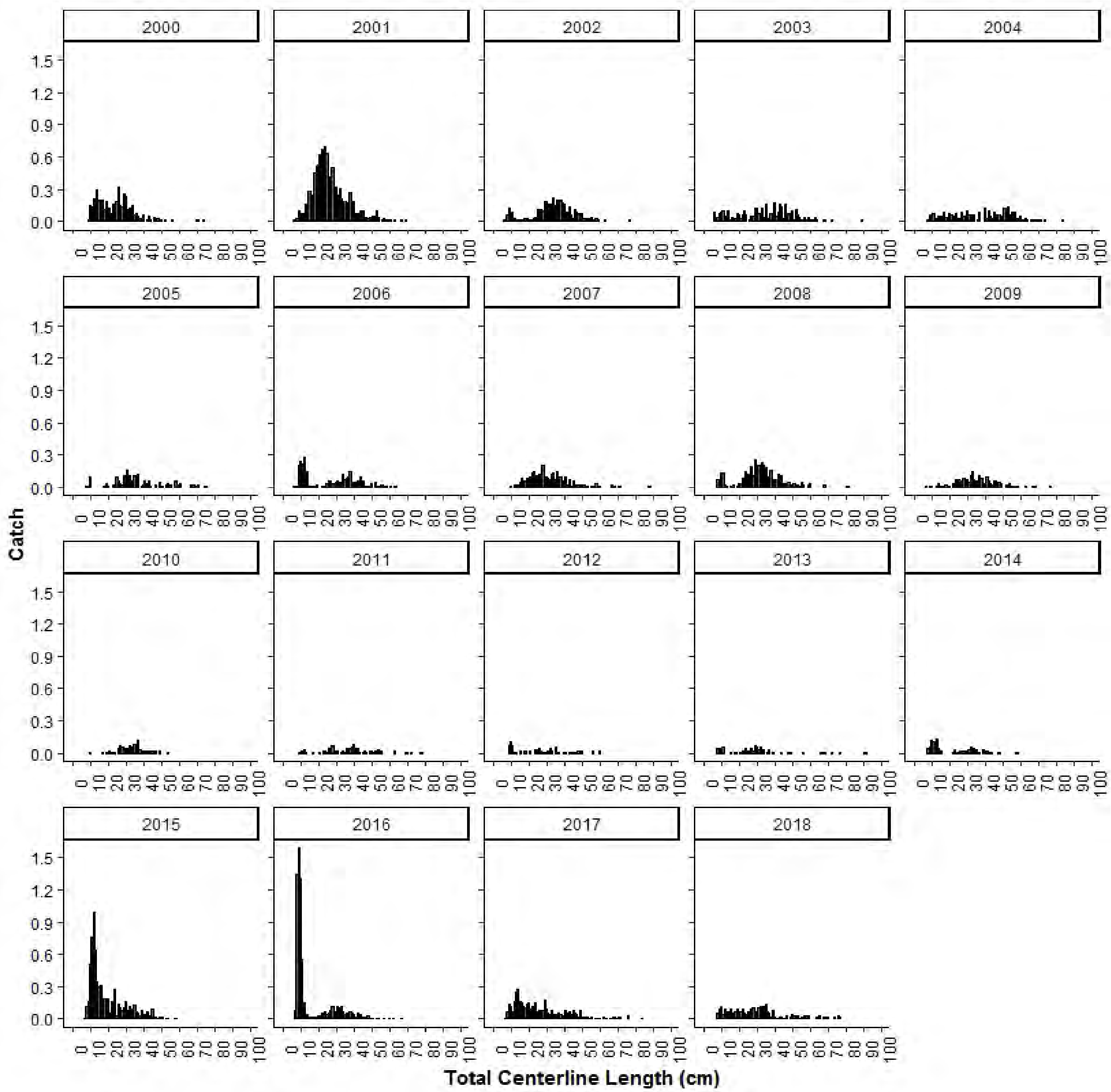


Figure 18. Abundance at length from ME/NH fall inshore trawl surveys in the northern management area. Data courtesy of Maine Department of Marine Resources.

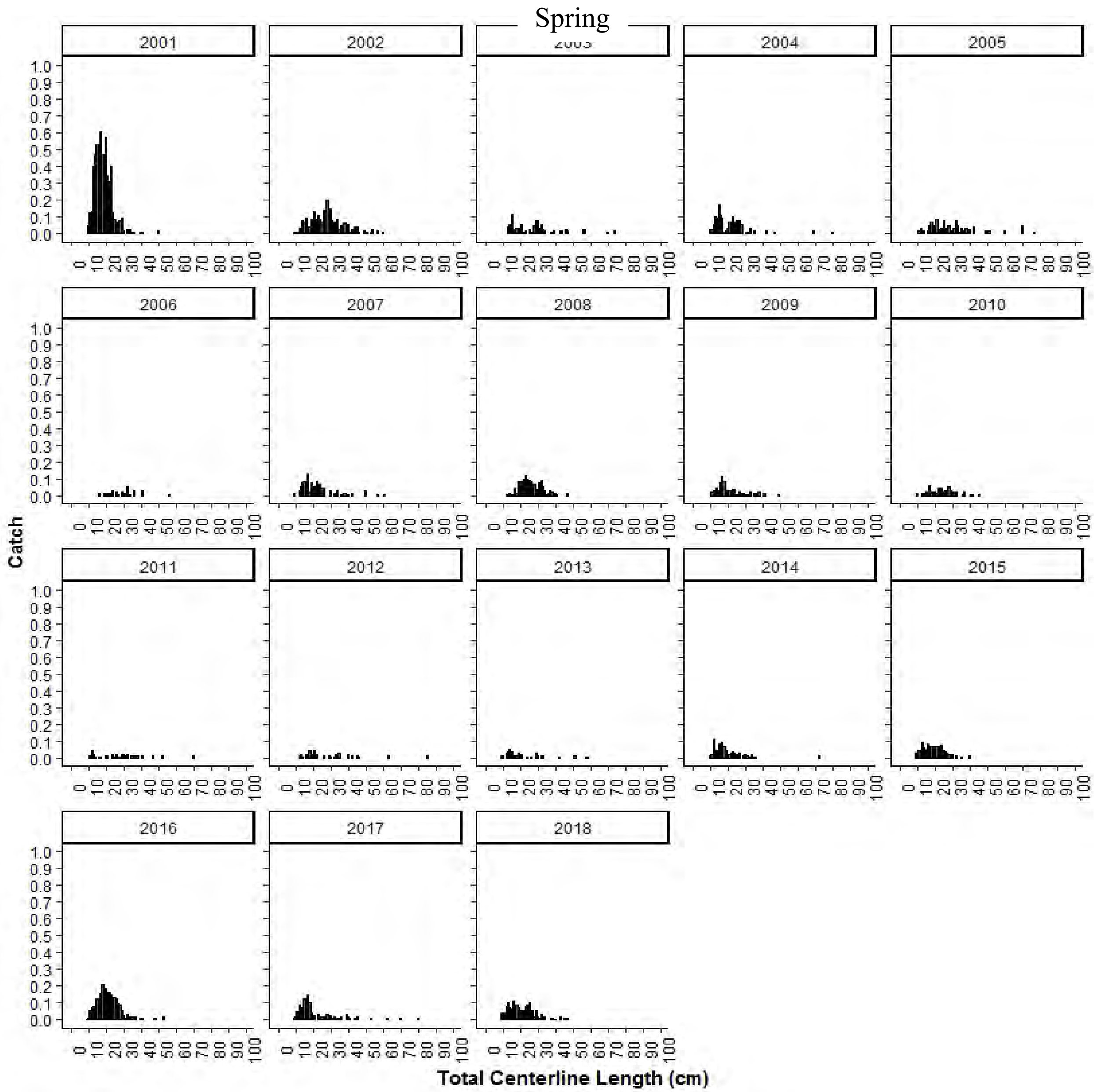
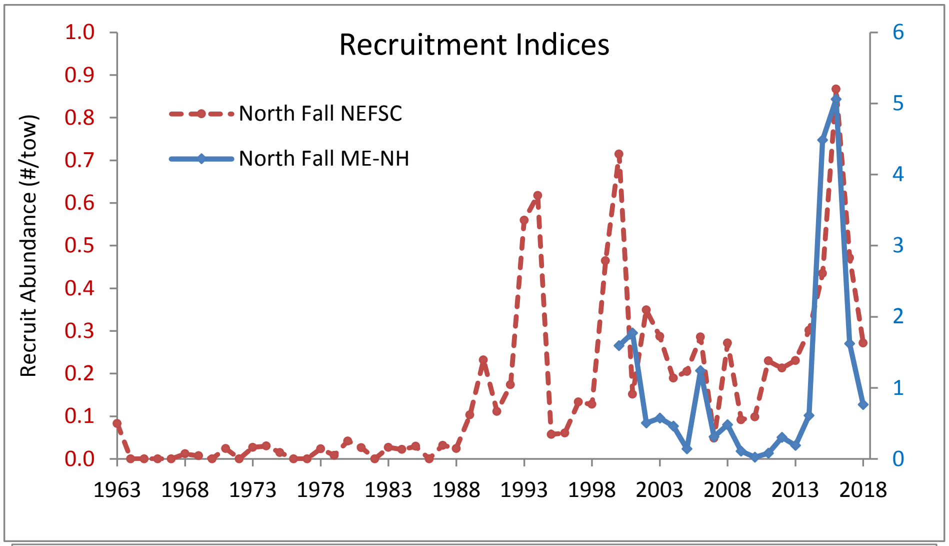


Figure 19. Abundance at length from ME/NH spring inshore trawl surveys in the northern management area. Data courtesy of Maine Department of Marine Resources.

A.



B.

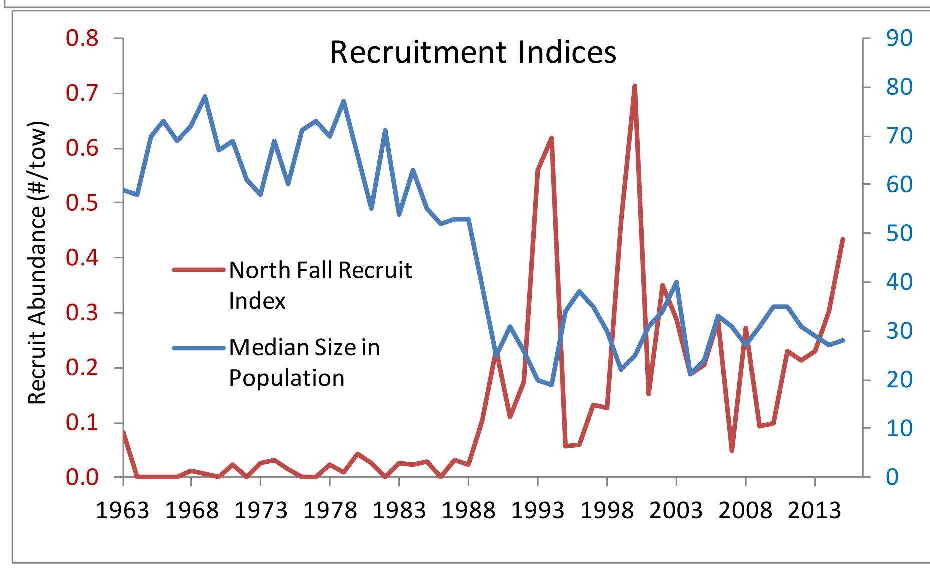


Figure 20. A. Recruitment indices for monkfish in the northern management area. Indices include monkfish in size ranges thought to represent young-of-year (age 0) in each area and season. B. Recruitment indices vs. median size of monkfish in the population (based on NEFSC fall surveys).

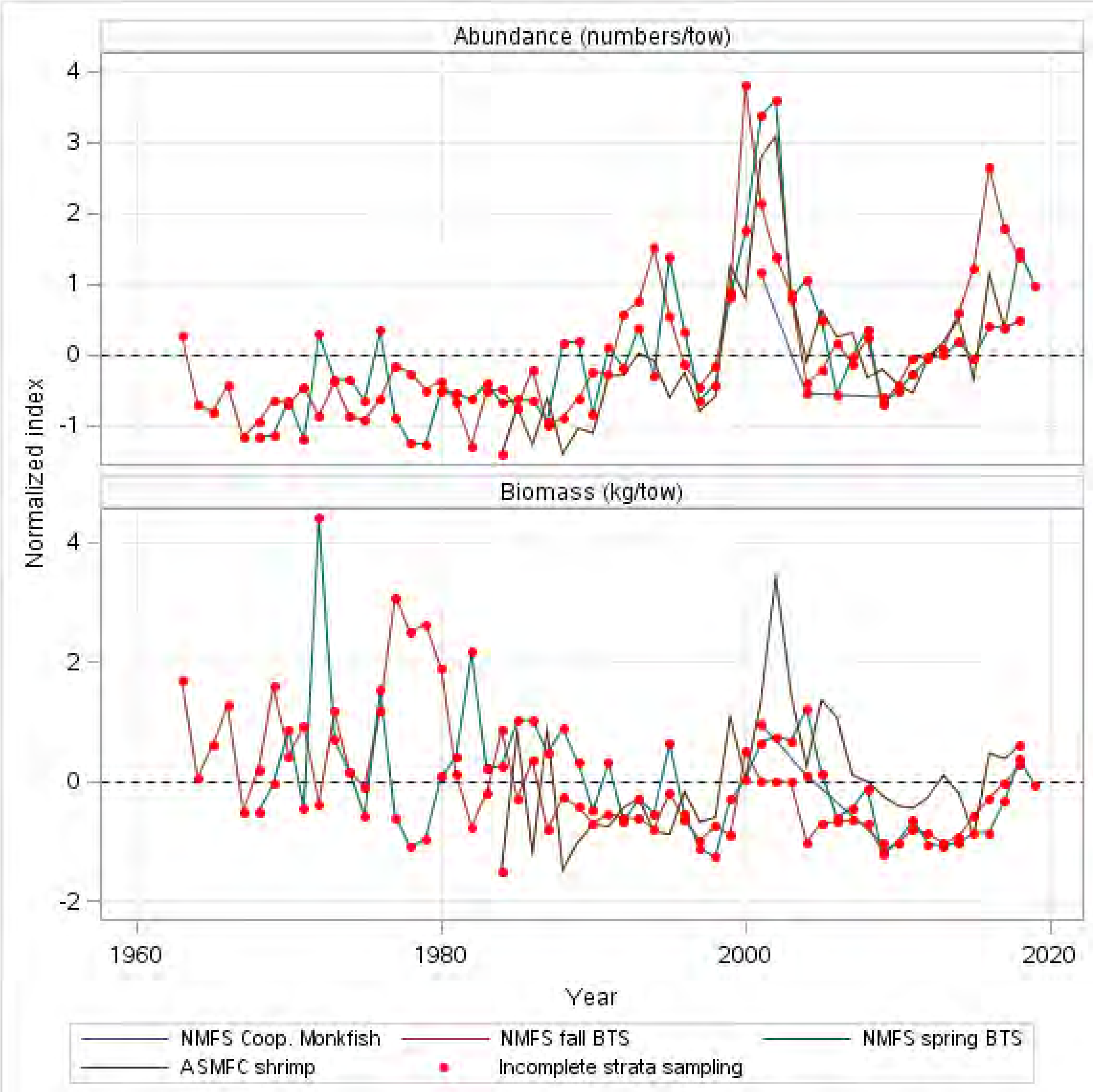
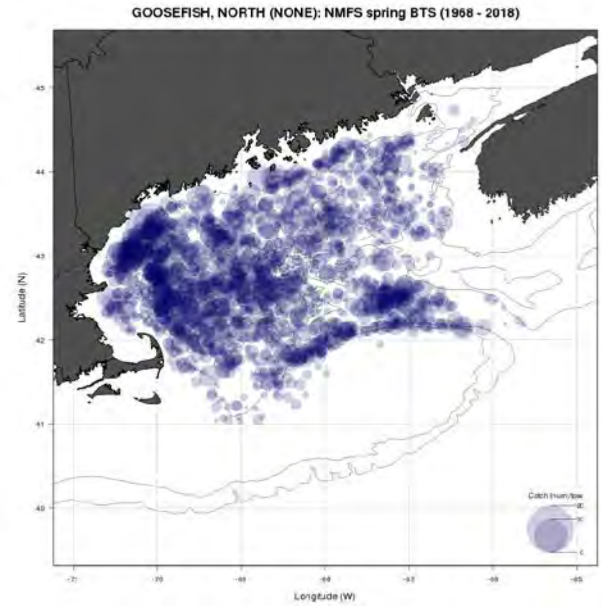
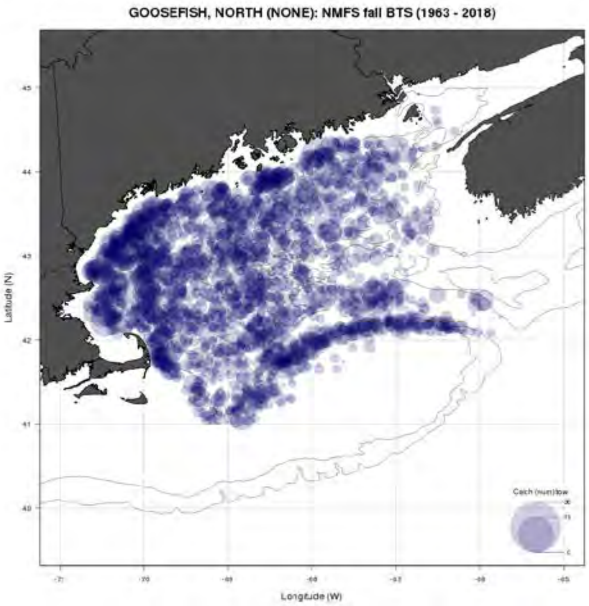


Figure 21. Normalized surveys for monkfish in the NMA.

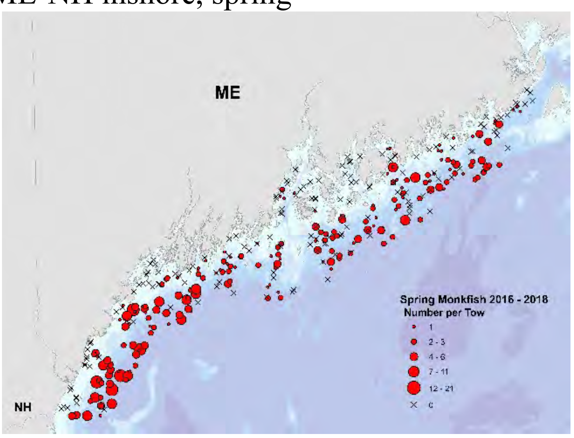
Spring



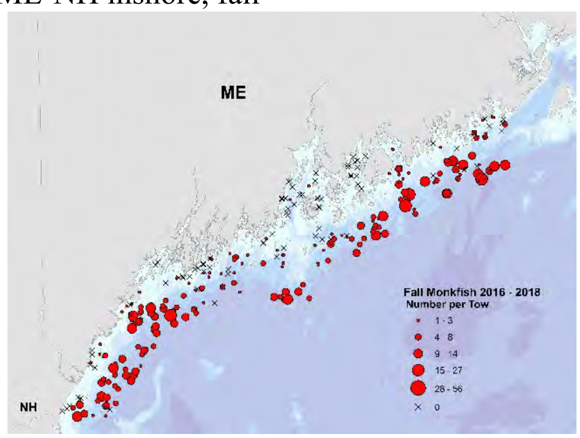
Fall



ME-NH inshore, spring



ME-NH inshore, fall



Summer shrimp

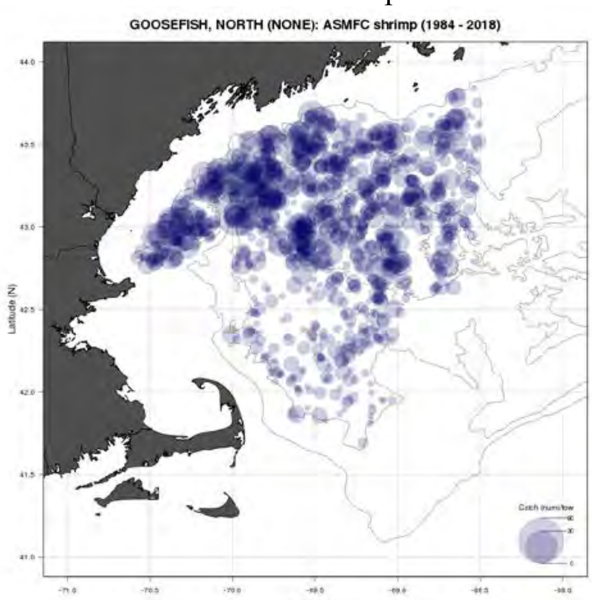


Figure 22. Distribution of monkfish in surveys in the northern management area.

South Biomass Abundance

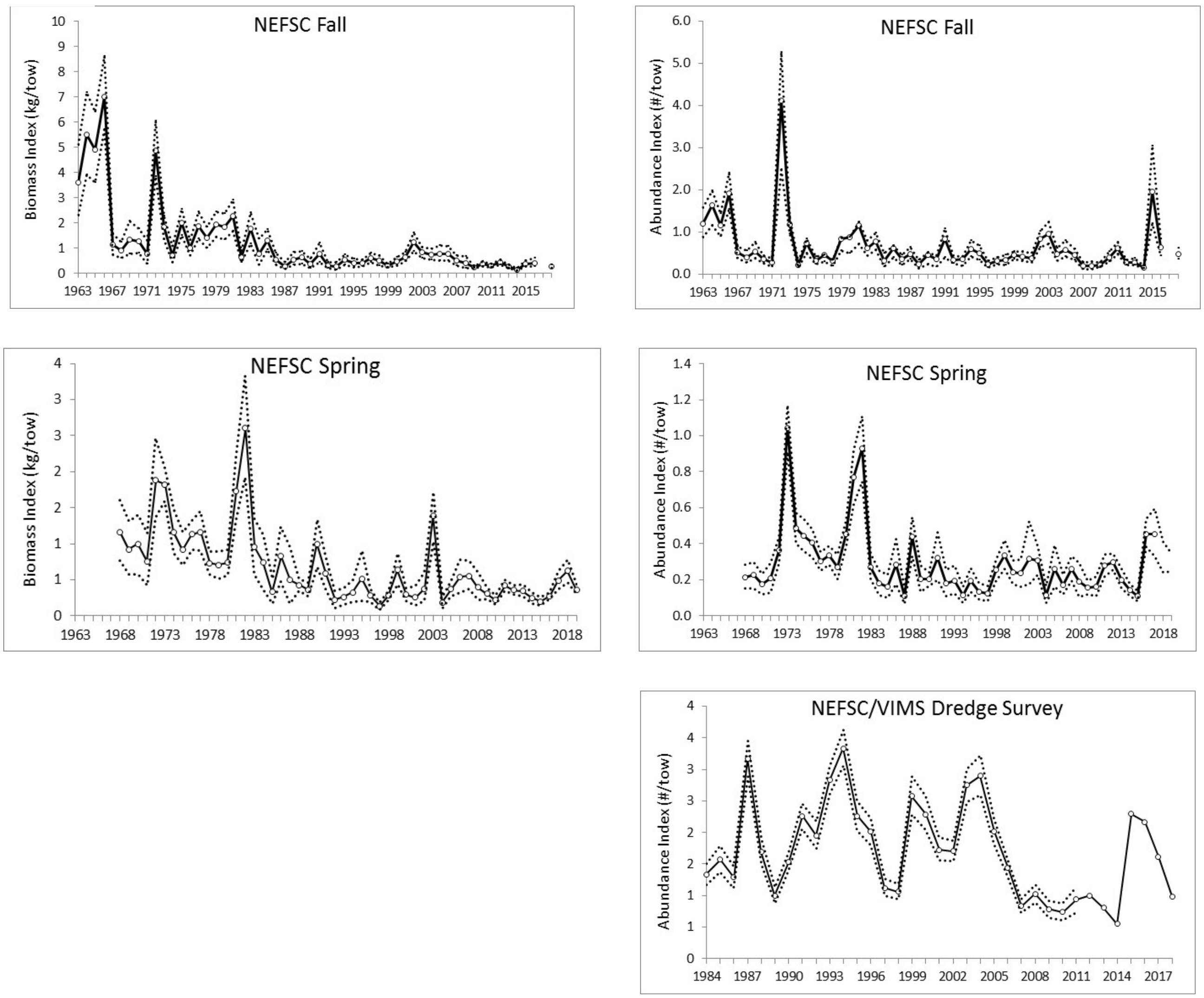


Figure 23. Survey indices for monkfish in the southern management area. Points after 2008 for NEFSC trawl surveys were conducted on the FSV Bigelow, converted to Albatross units as described in the text. Scallop dredge survey indices after 2011 were calculated from combined data from surveys conducted by NEFSC and Virginia Institute of Marine Science.

South

Biomass Abundance

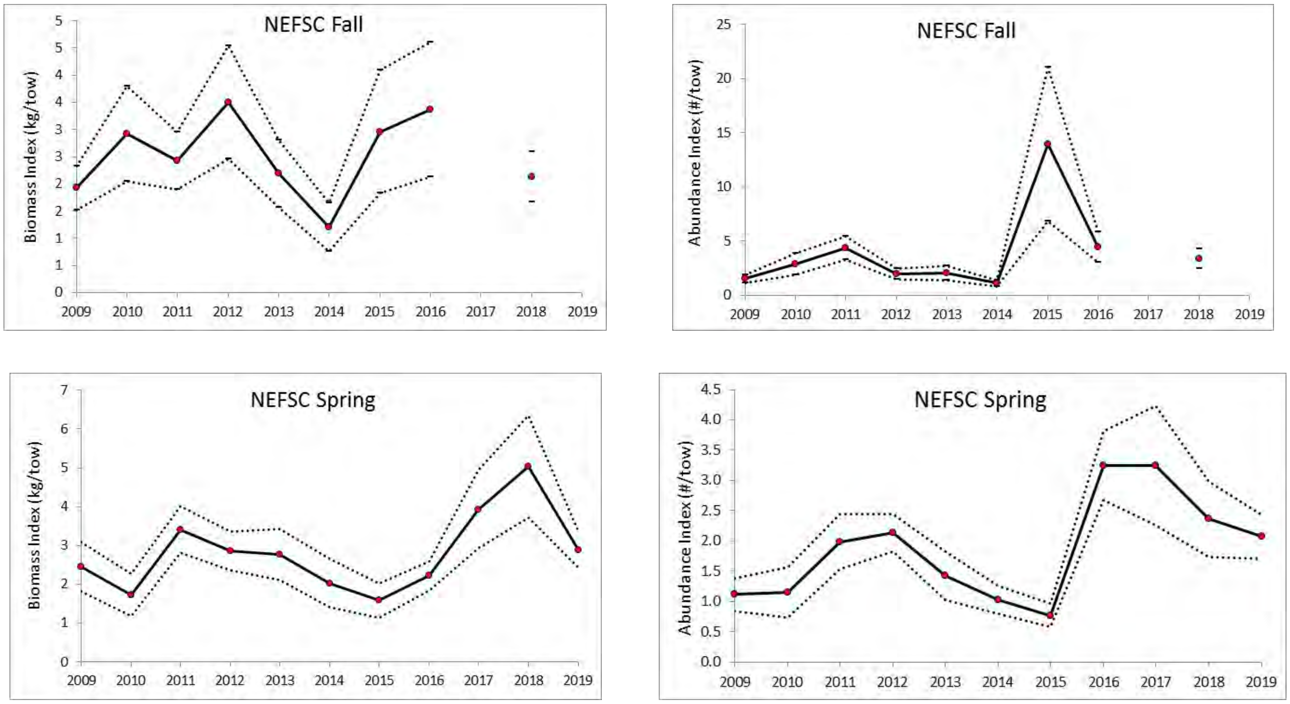


Figure 24. Survey indices from surveys conducted on the FRSV Bigelow in the southern management area, not converted to Albatross units.

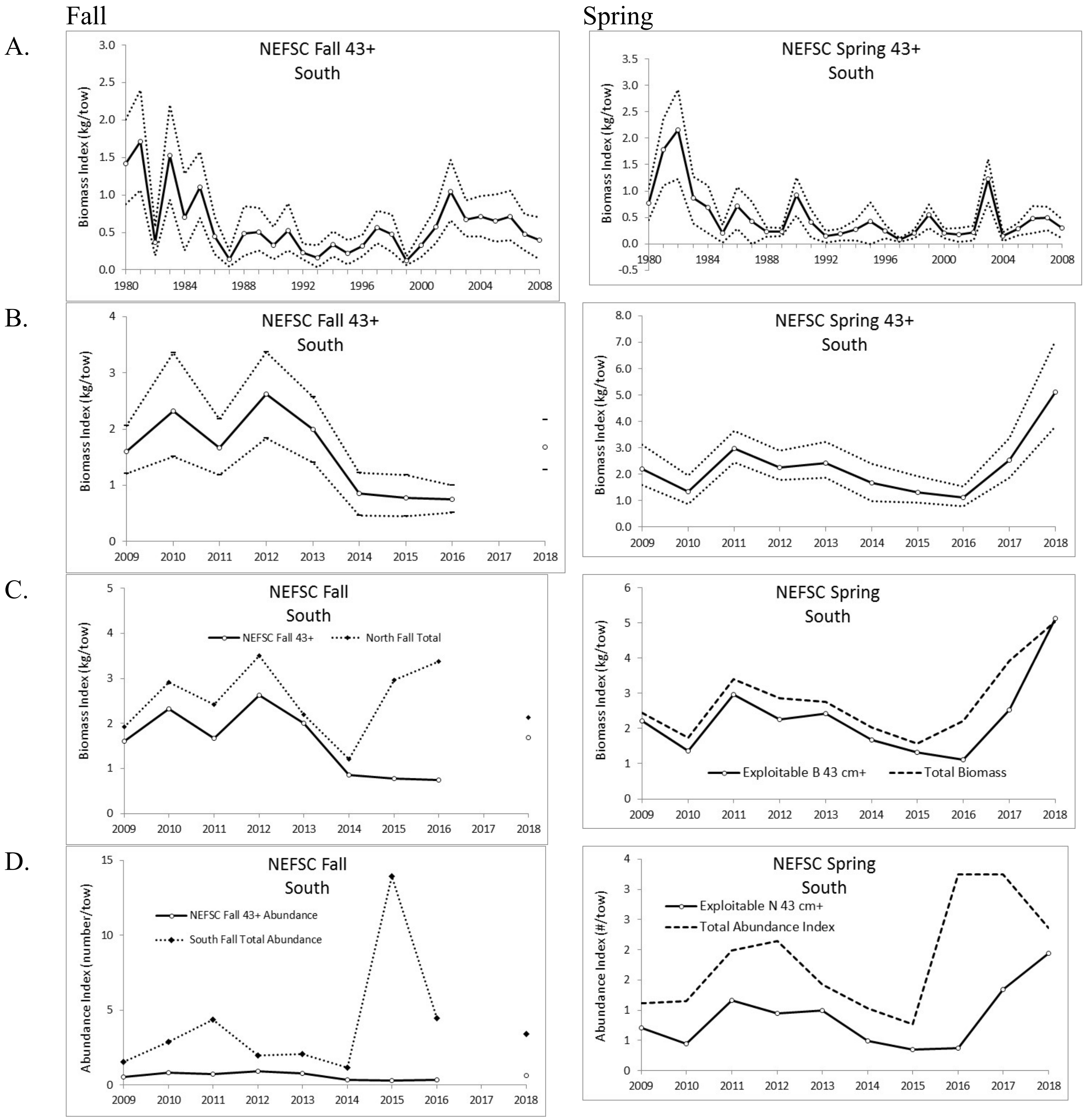


Figure 25. Exploitable biomass (≥ 43 cm total length) indices for monkfish from fall and spring surveys in the SMA. A. Exploitable biomass indices with 95% confidence intervals, 1980-2008 (surveys conducted on RV Albatross). B. Exploitable biomass indices with 95% confidence intervals, 2009-2018 (surveys conducted on RV H.B. Bigelow) C. Total biomass vs. exploitable biomass indices, 2009-2018, D. total abundance vs. exploitable abundance, 2009-2018.

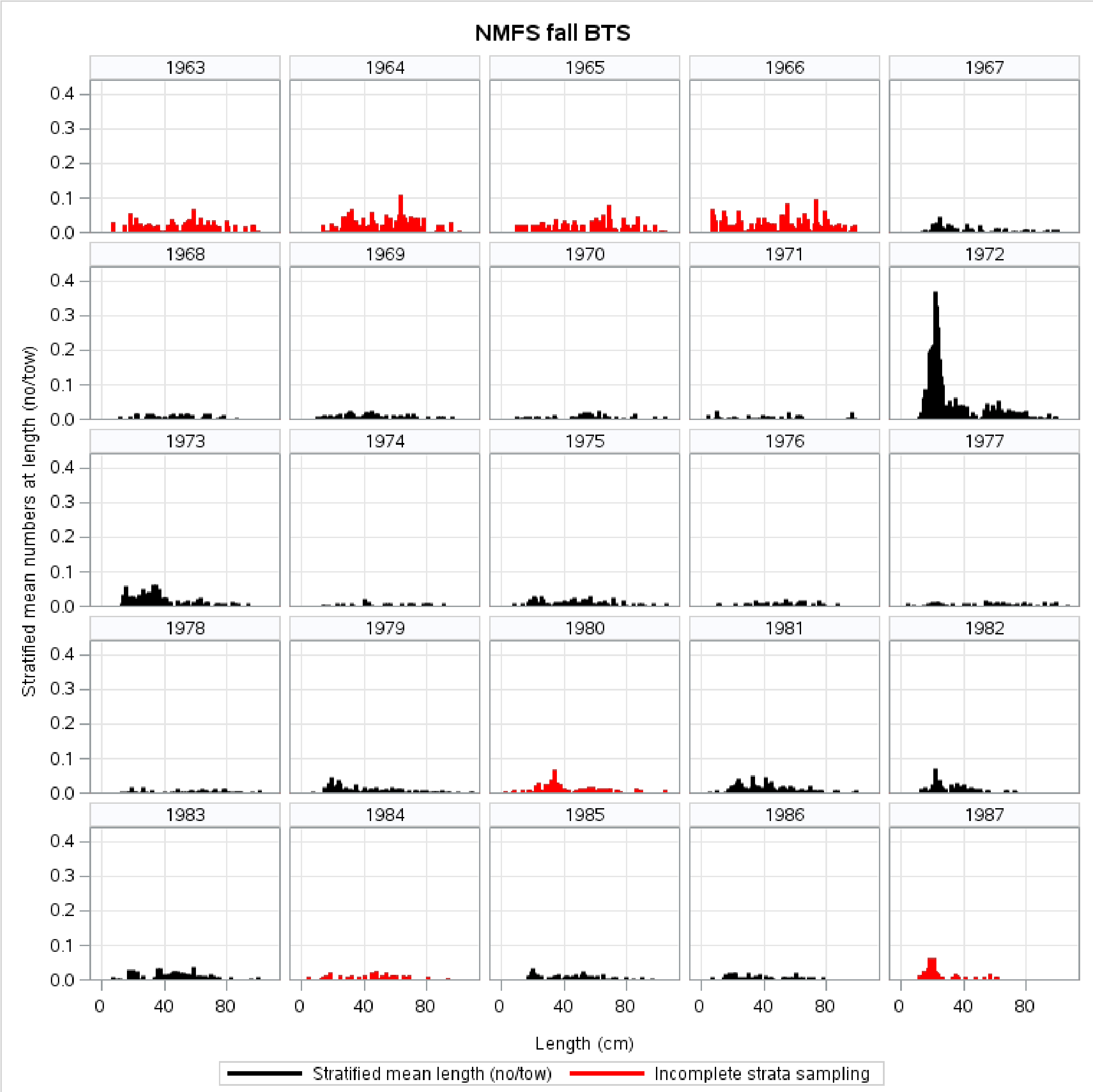


Figure 26. NEFSC fall survey indices of abundance at length, southern management area.

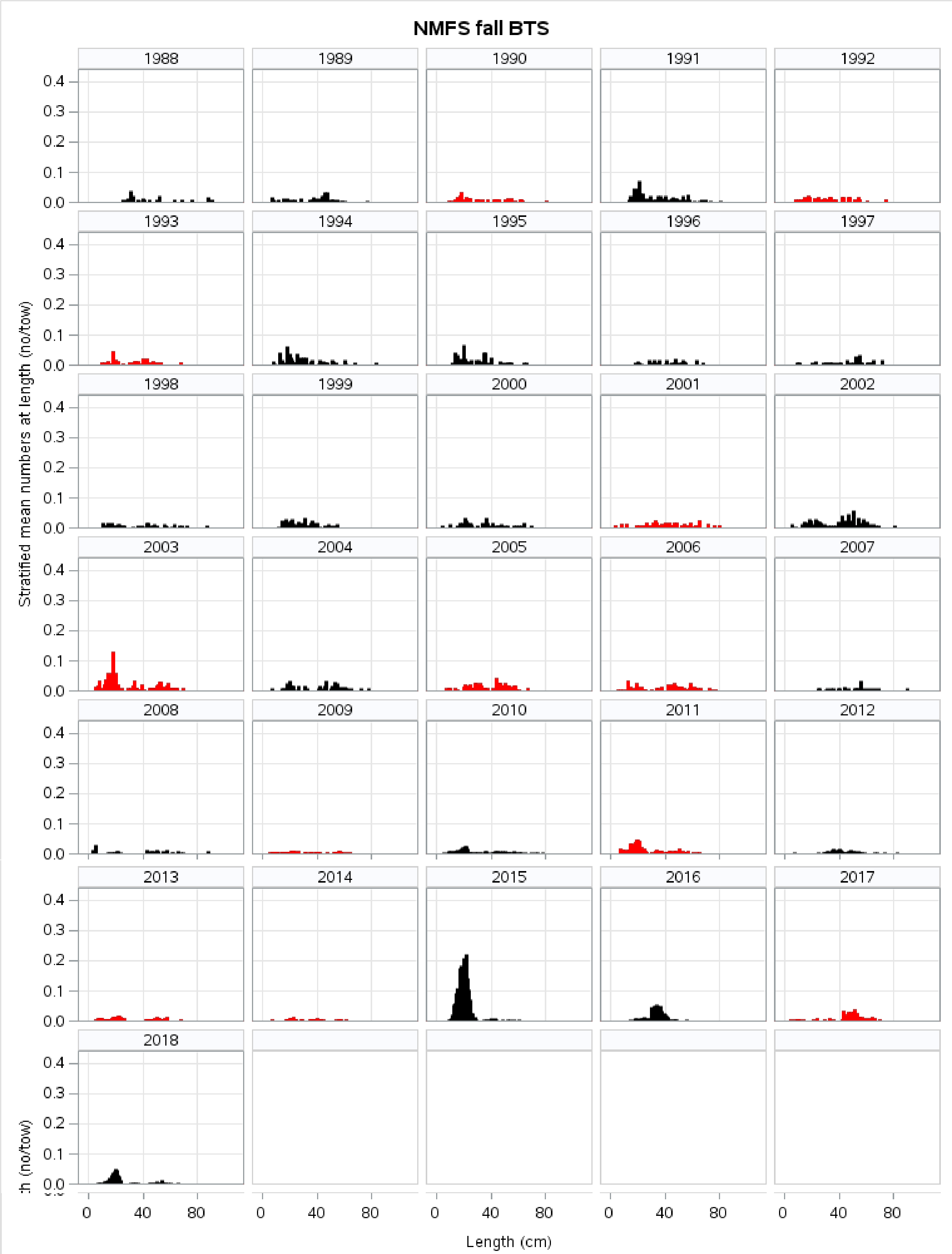


Figure 26, cont'd. (fall survey, south)

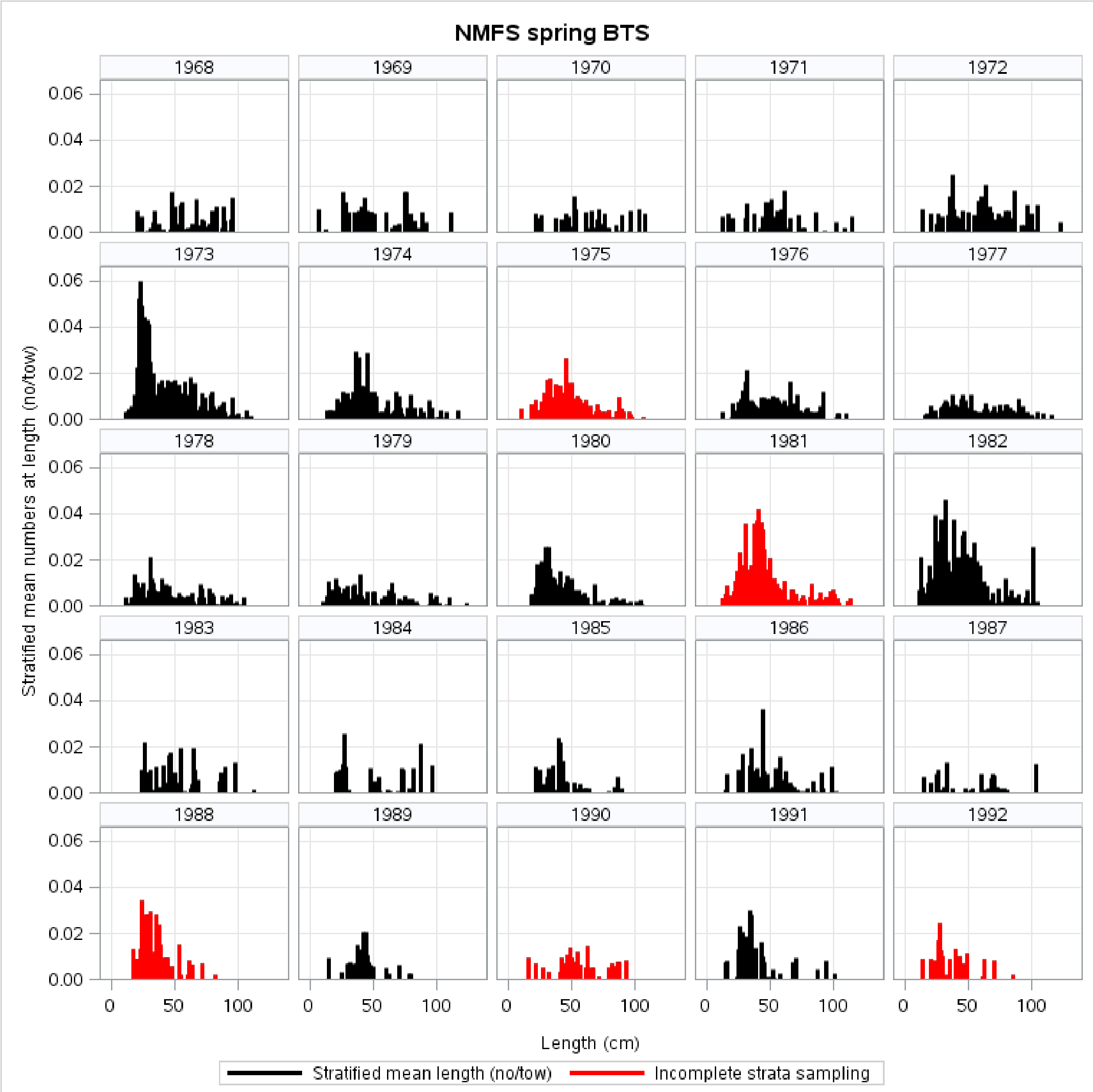


Figure 27. NEFSC spring survey indices of abundance at length, southern management area.

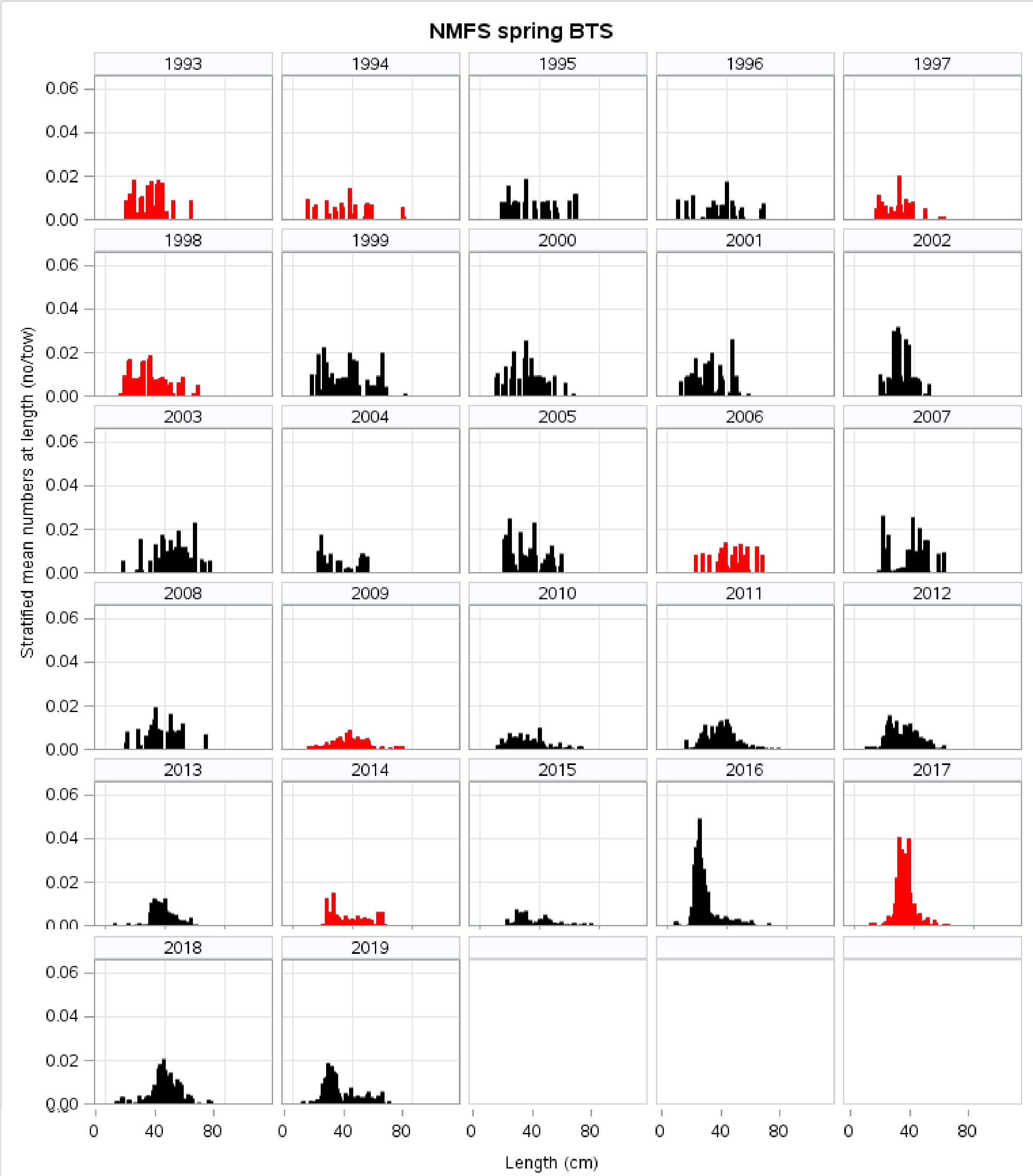


Figure 27, cont'd. (spring survey, south)

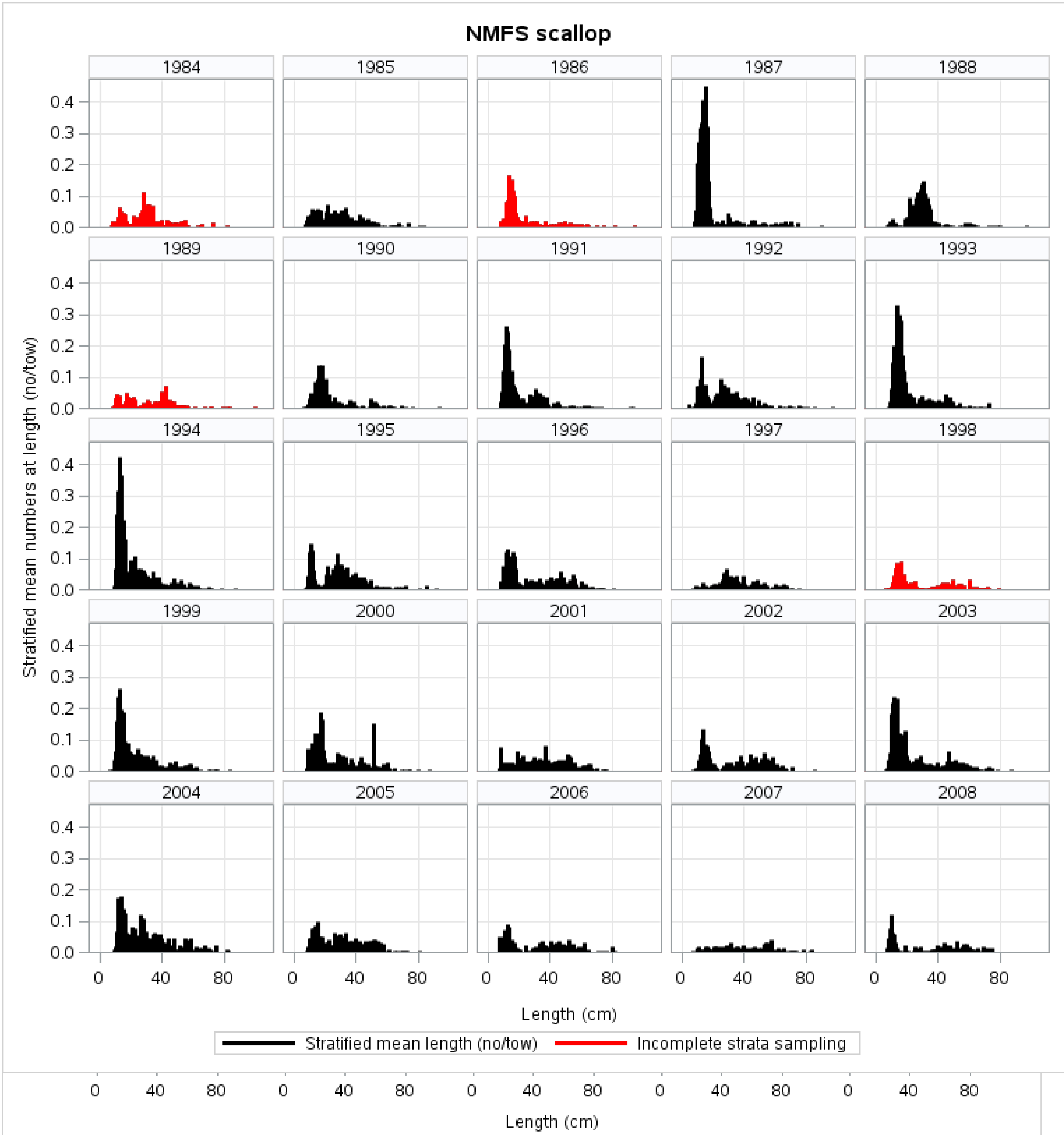


Figure 28. NEFSC spring/summer scallop dredge surveys. Survey timing shifted from summer to spring in 2009. These plots do not include sampling conducted by VIMS after 2011 (see Figure 23).

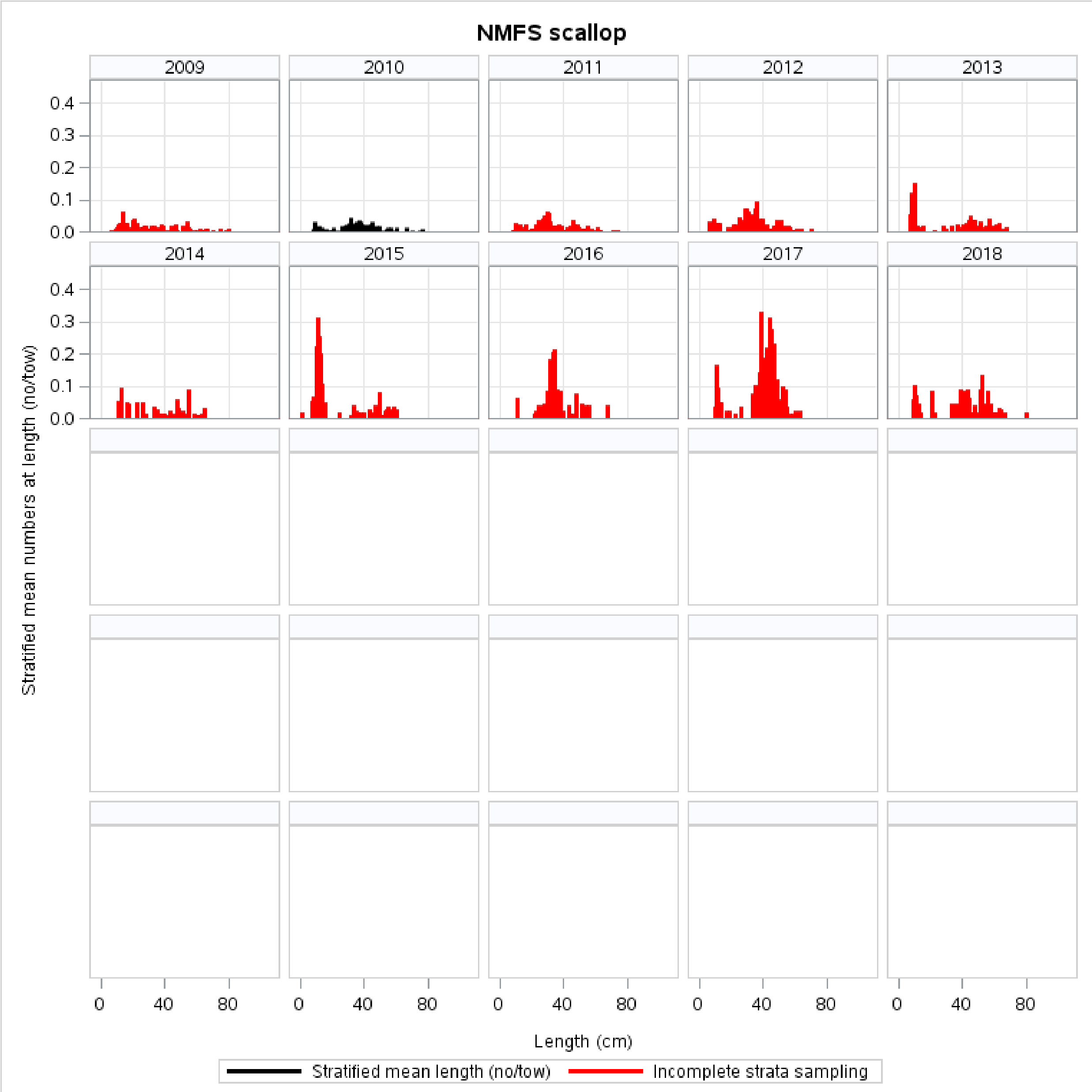


Figure 28, continued (NEFSC scallop dredge survey, south)

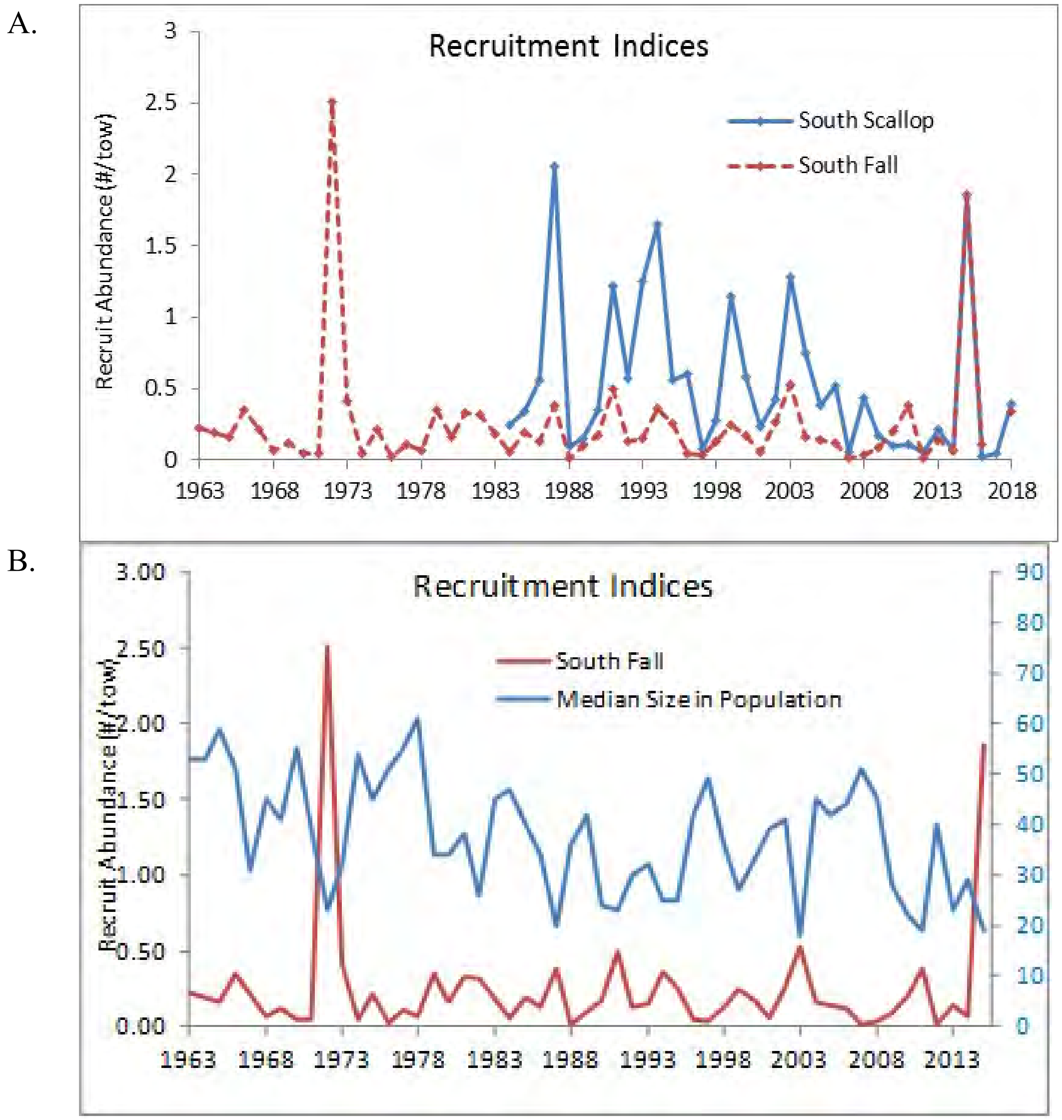


Figure 29. A. Recruitment indices for monkfish in the southern management area. Indices include monkfish in size ranges currently thought to represent young-of-year (age 0) in each season. There are no data for the fall survey in 2017 for the SMA. B. Recruitment indices vs. median size of monkfish in the population (based on NEFSC fall surveys).

D. Monkfish

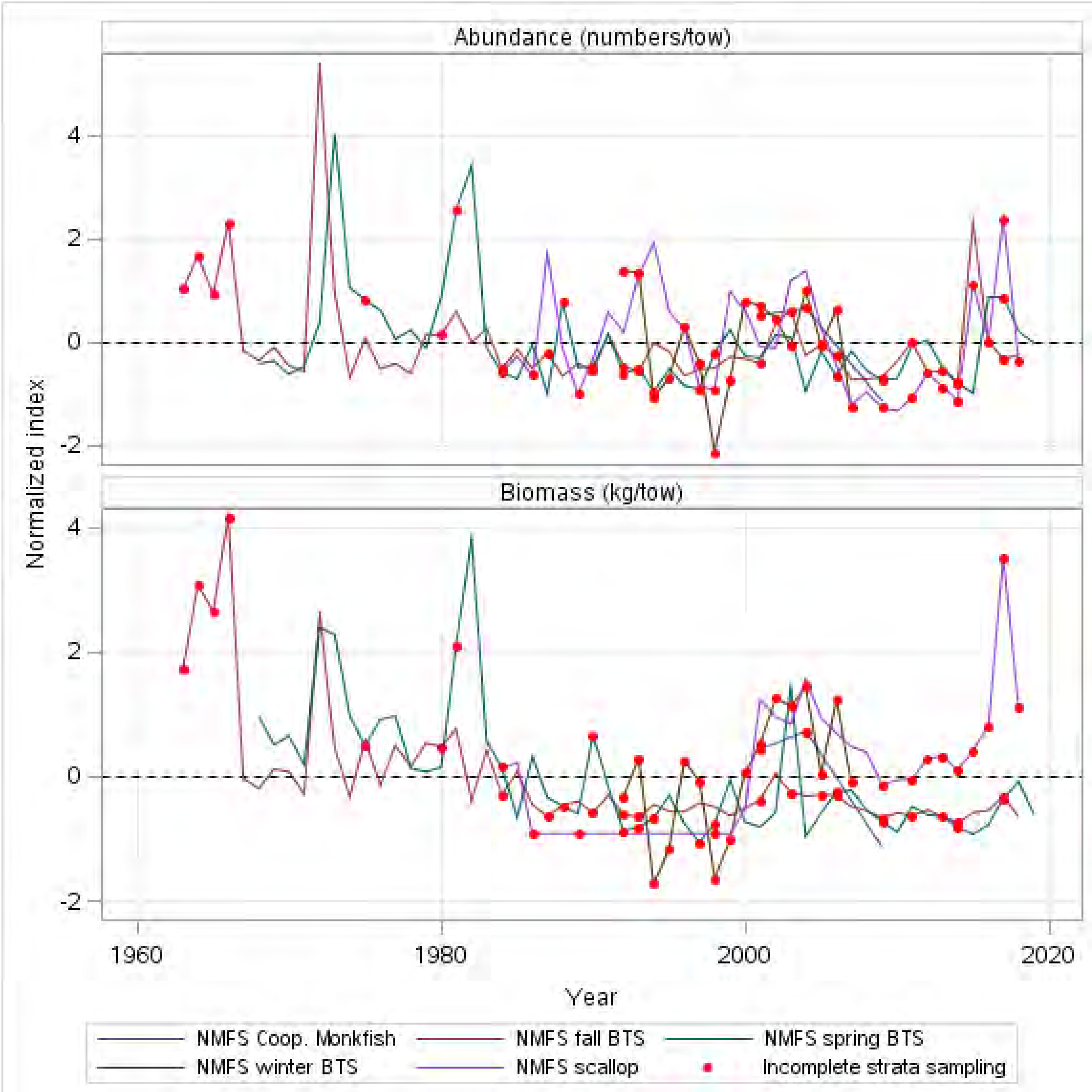
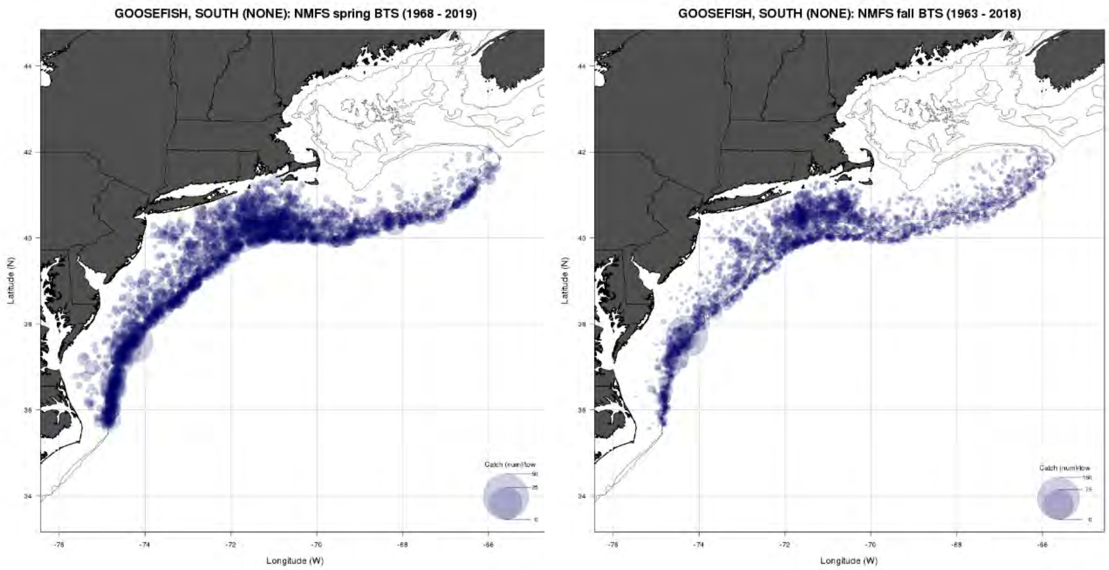


Figure 30. Normalized survey indices for monkfish in the southern management area. Scallop survey indices do not include VIMS portion of the survey starting in 2012.

Spring Fall

NEFSC bottom trawl surveys



Spring/Summer Scallop Survey

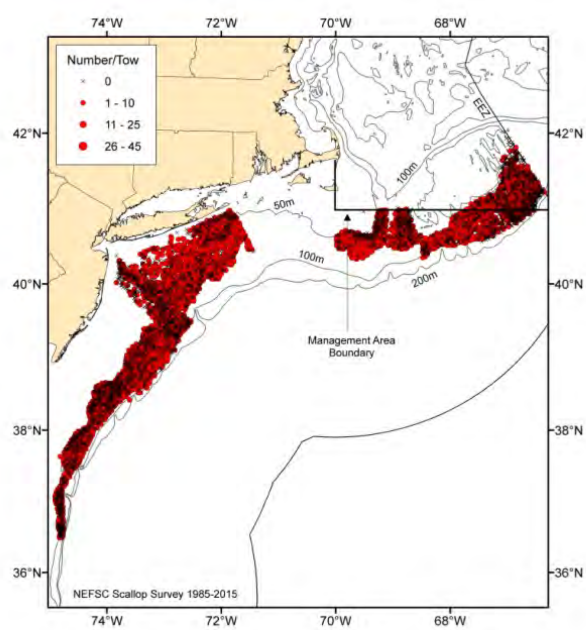
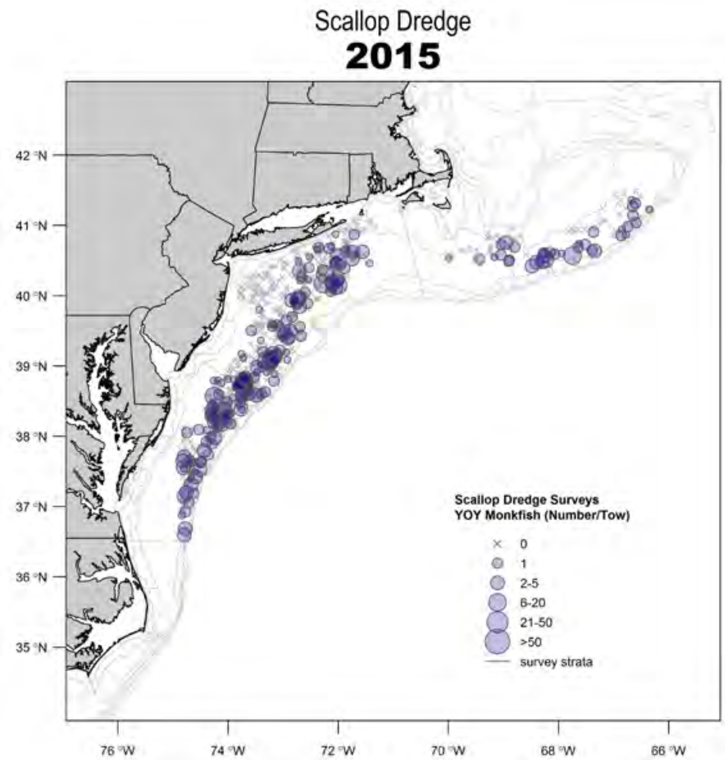


Figure 31. Distribution of monkfish in the southern management area from NEFSC spring (1968-2019) and fall (1963-2018) bottom trawl surveys and NEFSC and NEFSC/VIMS spring/summer scallop dredge surveys (1984-2015).

D. Monkfish

A.



B.

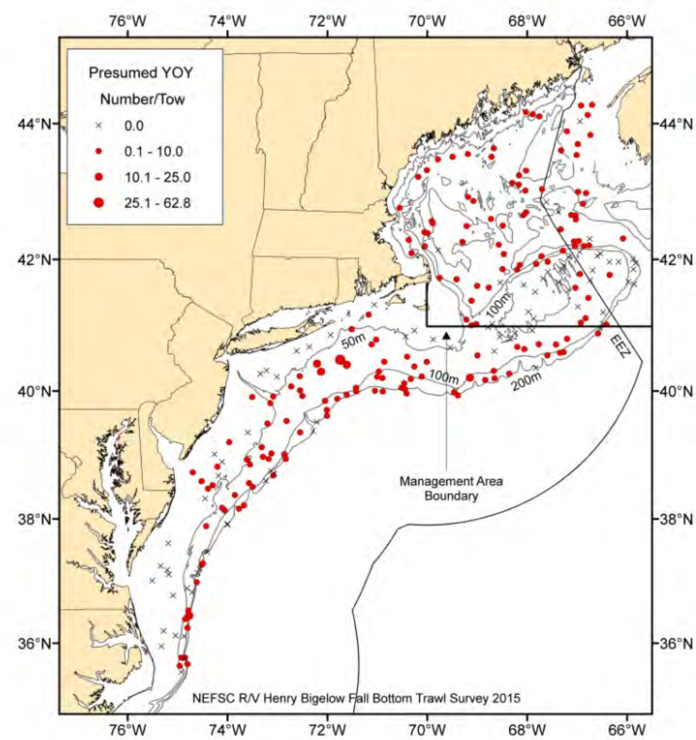


Figure 32. Distribution of presumed young-of-year monkfish in 2015 in (A.) NEFSC and VIMS scallop dredge survey tows (late spring), and (B.) NEFSC fall surveys.

D. Monkfish

North South

A.

B.

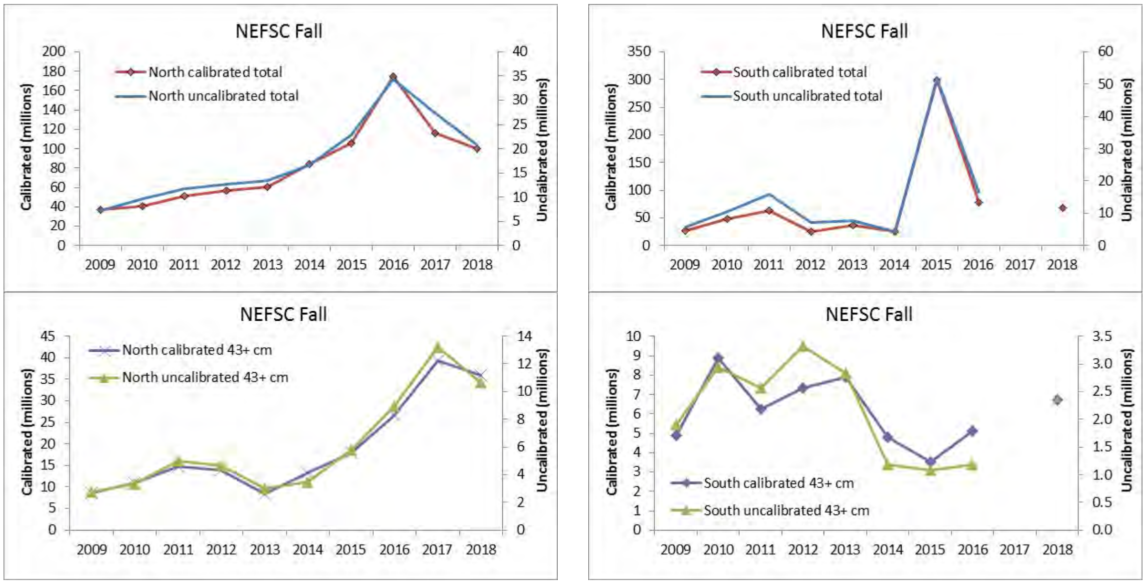
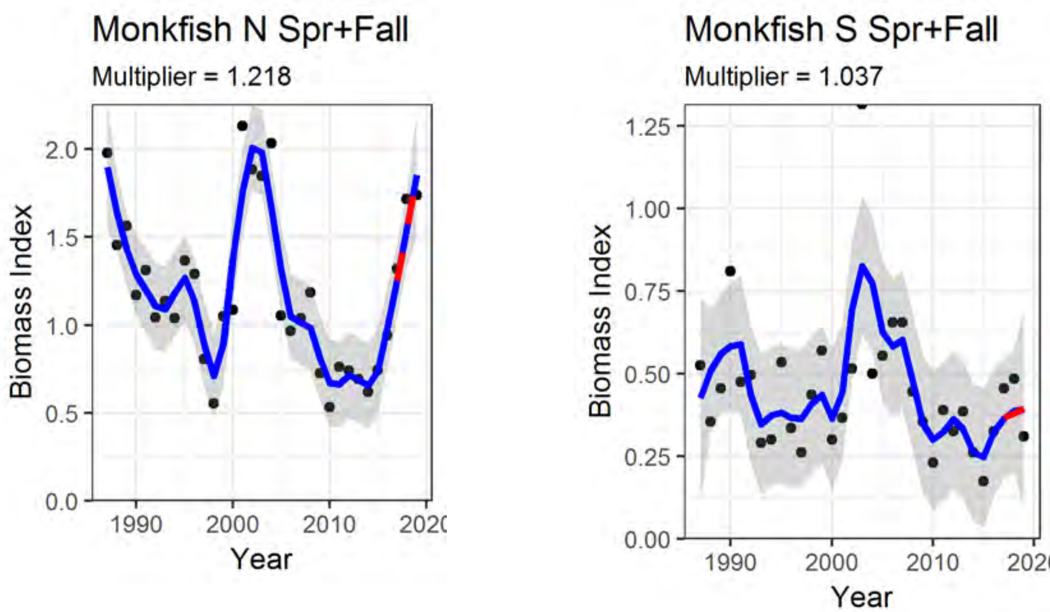


Figure 33. Area-swept abundance estimated from NEFSC fall surveys using adjustments from chain-sweep study compared to unadjusted estimates. A. total abundance, B. exploitable abundance (43+ cm).

D. Monkfish

Figure 34. Estimates of relative exploitation from NEFSC fall surveys using minimum area-swept numbers or biomass adjusted for sweep type (adjusted to chain sweep), assuming that 100% of monkfish encountered by the trawl are captured and not accounting for missed strata in some years.

A.



B.

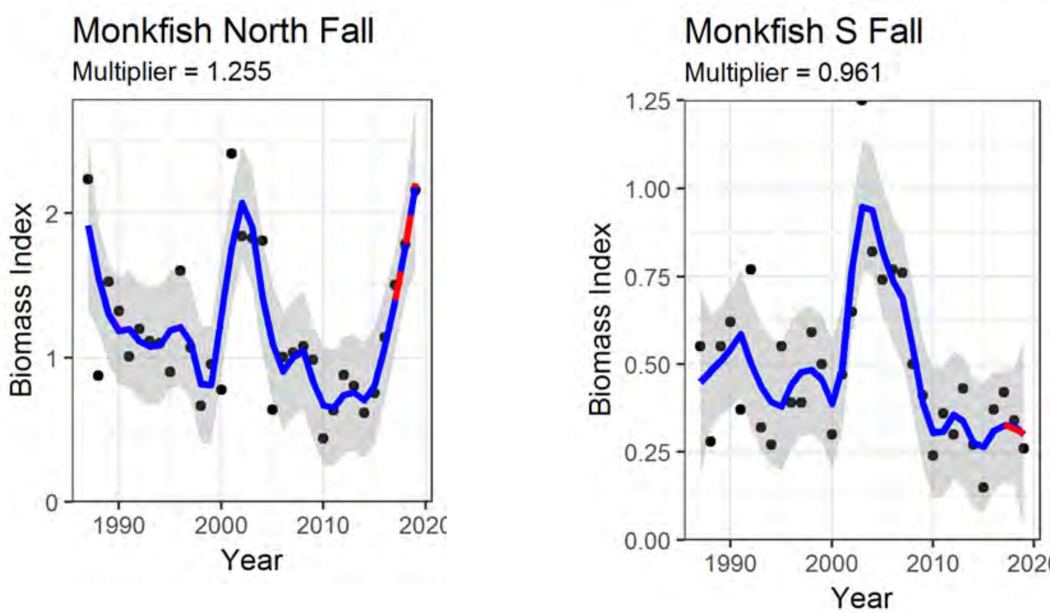


Figure 35. Results of "Plan B" analysis. Points are observed biomass indices, lines are loess-smoothed indices, "multiplier" is slope of log-linear regression through terminal three smoothed points. A. Results using both spring and fall indices, B. Results using fall survey indices only.

Spiny Dogfish Fishery Information Document

August 2019

This Fishery Information Document provides a brief overview of the biology, stock condition, management system, and fishery performance for spiny dogfish (*Squalus acanthias*) with an emphasis on 2018. Data sources for Fishery Information Documents are generally from unpublished National Marine Fisheries Service (NMFS) survey, dealer, vessel trip report (VTR), permit, and Marine Recreational Information Program (MRIP) databases and should be considered preliminary. For more resources, including previous Fishery Information Documents, please visit http://www.mafmc.org/dogfish.

Key Facts

- 2017 and 2018 fishing year landings were similar, about 17 million pounds.
- The current 2019 quota of 20.5 million pounds is 19% higher than 2018 landings.
- The 2020 quota would increase to 23.2 million pounds under previously-adopted multi-year specifications (and then to 27.4 million pounds in 2021) if no changes are recommended by the Scientific and Statistical Committee (SSC) or the Council.
- The Spiny Dogfish data update provided by the NMFS Science Center shows that the index that drives the assessment was up in 2019 from 2018. Because a 3-year average is used and the new 2019 value is lower than the 2016 value that drops out of the 3-year average (now 2017, 2018, and 2019), the 3-year average does fall compared to the previous calculation, to the lowest point since the stock was rebuilt.
- In 2020 the very low 2017 index value (the lowest in the time series) will no longer be part of the 3-year average and the 3-year average may increase unless there is a new all-time low for the 2020 index value.
- Based on input from the Advisory Panel, most tables and figures in this document are now done by fishing year (May 1- April 30) rather than calendar year, so some tables and figures may appear different than previous years' versions of this document.

Basic Biology

Spiny dogfish is a coastal shark with populations on the continental shelves of northern and southern temperate zones throughout the world. It is the most abundant shark in the western north Atlantic and ranges from Labrador to Florida, but is most abundant from Nova Scotia to Cape Hatteras, North Carolina. Its major migrations on the northwest Atlantic shelf are north and south, but it also migrates inshore and offshore seasonally in response to changes in water temperature. Spiny dogfish have a long life, late maturation, a long gestation period, and relatively low fecundity, making them generally vulnerable to depletion. Fish, squid, and ctenophores dominate the stomach contents of spiny dogfish collected during the Northeast Fisheries Science Center (NEFSC) bottom trawl surveys, but spiny dogfish are opportunistic and have been found to consume a wide variety of prey. More detailed life history information can be found in the essential fish habitat (EFH) source document for spiny dogfish at: http://www.nefsc.noaa.gov/publications/tm/tm203/tm203.pdf. [1]

Status of the Stock

Based on the current biomass reference point and an assessment update considering data through spring of 2018 (available at http://www.mafmc.org/ssc-meetings/2018/sept-11), the spiny dogfish stock is not overfished or experiencing overfishing. The 2018 biomass was 67% of the target. Fishing mortality in 2017, the most recent year available, was 83% of the overfishing threshold. A benchmark assessment is scheduled for 2022. The spiny dogfish spawning stock biomass estimate timeseries is provided in Figure 1. [2]

The Spiny Dogfish data update provided by the NMFS Science Center shows that the index that drives the assessment was up in 2019 from 2018. Because a 3-year average is used and the new 2019 value is lower than the 2016 value that drops out of the 3-year average (now 2017, 2018, and 2019), the 3-year average does fall compared to the previous calculation, to the lowest point since the stock was rebuilt. In 2020 the very low 2017 index value (the lowest in the time series) will no longer be part of the 3-year average and the 3-year average may increase unless there is a new all-time low for the 2020 index value. [3]

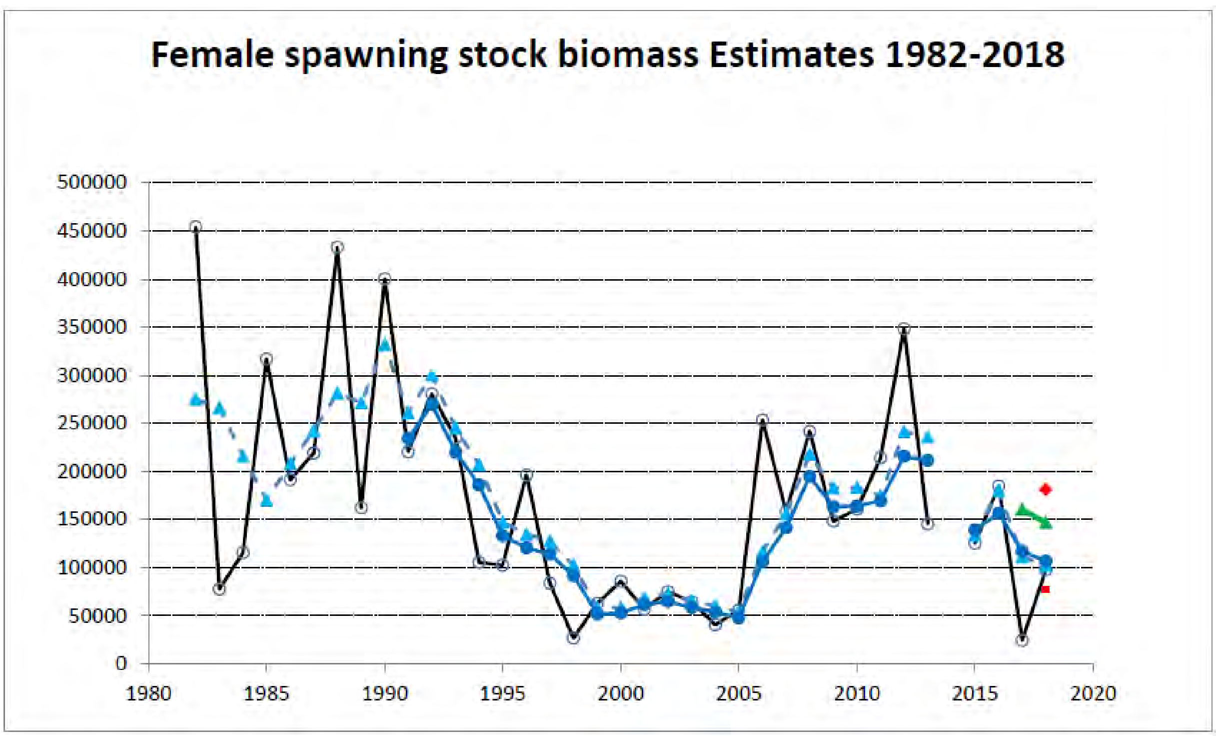


Figure 1. Stochastic SSB estimates for 1991 to 2018. Year refers to the terminal year in the three point moving average. The open circles are the yearly swept area SSB estimates, the blue triangles are the 3-year moving average of the swept area estimates, and the **closed blue circles are the stochastic SSB estimates**. The green triangles are the stochastic estimates not including 2017 and not adjusted with a Kalman filter, and the red diamond (no 2017) and square (with 2017) are the stochastic estimates adjusted with a Kalman filter (not used in last update). [2]

Management System and Fishery Performance

Management

The Council established management of spiny dogfish in 2000 and the management unit includes all federal East Coast waters.

Access to the fishery is not limited, but a federal permit must be obtained to fish in federal waters and there are various permit conditions (e.g. trip limit and reporting). There is a federal trip limit of 6,000 pounds. Some states mirror the federal trip limit, but states can set their own trip limits. The annual quota has been allocated to state shares through the Atlantic States Marine Fisheries Commission (http://www.asmfc.org/species/spiny-dogfish).

Spiny Dogfish three-year specifications were adopted by the Council in October 2018 for May 1, 2019 through April 30, 2022 (the 2019-2021 fishing years). Quotas for these fishing years are 20.5 million pounds (2019), 23.2 million pounds (2020), and 27.4 million pounds (2021).

Recreational landings are a minimal component of fishing mortality, and dead recreational discards comprise a relatively low portion of discard mortality.

Commercial Fishery

Figure 2 and Table 1 illustrate spiny dogfish landings for the 2000-2018 fishing years relative to the quotas in those years. Additional landings are available in the NMFS Science Center data update. Landings have been substantially less than quotas since 2012. The Advisory Panel has previously noted that the fishery is subject to strong market constraints given weak demand.

Figure 3 provides inflation-adjusted spiny dogfish ex-vessel prices in 2018 dollars. A downward trend is evident.

Figure 4 illustrates landings from the 2019 and 2018 fishing years relative to the current quota.

Tables 2-4 provide information on landings in the 2016-2018 fishing years by state, month, and gear type. Database errors for 2017 landings identified during the 2018 Advisory Panel meeting have been corrected.

Figure 5 illustrates the size of identifiable spiny dogfish trips in the 2018 fishing year. The procedure to group dealer records by vessel trip is somewhat approximate, so Figure 5 is an approximation of trips. While the trips cannot be organized by month in this particular analysis, the trips on the far left side are at the beginning of the fishing year (May 1, 2018), and the trips on the far right side of Figure 5 are near the end of the fishing year (April 30, 2019).

Table 5 provides information on the numbers of participating vessels that have at least one federal permit. State-only vessels are not included, but the table should still illustrate trends in participation.

Location of catch information is provided in the NMFS Science Center data update, and is reproduced in Figure 6 below for the 2016-2018 calendar years.

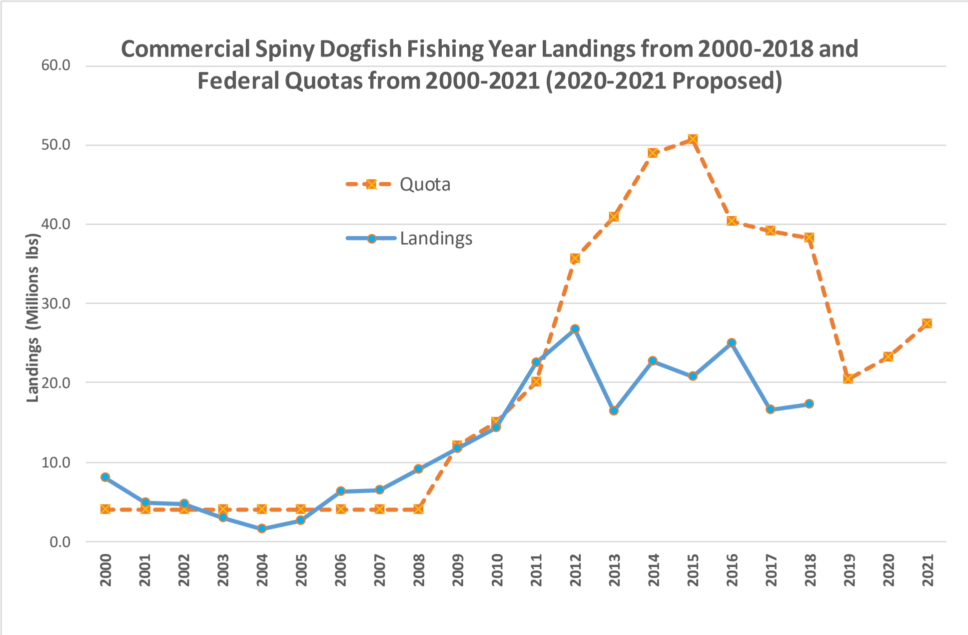


Figure 2. Annual spiny dogfish landings and federal quotas since 2000. [4]

Table 1. Commercial spiny dogfish fishing year landings from 2000-2018 and federal quotas from 2000-2021 (2020-2021 Proposed)[4]

Fishing year	Quota (M lb)	Landings (M lb)
2000	4.0	8.0
2001	4.0	4.9
2002	4.0	4.7
2003	4.0	3.0
2004	4.0	1.5
2005	4.0	2.5
2006	4.0	6.3
2007	4.0	6.4
2008	4.0	9.0
2009	12.0	11.7
2010	15.0	14.2
2011	20.0	22.5
2012	35.7	26.8
2013	40.8	16.3
2014	49.0	22.8
2015	50.6	20.8
2016	40.4	25.0
2017	39.1	16.5
2018	38.2	17.2
2019	20.5	
2020	23.2	
2021	27.4	

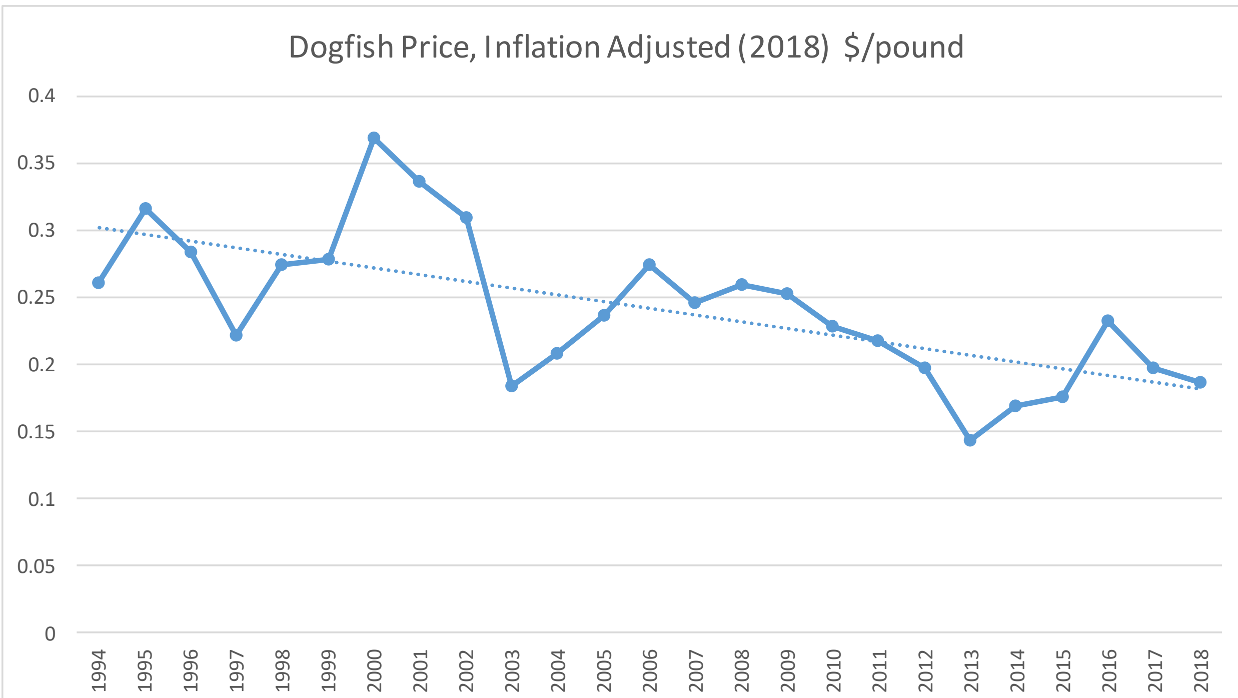


Figure 3. Price of spiny dogfish ($/live pound) (adjusted to 2018 "real" dollars using the producer price index (PPI), 1994-2018 fishing years. Source: NMFS unpublished dealer data. [4]

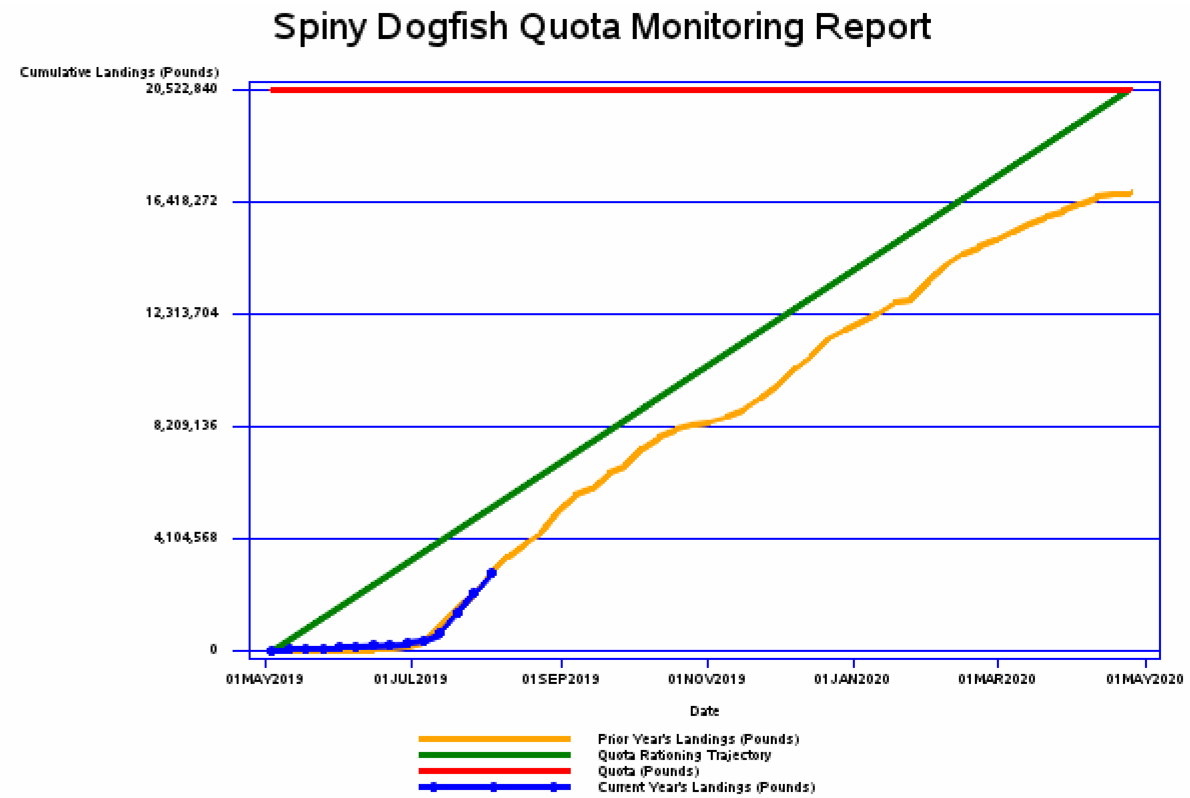


Figure 4. Preliminary Spiny dogfish landings; the 2019 fishing year is in blue through August 3, 2019, and the 2018 fishing year is in yellow-orange. Source: https://www.greateratlantic.fisheries.noaa.gov/aps/monitoring/spinydogfish.html. [4]

Table 2. Commercial Spiny Dogfish landings (live weight – millions of pounds) by state for 2016-2018 fishing years. Source: NMFS unpublished dealer data. [4]

YEAR	MA	MD	NC	NH	NJ	RI	VA	Other	Total
2016	14.3	2.4	0.4	0.8	2.9	0.6	3.6	0.1	25.0
2017	9.6	0.5	0.7	0.8	1.9	0.3	2.5	0.1	16.5
2018	7.7	0.7	1.4	0.5	1.3	0.2	5.2	0.1	17.2

Table 3. Commercial Spiny Dogfish landings (live weight – millions of pounds) by month for 2016-2018 fishing years. Source: NMFS unpublished dealer data. [4]

fishyear	May	June	July	August	September	October	November	December	January	February	March	April
2016	0.3	1.1	3.8	5.0	3.2	2.1	2.0	1.7	1.4	1.3	1.6	1.5
2017	0.2	0.4	3.7	3.3	1.5	1.6	1.1	1.7	0.7	0.9	0.9	0.5
2018	0.0	0.1	2.3	2.7	1.8	1.5	1.3	2.5	1.6	1.7	1.1	0.7

Table 4. Commercial Spiny Dogfish landings (live weight – millions of pounds) by gear for 2016-2018 fishing years. Source: NMFS unpublished dealer data. [4]

fishyear	Sink Gill Net	Bottom Longline	Bottom Trawl	Other Gillnet	Other/Unknown	Total
2016	15.2	6.5	1.2	0.8	1.3	25.0
2017	9.7	4.2	0.8	1.0	0.8	16.5
2018	10.3	3.9	0.4	1.6	0.9	17.2

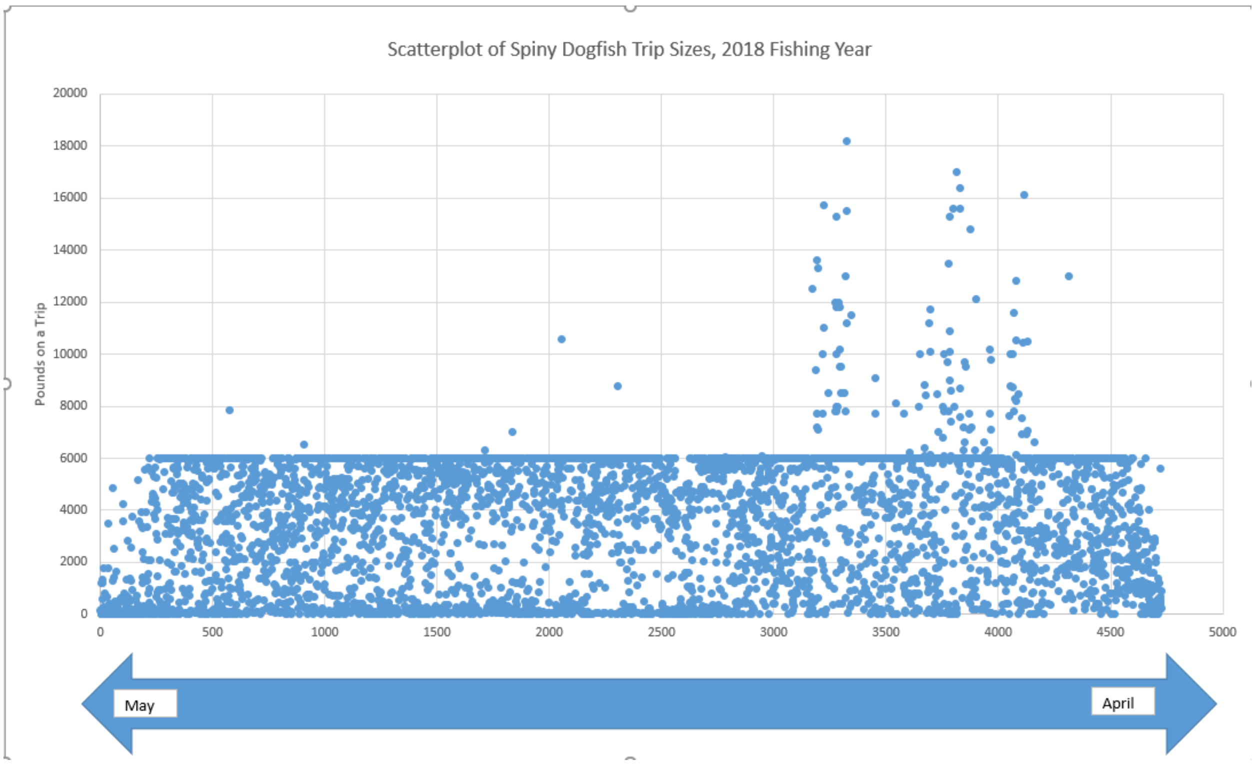


Figure 5. Scatterplot of spiny dogfish trips, 2018 fishing year. Trips toward the left occur early in the fishing year (starts May 1, 2018); Trips toward the right occur late in the fishing year (ends April 30, 2019). Vessels above the 6,000 federal trip limit had a federal permit, but probably did not have a federal permit for spiny dogfish at the time of the trip, which would limit them to 6,000 pounds. [4]

Table 5. Participation by fishing year of federally-permitted vessels. State-only vessels are not included. [4]

YEAR	Vessels 200,000+	Vessels 100,000 - 199,999	Vessels 50,000 - 99,999	Vessels 10,000 - 49,999	Total with at least 10,000 pounds landings
2000	16	10	8	43	77
2001	4	12	10	33	59
2002	2	14	8	31	55
2003	4	5	3	17	29
2004	0	0	0	42	42
2005	0	0	1	67	68
2006	0	4	11	114	129
2007	1	2	21	72	96
2008	0	5	20	119	144
2009	0	11	42	166	219
2010	0	26	54	124	204
2011	1	48	73	135	257
2012	25	55	56	146	282
2013	10	27	45	87	169
2014	27	38	38	81	184
2015	31	33	36	59	159
2016	52	26	14	45	137
2017	28	27	24	32	111
2018	28	26	20	36	110

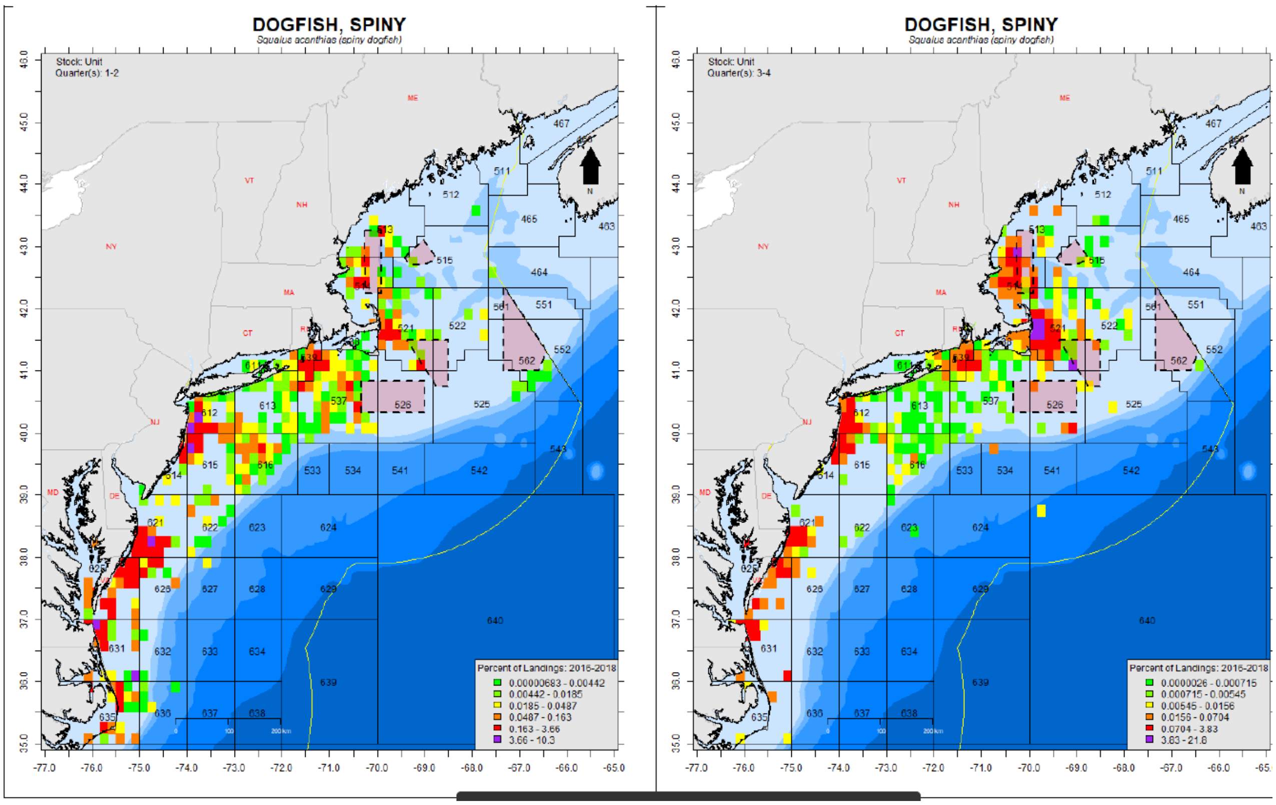


Figure 6. These maps represent commercial spiny dogfish landing densities for 2016-2018 calendar years. Landings are from Dealer reports. Data have been restricted to dealer trips matched to a Vessel Trip Report (VTR) (ALEVEL=A) to ensure area information is as accurate as possible. Landings from quarters 1 and 2 are on the left (67.24% of total landings reported for these quarters) and landings from quarters 3 and 4 are in the right panel (85.78% of total landings reported for these quarters). Groundfish closed areas (dashed borders), and the Exclusive Economic Zone (offshore yellow line) have been overlaid. Data queried on July 22, 2019. [4]

References

[1] Stehlik, Linda. 2007. Essential Fish Habitat source document: Spiny Dogfish, *Squalus acanthias*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-203; 52 p. Available at https://www.nefsc.noaa.gov/publications/tm/tm203/tm203.pdf.

[2] NEFSC 2018. Spiny Dogfish Assessment Update. Available at http://www.mafmc.org/ssc-meetings/2018/sept-11.

[3] NEFSC 2019. Spiny Dogfish Data Update. Available at http://www.mafmc.org/ssc-meetings/2019/september-9-11.

[4] Unpublished NMFS dealer and/or Vessel Trip Report data.

Update of Landings, Discards and Survey Indices for Spiny Dogfish in 2018-2019

Katherine Sosebee
Northeast Fisheries Science Center
National Marine Fisheries Service

Mid Atlantic Fishery Management Council
Scientific and Statistical Committee
September 10, 2019

This information is distributed solely for the purpose of pre-dissemination peer review. It has not been formally disseminated by NOAA. It does not represent any final agency determination or policy.

Commercial Data

The stock of spiny dogfish encompasses the area from NAFO Subarea 2 through 6 (Labrador to North Carolina. This document summarizes the most recent information on spiny dogfish stock status in 2019 and catch data through 2018. Landings data include landings from US and distant water commercial fisheries, and US recreational landings. Discard information includes discards from US commercial fisheries estimated by the SBRM approach and US recreational fisheries. Estimates of dead discards are obtained by multiplying the discards by the gear-specific discard mortality rates.

Recreational landings and discards were obtained from the Marine Recreational Information Program (MRIP) http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-data-query/index. Canadian and distant water landings were obtained from the Northwest Atlantic Fisheries Organization (NAFO) catch statistics database (https://www.nafo.int/Data/STATLANT) for both spiny dogfish and unclassified dogfishes for NAFO Subareas 2-4.

Total landings are summarized in Table 1 and Figure 1. US commercial landings decreased 22% from 8,919 mt in 2017 to 6,958 mt in 2018 (Table 1). Recreational landings and distant water fleet landings were negligible, totaling only 99 mt. Canadian landings have been less than 100 tons since 2009.

The value of commercial landings for 2017 is lower than the value in the 2018 report (Sosebee and Rago 2018) due to the correction of duplicate records in the database. The stochastic estimator was re-run for 2017 to see the impact of this change. The fishing mortality estimate with the reduced commercial landings changed from 0.202 to 0.168 while the SSB did not change.

The recreational catch estimates obtained from MRIP have been revised since the 2018 report. Although some changes are large for the landed portion (A+B1), (Table 2, Figure 2), the totals are still small relative to the commercial landings. The change for the discards (B2) was large and since 2003 was entirely in one direction with the new estimates increasing an average of 165% over that time period (Table 2, Figure 3). The stochastic estimator was re-run for the year with the second largest change (2014; the largest change was in 2013 for which no value of fishing mortality was estimated due to the missing 2014 survey) and for 2017. In 2014, the fishing mortality increased from 0.214 to 0.239. The change in the MRIP estimates in 2017 along with the change in Virginia landings changed the fishing mortality to 0.173.

The precision of the recreational landings (catch types A and B1) in 2018 was relatively poor with Proportional Standard Errors of 69.8 and 53.1% respectively (Table 2). The precision of the discarded dogfish estimates (B2) was much better at 19.5%

The primary sources of commercial discards are otter trawls (3,938 mt; CV=9.7%) and sink gill nets (1,111 mt; CV=18.4%). Discards of spiny dogfish by scallop dredges (135 mt; CV=14.4%) and long lines (18 mt; CV=17.9%) are less important (Table 3). The trawl discards include the three observed trips and total commercial landings from the Max Retention Electronic Monitoring program since the discard to kept ratio was 0.0213 with the trips and 0.0210 without the trips. This resulted in a difference of 9 tons of trawl discards.

Total discards in 2018 of 8,999 mt were 11% less than the 10,157 mt in 2017 and 50% less than the previous 5 year average (Table 4, Figure 4). This value was the third lowest in the time series. Similar patterns were observed for dead discards. There were no major changes in the discarding patterns among fleets. The ratio of dead discards to landings of 45% in 2018 was similar to the last three years. The ratios of total discards to landings and total dead discards to landings exhibited a generally declining trend since 2004 (Figure 5). The total catch estimate in 2018 of 10,111 mt (Table 4) was 44% of the 2018 ABC of 23,045 mt.

Biological samples collected by port agents are used to estimate the size and sex composition of the spiny dogfish landings (Table 5). Overall landings are dominated by females, a trend that has persisted since the US EEZ fishery began (Figure 6). Most fishing takes place near shore where females are more abundant (Appendix 2). The fraction of male dogfish in the landings increased in 2018 to about 10%. About 2.8 million spiny dogfish were landed in 2018. This was a decrease of about 17% in total numbers landed since 2017 (Table 5).

Although sex ratios of discarded fish are dominated by females, they represent only 65% of total discards by weight (Table 6) compared to the 90% of landings. This difference is likely due to the males being discarded at a higher rate than females. On a numerical basis, about 62% of the female dogfish caught and killed in 2018 were landed (Tables 5 and 6). In contrast, only about 30% of male dogfish caught were landed.

Survey Data

The Northeast Fisheries Science Center (NEFSC) bottom trawl survey was delayed in 2016 however all of the core survey strata were completed. In contrast, mechanical problems on the FSV Bigelow in 2014 not only delayed the NEFSC spring bottom trawl survey but also resulted in the loss of critical survey strata in the Mid-Atlantic region. The potential effects of the delay in survey timing in 2016 on the abundance indices are unknown.

Survey estimates of relative abundance from Bigelow surveys were converted to Albatross-equivalent estimates using the methods described in Miller et al. (2010).

The three-point moving average of female spawning stock biomass estimates from 2009 to 2015 exceeded the female spawning stock biomass target (159,288 mt; Rago and Sosebee 2010). The biomass estimates increased in 2016 and it is unknown whether the delay in the 2016 survey made the estimate non-representative. Swept area abundance estimates for both male and female spiny dogfish decreased in 2017 compared to 2016 (Table 7, Figure 7). The female SSB estimate for 2017 of 24,400 mt was the lowest in the time series, likely the result of decreased availability to the survey since all size and sex classes decreased. There is no a priori reason to remove this value from the three-year average since the survey was conducted on time and covered all strata. The spatial distribution for 2017 was unusual since almost no dogfish were caught on Georges Bank (Sosebee and Rago 2018). The distribution in 2019 is similar to 2017 and 2018, however, the total survey catch was higher (Table 7). The 3-yr average of the mature female swept area biomass was 102 kt in 2018 and decreased to 83 kt in 2019 because the high 2016 value in the 3 year average was replaced by the lower survey biomass estimate from 2019. This is still above the biomass threshold and it would take a value lower than 24,400 mt in 2020 to cause an overfished condition next year. It is important to note that the comparisons with the biomass target and threshold are based on outputs of the stochastic model (which was not updated this year) rather than the simple 3-yr average. However, these quantities are closely correlated so the raw survey data provides a first approximation.

Pup production (Figure 8) in 2019 was below both the long term (1968-2018) mean (2.54 kg/tow) and median (1.64 kg/tow) values. The ratio of mature males to mature females increased five-fold (Figure 9) in 2017 but decreased to values similar to that of 2013-2016 in 2018 and 2019. The increase in 2017 may have been a year specific effect. The mean length of mature females has been relatively stable since 2011 above the average of 1997-2003 when recruitment was low (Figure 10). The mean length of pups (Figure 11) in 2017 and 2018 was near or above the long term mean and median values and well above the average of 1997-2003 when recruitment was low. The sizes of mature females and males have been maintained. (Figure 12). The size composition of sub adults is broadening and approaching distribution seen prior to major fisheries in 1990s.

References

Miller TJ, Das C, Politis PJ, Miller AS, Lucey SM, Legault CM, Brown RW, Rago PJ. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. Northeast Fish Sci Cent Ref Doc. 10-05; 233 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026. http://www.nefsc.noaa.gov/publications/crd/crd1005/

Rago PJ and KA Sosebee. 2010. Biological Reference Points for Spiny Dogfish. Northeast Fish Sci Cent Ref Doc. 10-06; 52 p. http://www.nefsc.noaa.gov/publications/crd/crd1006/

Sosebee, KA and PJ Rago. 2018. Update on the Status of Spiny Dogfish in 2018 and Projected Harvests at the Fmsy Proxy and Pstar of 40%. Report to MAFMC SSC September 2018. 82 p.

Table 1. Total spiny dogfish landings (mt, live) in NAFO Areas 2 to 6, 1962-2018.

	United States						
Year	Commercial	Old Recreational	New Recreational	Canada	Distant Water Fleets	Old Total Landings	New Total Landings
1962	235			0	0	235	235
1963	610			0	1	611	611
1964	730			0	16	746	746
1965	488			9	198	695	695
1966	578			39	9,389	10,006	10,006
1967	278			0	2,436	2,714	2,714
1968	158			0	4,404	4,562	4,562
1969	113			0	9,190	9,303	9,303
1970	106			19	5,640	5,765	5,765
1971	73			4	11,566	11,643	11,643
1972	69			3	23,991	24,063	24,063
1973	89			20	18,793	18,902	18,902
1974	127			36	24,513	24,676	24,676
1975	147			1	22,523	22,671	22,671
1976	550			3	16,788	17,341	17,341
1977	931			1	7,199	8,131	8,131
1978	828			84	622	1,534	1,534
1979	4,753			1,331	187	6,271	6,271
1980	4,085			660	599	5,344	5,344
1981	6,865	1,493	2,017	564	974	9,896	10,420
1982	5,411	70	56	389	364	6,234	6,220
1983	4,897	67	111		464	5,428	5,472
1984	4,450	91	102	2	391	4,935	4,945
1985	4,028	89	48	13	1,012	5,142	5,101
1986	2,748	182	236	20	368	3,318	3,371
1987	2,703	306	321	281	139	3,429	3,445
1988	3,105	359	348	1	647	4,112	4,101
1989	4,492	418	220	167	256	5,333	5,135
1990	14,731	179	215	1,309	393	16,611	16,648
1991	13,177	131	240	307	234	13,848	13,957
1992	16,858	215	173	868	67	18,008	17,966
1993	20,643	120	187	1,435	27	22,225	22,292
1994	18,798	155	146	1,820	2	20,774	20,766
1995	22,578	68	89	956	14	23,615	23,637
1996	27,136	25	27	431	236	27,827	27,830
1997	18,351	66	110	446	214	19,078	19,121
1998	20,628	39	36	1,055	607	22,329	22,326
1999	14,855	53	83	2,091	554	17,552	17,582
2000	9,257	5	4	2,741	402	12,405	12,404
2001	2,294	28	25	3,820	677	6,819	6,816
2002	2,199	205	358	3,584	474	6,462	6,614
2003	1,170	40	54	1,302	643	3,155	3,169
2004	982	105	357	2,362	330	3,778	4,030
2005	1,147	45	42	2,270	330	3,792	3,789
2006	2,249	94	74	2,439	10	4,792	4,772
2007	3,503	84	129	2,384	31	6,002	6,047
2008	4,108	214	236	1,572	131	6,025	6,048
2009	5,377	34	102	113	82	5,606	5,674
2010	5,440	21	12	6	127	5,594	5,585
2011	9,480	32	58	124	143	9,779	9,805
2012	10,660	19	45	65	137	10,881	10,907
2013	7,312	37	67	NA	61	7,410	7,440
2014	10,651	31	108	54	31	10,767	10,844
2015	8,663	39	44	1	23	8,726	8,731
2016	12,097	73	141	37	24	12,231	12,299
2017	8,735	81	130	54	0	8,870	8,919
2018	6,878	21	35	45	0	6,944	6,958

Table 2. Summary of spiny dogfish landings and discards based on revised Marine Recreational Information Program estimates. As in previous assessments, the average weight of landed and discarded spiny dogfish is assumed to be 2.5 kg. Discard mortality is assumed to be 20%. The percent change from the previous values is given for landings and dead discards.

	Catch in Numbers								Numbers		Weight			Estimates used in Previous assessments			
Year	Observed Harvest (A)	PSE	Reported Harvest (B1)	PSE	Released Alive (B2)	PSE	Total Catch A+B1+B2	PSE	Total Landings A+B1 (number)	Discards B2 (number)	Landings (A+B1) (mt)	Discards (B2) (mt)	Dead Discards (mt)	Landings (mt)	Discards (mt)	% change Landings	% change Discard
1981	1,540	56.5	805,317	65.9	128,652	26.2	935,509	57.1	806,857	128,652	2017	322	64	1,493	59	35.1	8.6
1982	13,193	55.5	9,398	33.6	161,147	43.4	183,738	39.4	22,591	161,147	56	403	81	70	70	-19.8	15.3
1983	14,579	50.4	29,826	48.4	294,107	21.1	338,512	19.7	44,405	294,107	111	735	147	67	108	65.5	36.2
1984	17,680	73.1	23,124	40.7	994,439	67.6	1,035,243	65.0	40,804	994,439	102	2486	497	91	85	11.7	486.4
1985	24,512	86.4	34,792	55.0	167,371	32.5	226,675	27.4	59,304	167,371	148	418	84	89	193	66.3	-56.6
1986	13,036	33.0	81,888	40.6	564,352	24.7	659,276	21.9	94,924	564,352	237	1411	282	183	237	29.5	18.8
1987	64,431	78.1	64,119	50.6	373,458	42.0	502,008	33.8	128,550	373,458	321	934	187	306	211	5.0	-11.6
1988	56,212	40.4	87,845	37.7	545,672	23.6	689,729	20.3	144,057	545,672	360	1364	273	360	175	0.0	55.7
1989	49,649	57.6	72,777	28.3	794,579	28.5	917,005	25.8	122,426	794,579	306	1986	397	419	270	-26.9	47.2
1990	55,501	41.6	71,655	35.2	753,649	20.3	880,805	19.4	127,156	753,649	318	1884	377	179	234	78.1	61.0
1991	81,441	29.6	53,394	35.9	1,040,163	18.4	1,174,998	16.9	134,835	1,040,163	337	2600	520	131	270	157.6	92.7
1992	123,555	48.6	32,165	27.4	523,665	16.0	679,385	15.7	155,720	523,665	389	1309	262	243	204	60.1	28.5
1993	38,093	34.3	40,403	42.4	778,604	19.7	857,100	18.1	78,496	778,604	196	1947	389	120	222	63.9	75.3
1994	13,890	40.4	44,574	58.6	593,746	22.4	652,210	20.9	58,464	593,746	146	1484	297	155	194	-5.6	53.3
1995	19,030	30.4	16,562	47.2	356,311	25.3	391,903	23.4	35,592	356,311	89	891	178	68	131	31.7	36.3
1996	6,753	44.0	4,365	68.8	186,192	19.4	197,310	18.6	11,118	186,192	28	465	93	26	66	7.5	41.4
1997	31,872	48.1	12,055	70.1	487,269	20.3	531,196	19.3	43,927	487,269	110	1218	244	66	169	65.1	44.4
1998	21,530	41.4	44,432	94.1	417,596	22.4	483,558	21.9	65,962	417,596	165	1044	209	61	122	171.7	71.2
1999	21,757	63.3	13,231	74.5	362,473	19.7	397,461	19.7	34,988	362,473	87	906	181	54	107	61.2	68.6
2000	1,640	44.0	96	85.7	335,904	24.6	337,640	24.5	1,736	335,904	4	840	168	5	138	-15.1	21.6
2001	6,751	56.3	3,352	68.5	1,153,341	12.5	1,163,444	12.4	10,103	1,153,341	25	2883	577	28	421	-10.0	36.9
2002	3,000	37.6	140,033	66.1	997,419	15.0	1,140,452	15.3	143,033	997,419	358	2494	499	205	335	74.5	49.0
2003	15,581	42.0	8,584	56.6	1,584,326	14.1	1,608,491	14.0	24,165	1,584,326	60	3961	792	40	600	52.2	32.1
2004	75,946	49.1	71,732	50.2	2,705,518	13.8	2,853,196	13.3	147,678	2,705,518	369	6764	1353	120	658	207.1	105.6
2005	8,811	41.4	10,001	42.8	1,983,774	19.3	2,002,586	19.2	18,812	1,983,774	47	4959	992	35	670	33.2	48.1
2006	7,980	40.1	23,195	61.2	2,336,176	13.9	2,367,351	13.8	31,175	2,336,176	78	5840	1168	80	710	-2.0	64.5
2007	3,319	62.0	48,365	63.3	2,413,174	14.0	2,464,858	13.8	51,684	2,413,174	129	6033	1207	86	779	49.9	55.0
2008	25,731	36.9	68,959	48.3	2,216,029	13.3	2,310,719	13.1	94,690	2,216,029	237	5540	1108	114	539	107.5	105.5
2009	9,216	42.2	33,972	39.0	2,885,331	14.8	2,928,519	14.6	43,188	2,885,331	108	7213	1443	43	516	152.8	179.6
2010	5,112	42.0	10,637	66.5	1,936,270	19.9	1,952,019	19.7	15,749	1,936,270	39	4841	968	16	395	145.0	145.0
2011	16,750	39.9	17,716	54.7	2,372,432	15.8	2,406,898	15.6	34,466	2,372,432	86	5931	1186	32	462	169.2	156.5
2012	6,629	68.7	12,719	81.7	1,726,341	27.6	1,745,689	27.3	19,348	1,726,341	48	4316	863	19	275	157.4	214.0
2013	20,326	56.2	55,131	73.0	4,803,736	19.0	4,879,193	19.3	75,457	4,803,736	189	12009	2402	37	531	414.2	352.7
2014	5,159	56.6	39,952	25.5	7,008,107	43.0	7,053,218	42.7	45,111	7,008,107	113	17520	3504	32	950	256.0	268.7
2015	9,173	56.7	16,379	62.9	1,711,330	22.3	1,736,882	22.0	25,552	1,711,330	64	4278	856	39	244	62.1	250.0
2016	35,052	80.7	43,877	62.6	3,630,248	26.1	3,709,177	25.8	78,929	3,630,248	197	9076	1815	73	625	169.8	190.2
2017	18,173	64.8	34,495	38.8	1,426,245	21.1	1,478,913	20.6	52,668	1,426,245	132	3566	713	81	183	62.4	289.1
2018	4604	69.8	16,864	53.1	1490265	19.5	1,511,733	19.2	21,468	1,490,265	54	3726	745	21	241	150.6	208.6

Table 3. Estimated total discards of spiny dogfish (mt) from commercial and recreational US fisheries, 1981-2018. The values for otter trawl and gill net from 1981-1989 are hindcast estimates (see SARC 43).

								Assumed Discard Mortality Rate					
								0.50	0.30	0.75	0.10	0.20	
	Total Discards (mt)							Dead Discards					
Year	Otter Trawl	Sink Gill Net	Scallop Dredge	Line gear	Recreational	Total		Otter Trawl	Sink Gill Net	Scallop Dredge	Line gear	Recreational	Total Dead
1981	36,360	5,360	na	na	322	42,042		18,180	1,608	na	na	64	19,852
1982	42,910	4,454	na	na	403	47,767		21,455	1,336	na	na	81	22,872
1983	42,188	4,042	na	na	735	46,965		21,094	1,213	na	na	147	22,454
1984	39,625	4,918	na	na	2,486	47,029		19,813	1,475	na	na	497	21,785
1985	33,354	4,539	na	na	418	38,311		16,677	1,362	na	na	84	18,122
1986	31,745	4,883	na	na	1,411	38,039		15,873	1,465	na	na	282	17,620
1987	29,050	4,864	na	na	934	34,848		14,525	1,459	na	na	187	16,171
1988	28,951	5,132	na	na	1,364	35,447		14,476	1,540	na	na	273	16,288
1989	28,286	5,360	na	na	1,986	35,632		14,143	1,608	na	na	397	16,148
1990	34,242	6,062	na	na	1,884	42,188		17,121	1,819	na	na	377	19,316
1991	19,322	11,030	32	97	2,600	33,081		9,661	3,309	24	10	520	13,524
1992	32,617	5,953	827	650	1,309	41,356		16,309	1,786	620	65	262	19,041
1993	17,284	9,814	209	44	1,947	29,298		8,642	2,944	157	4	389	12,137
1994	13,908	2,887	723	na	1,484	19,002		6,954	866	542	na	297	8,659
1995	16,997	6,731	378	na	891	24,997		8,499	2,019	284	na	178	10,979
1996	9,402	3,890	121	na	465	13,878		4,701	1,167	91	na	93	6,052
1997	6,704	2,326	198	na	1,218	10,446		3,352	698	149	na	244	4,442
1998	5,268	1,965	120	na	1,044	8,397		2,634	590	90	na	209	3,522
1999	7,685	2,005	41	na	906	10,637		3,843	602	31	na	181	4,656
2000	2,728	4,684	14	na	840	8,266		1,364	1,405	11	na	168	2,948
2001	4,919	7,204	30	na	2,883	15,036		2,460	2,161	23	na	577	5,220
2002	5,540	4,997	58	4,015	2,494	17,104		2,770	1,499	44	402	499	5,213
2003	3,853	5,413	103	2	3,961	13,332		1,927	1,624	77	0	792	4,420
2004	8,299	4,031	53	497	6,764	19,644		4,150	1,209	40	50	1,353	6,801
2005	7,515	3,338	15	1,175	4,959	17,002		3,758	1,001	11	118	992	5,880
2006	7,773	3,369	14	131	5,840	17,127		3,886	1,011	10	13	1,168	6,088
2007	8,115	5,133	61	73	6,033	19,415		4,058	1,540	45	7	1,207	6,857
2008	5,604	4,864	237	260	5,540	16,505		2,802	1,459	178	26	1,108	5,573
2009	7,010	4,874	364	835	7,213	20,296		3,505	1,462	273	84	1,443	6,766
2010	5,564	2,385	196	509	4,841	13,494		2,782	716	147	51	968	4,663

Table 3 cont.

								Assumed Discard Mortality Rate					
								0.50	0.30	0.75	0.10	0.20	
	Total Discards (mt)							Dead Discards					
Year	Otter Trawl	Sink Gill Net	Scallop Dredge	Line gear	Recreational	Total		Otter Trawl	Sink Gill Net	Scallop Dredge	Line gear	Recreational	Total Dead
2011	6,540	2,831	226	356	5,931	15,883		3,270	849	170	36	1,186	5,510
2012	6,687	2,959	432	172	4,316	14,567		3,344	888	324	17	863	5,436
2013	6,897	3,107	127	37	12,009	22,177		3,448	932	95	4	2,402	6,881
2014	8,070	2,388	108	17	17,520	28,104		4,035	716	81	2	3,504	8,338
2015	5,096	1,655	41	19	4,278	11,089		2,548	496	31	2	856	3,933
2016	5,084	1,941	120	165	9,076	16,386		2,542	582	90	17	1,815	5,046
2017	5,451	881	75	185	3,566	10,157		2,726	264	56	19	713	3,777
2018	3,928	1,111	135	101	3,726	8,999		1,964	333	101	10	745	3,153

Table 4. Total landings, discards and total catch for spiny dogfish, 1989-2018.

Year	Total Discard (mt)	Total Dead Discards (mt)	Total Landings (mt)	Dead Discard/ Landings	Total Discard / Landings	Total Catch (mt)
1989	35,632	16,148	5,135	3.00	6.56	21,353
1990	42,188	19,316	16,648	1.15	2.50	35,785
1991	33,081	13,524	13,957	0.96	2.30	27,122
1992	41,356	19,041	17,966	1.05	2.28	36,991
1993	29,298	12,137	22,292	0.54	1.28	34,194
1994	19,002	8,659	20,766	0.41	0.89	29,330
1995	24,997	10,979	23,637	0.46	1.05	34,547
1996	13,878	6,052	27,830	0.22	0.49	33,852
1997	10,446	4,442	19,121	0.23	0.53	23,443
1998	8,397	3,522	22,326	0.15	0.36	25,764
1999	10,637	4,656	17,582	0.26	0.58	22,134
2000	8,266	2,948	12,404	0.24	0.65	15,321
2001	15,036	5,220	6,816	0.74	2.09	11,882
2002	17,104	5,213	6,614	0.78	2.52	11,510
2003	13,332	4,420	3,169	1.34	3.92	7,380
2004	19,644	6,801	4,030	1.63	4.33	9,925
2005	17,002	5,880	3,789	1.47	4.10	9,382
2006	17,127	6,088	4,772	1.19	3.16	10,480
2007	19,415	6,857	6,047	1.08	2.95	12,512
2008	16,505	5,573	6,048	0.84	2.34	11,113
2009	20,296	6,766	5,674	1.05	2.85	11,503
2010	13,494	4,663	5,585	0.73	1.89	9,675
2011	15,883	5,510	9,805	0.56	1.62	15,315
2012	14,567	5,436	10,907	0.50	1.34	16,343
2013	22,177	6,881	7,440	0.92	2.98	14,321
2014	28,104	8,338	10,844	0.77	2.59	19,182
2015	11,089	3,933	8,731	0.45	1.27	12,664
2016	16,386	5,046	12,299	0.41	1.33	17,344
2017	10,157	3,777	8,919	0.42	1.14	12,696
2018	8,999	3,153	6,958	0.45	1.29	10,111

Table 5. Summary of estimated landings of US, Canadian and foreign fisheries by sex, 1982-2018. US recreational landings included. Estimated total weights based on sum of estimated weights from sampled length frequency distributions from port samples. Estimated weights computed for female as W = exp(-15.025)^L^3.606935 and males as W = exp(-13.002)*L^3.097787 with weight in kg and length in cm. "Samples" = number of measured dogfish.

	NMFS Biological Samples from Ports								Prorated Landings by Sex				
Year	Total Samples Males	Est Total Wt (kg) Males	Average Wt (kg) Males	Total Samples Females	Est Total Wt (kg) Females	Average Wt (kg) Females	Fraction Females by Weight	Total Landings (mt)	Est Landings (mt) of Males	Est Landings (mt) of Females	Number of Males Landed (000)	Number of Females Landed (000)	Total Numbers Landed (000)
1982	24	52.0	2.167	680	3,015.7	4.435	0.9830	6,220	106	6,128	49	1,382	1,431
1983				610	2,513.9	4.121	1.0000	5,472	0	5,428		1,317	1,317
1984	9	15.8	1.760	1,499	6,626.0	4.420	0.9976	4,945	12	4,923	7	1,114	1,120
1985	21	35.2	1.678	1,657	6,799.2	4.103	0.9948	5,101	27	5,116	16	1,247	1,263
1986	64	104.1	1.626	1,165	4,669.0	4.008	0.9782	3,371	72	3,246	44	810	854
1987	31	52.7	1.700	2,000	7,550.1	3.775	0.9931	3,445	24	3,406	14	902	916
1988	7	14.8	2.114	1,764	7,560.7	4.286	0.9980	4,101	8	4,104	4	957	961
1989	35	67.5	1.927	1,375	5,528.0	4.020	0.9879	5,135	64	5,269	33	1,311	1,344
1990	19	33.7	1.772	2,230	8,916.6	3.998	0.9962	16,648	63	16,549	35	4,139	4,174
1991	161	379.2	2.356	1,518	5,923.9	3.902	0.9398	13,957	833	13,015	354	3,335	3,689
1992	12	22.3	1.861	3,187	12,180.6	3.822	0.9982	17,966	33	17,975	18	4,703	4,721
1993	42	78.4	1.866	2,773	9,927.5	3.580	0.9922	22,292	174	22,051	93	6,159	6,253
1994	47	86.6	1.843	2,092	6,639.9	3.174	0.9871	20,766	267	20,507	145	6,461	6,606
1995	25	38.9	1.555	2,266	6,676.6	2.946	0.9942	23,637	137	23,479	88	7,969	8,056
1996	569	886.7	1.558	1,662	4,397.6	2.646	0.8322	27,830	4,669	23,158	2,996	8,752	11,749
1997	303	449.1	1.482	382	780.9	2.044	0.6349	19,121	6,966	12,112	4,700	5,925	10,625
1998	68	85.4	1.257	683	1,434.5	2.100	0.9438	22,326	1,255	21,073	999	10,034	11,033
1999	93	130.3	1.401	311	625.5	2.011	0.8276	17,582	3,026	14,527	2,160	7,223	9,382
2000	345	473.1	1.371	1,921	3,921.2	2.041	0.8923	12,404	1,335	11,069	974	5,423	6,397
2001	12	17.1	1.422	215	456.5	2.123	0.9640	6,816	246	6,573	173	3,096	3,269
2002	1	1.3	1.279	278	752.5	2.707	0.9983	6,614	11	6,451	9	2,383	2,392
2003	34	48.3	1.421	966	2,338.4	2.421	0.9798	3,169	64	3,091	45	1,277	1,322
2004	15	23.9	1.593	1,180	3,296.9	2.794	0.9928	4,030	27	3,751	17	1,343	1,360
2005	745	1018.7	1.367	2,065	5,196.0	2.516	0.8361	3,789	622	3,171	455	1,260	1,715
2006	646	924.4	1.431	4,211	10,382.9	2.466	0.9182	4,772	392	4,400	274	1,785	2,058
2007	507	720.7	1.421	2,865	7,514.8	2.623	0.9125	6,047	525	5,477	370	2,088	2,458
2008	236	342.0	1.449	2,925	7,973.8	2.726	0.9589	6,048	248	5,777	171	2,119	2,290
2009	472	696.6	1.476	3,378	9,161.6	2.712	0.9293	5,674	396	5,210	268	1,921	2,189
2010	821	1213.4	1.478	4,963	14,217.4	2.865	0.9214	5,585	439	5,146	297	1,796	2,094
2011	868	1109.9	1.279	4,800	12,786.8	2.664	0.9201	9,805	781	8,998	611	3,378	3,989
2012	213	371.8	1.746	3,763	10,727.9	2.851	0.9665	10,907	365	10,516	209	3,689	3,898
2013	450	736.7	1.637	5,441	16,258.3	2.988	0.9567	7,440	321	7,089	196	2,372	2,569
2014	546	830.6	1.521	4,505	13,198.1	2.930	0.9408	10,844	634	10,081	417	3,441	3,858
2015	1,164	1705.9	1.466	2,943	7,782.9	2.645	0.8202	8,731	1,569	7,157	1,070	2,706	3,777
2016	628	971.9	1.548	4,792	13,192.7	2.753	0.9314	12,299	844	11,455	545	4,161	4,706
2017	398	609.9	1.532	5,178	13,930.7	2.690	0.9581	8,919	374	8,545	244	3,176	3,420
2018	772	1179.8	1.528	3,861	10,210.0	2.644	0.8964	6,958	721	6,237	472	2,359	2,830
formula	*A*	*B*	*C=B/A*	*D*	*E*	*F=E/D*	*G=E/(E+B)*	*H*	*I=(1-G)*H*	*J=G*H*	*K=I/C*	*L=J/F*	*M=K+L*

Draft Working Paper for Predissemination Peer Review Only

Table 6. Summary of estimated discards of combined US fleets by sex, 1991-2018. Estimated total weights based on summation of estimated weights from sampled length frequency distributions. Estimated weights computed from length-weight regressions. Female W = exp(-15.025)^L^3.606935. Male W = exp(-13.002)*L^3.097787 with weight in kg and length in cm. "Samples" = number of measured dogfish that were discarded.

	NMFS Biological Samples from Observers								Prorated Discards by Sex				
Year	Total Samples Males	Est Total Wt (kg) Males	Average Wt (kg) Males	Total Samples Females	Est Total Wt (kg) Females	Average Wt (kg) Females	Fraction Females by Weight	Total Dead Discards (mt)	Est Landings (mt) of Males	Est Discards (mt) of Females	Number of Males Discarded (000)	Number of Females Discarded (000)	Total Numbers Discarded (000)
1991	376	463	1.231	894	2,350	2.628	0.8355	13,524	2,184	11,090	1,775	4,219	5,994
1992	449	504	1.123	632	1,090	1.724	0.6836	19,041	6,007	12,976	5,347	7,526	12,873
1993	57	62	1.087	130	414	3.184	0.8697	12,137	1,559	10,410	1,434	3,270	4,704
1994	207	207	1.001	747	1,397	1.870	0.8708	8,659	1,105	7,451	1,104	3,985	5,090
1995	2,191	2,342	1.069	2,384	3,064	1.285	0.5668	10,979	4,735	6,197	4,431	4,821	9,251
1996	1,643	1,833	1.115	1,370	2,013	1.469	0.5234	6,052	2,871	3,153	2,574	2,147	4,721
1997	1,359	1,391	1.024	1,427	2,070	1.451	0.5980	4,442	1,755	2,611	1,714	1,800	3,514
1998	1,289	1,320	1.024	1,463	1,939	1.326	0.5951	3,522	1,391	2,044	1,359	1,542	2,901
1999	447	440	0.984	870	1,808	2.078	0.8044	4,656	896	3,685	911	1,773	2,684
2000	423	568	1.343	1,498	3,207	2.141	0.8495	2,948	439	2,478	327	1,157	1,484
2001	650	842	1.295	2,987	7,377	2.470	0.8976	5,220	518	4,545	400	1,840	2,241
2002	1,293	1,819	1.407	5,880	13,899	2.364	0.8843	5,213	584	4,464	415	1,889	2,304
2003	4,711	5,367	1.139	12,826	27,210	2.121	0.8353	4,420	696	3,529	611	1,664	2,275
2004	10,878	14,480	1.331	28,583	64,771	2.266	0.8173	6,801	1,123	5,023	844	2,217	3,060
2005	7,470	9,450	1.265	13,024	28,593	2.195	0.7516	5,880	1,388	4,201	1,098	1,914	3,011
2006	4,512	5,449	1.208	7,041	14,559	2.068	0.7277	6,088	1,549	4,139	1,283	2,002	3,284
2007	3,955	5,183	1.310	9,830	24,621	2.505	0.8261	6,857	1,132	5,378	864	2,147	3,011
2008	3,096	3,969	1.282	6,140	14,857	2.420	0.7892	5,573	1,073	4,015	837	1,659	2,496
2009	1,719	2,088	1.215	3,083	6,849	2.221	0.7664	6,766	1,378	4,519	1,134	2,034	3,169
2010	1,634	2,190	1.340	2,086	4,994	2.394	0.6952	4,663	1,244	2,837	928	1,185	2,113
2011	2,286	2,920	1.278	2,428	5,864	2.415	0.6675	5,510	1,591	3,196	1,246	1,323	2,569
2012	734	1,010	1.376	1,384	3,302	2.386	0.7657	5,436	1,136	3,712	825	1,556	2,381
2013	448	381	0.850	701	1,210	1.725	0.7605	6,881	1,200	3,810	1,411	2,208	3,620
2014	743	786	1.058	784	1,428	1.822	0.6449	8,338	2,961	5,377	2,797	2,952	5,749
2015	750	938	1.251	559	1,050	1.878	0.5280	3,933	1,856	2,076	1,483	1,106	2,589
2016	384	469	1.222	314	611	1.945	0.5655	5,046	2,193	2,853	1,794	1,467	3,261
2017	1,271	1,653	1.301	1,535	2,481	1.616	0.6001	3,777	1,510	2,267	1,161	1,402	2,564
2018	1,240	1,220	0.984	1,625	2,302	1.416	0.6535	3,153	1,092	2,061	1,110	1,455	2,565
formula	*A*	*B*	*C=B/A*	*D*	*E*	*F=E/D*	*G=E/(E+B)*	*H*	*I=(1-G)*H*	*J=G*H*	*K=I/C*	*L=J/F*	*M=K+L*

Table 7. Biomass estimates for spiny dogfish (thousands of metric tons) based on area swept by NEFSC bottom trawl during spring surveys, 1968-2019. Estimate for 2014 not included as survey coverage was incomplete.

	Lengths >= 80 cm				Lengths 36 to 79 cm				Length <= 35 cm					3-pt
	Females	Males	Total		Females	Males	Total		Females	Males	Total		All Lengths	Average Female SSB
1968			41.4				110.4				1.52		153.3	
1969			27.4				69.3				0.66		97.3	
1970			36.7				33.0				3.19		72.9	
1971			103.8				27.6				2.76		134.2	
1972			126.6				145.9				1.55		274.1	
1973			178.7				165.3				2.58		346.5	
1974			221.9				179.6				2.66		404.1	
1975			105.1				125.0				3.97		234.0	
1976			96.3				120.8				1.20		218.3	
1977			77.3				68.0				0.53		145.9	
1978			87.4				131.2				1.24		219.8	
1979			52.3				18.6				1.82		72.7	
1980	104.7	15.3	168.1		16.8	72.2	123.5		0.32	0.39	0.84		292.4	
1981	266.5	24.4	293.8		25.5	75.1	100.6		2.14	2.80	5.06		399.5	
1982	454.0	34.6	488.6		61.6	143.3	204.9		0.48	0.69	1.17		694.6	275.1
1983	77.7	30.1	107.8		36.7	98.5	135.3		3.09	3.95	7.03		250.1	266.1
1984	115.6	27.5	143.1		33.4	88.0	121.4		0.14	0.21	0.35		264.9	215.8
1985	317.0	125.5	442.6		102.5	502.5	605.0		4.01	5.10	9.10		1056.7	170.1
1986	191.3	3.5	194.8		51.9	29.6	81.5		0.84	1.11	1.96		278.2	208.0
1987	219.1	90.5	309.6		61.5	171.7	233.1		2.46	4.76	7.22		550.0	242.5
1988	433.1	26.2	459.4		93.3	153.6	247.0		0.89	1.09	1.98		708.4	281.2
1989	162.1	40.5	202.6		100.4	158.2	258.6		1.14	1.54	2.68		463.9	271.5
1990	400.3	70.7	471.0		163.5	303.1	466.6		0.68	1.03	1.71		939.3	331.8
1991	220.4	30.0	250.3		108.4	186.3	294.7		0.98	1.43	2.41		547.4	260.9
1992	280.5	41.9	322.4		179.9	231.9	411.8		0.73	1.00	1.73		735.9	300.4
1993	234.6	27.8	262.5		104.1	198.5	302.6		0.55	0.65	1.21		566.3	245.2
1994	105.3	37.1	142.4		108.3	254.2	362.5		4.28	5.54	9.82		514.8	206.8
1995	102.4	29.5	131.9		154.0	174.5	328.5		0.25	0.35	0.59		460.9	147.5
1996	196.5	33.4	229.9		201.7	334.8	536.4		0.98	1.14	2.12		768.5	134.7
1997	83.7	17.5	101.2		205.2	209.1	414.3		0.05	0.05	0.10		515.5	127.5
1998	26.7	22.9	49.7		69.0	236.4	305.4		0.05	0.08	0.13		355.2	102.3
1999	62.7	20.4	83.1		140.8	256.4	397.2		0.02	0.03	0.05		480.4	57.7
2000	85.8	11.7	97.5		91.5	166.2	257.7		0.07	0.09	0.16		355.4	58.4
2001	56.7	16.7	73.4		71.4	160.5	231.9		0.04	0.03	0.07		305.4	68.4
2002	75.2	19.0	94.2		131.5	246.3	377.8		0.06	0.06	0.12		472.1	72.5
2003	64.5	22.5	87.1		125.5	256.3	381.8		0.13	0.14	0.27		469.1	65.5
2004	40.4	10.0	50.3		46.9	126.2	173.1		0.66	0.91	1.56		225.0	60.0
2005	55.8	30.8	86.6		59.8	294.7	354.5		0.28	0.42	0.69		441.9	53.6
2006	253.4	29.0	282.5		141.6	406.5	548.1		0.10	0.17	0.27		830.8	116.6
2007	158.0	18.9	176.9		73.6	227.6	301.1		0.23	0.32	0.56		478.6	155.8
2008	241.7	29.6	271.4		91.2	293.7	385.0		0.47	0.59	1.05		657.4	217.7

Table 7. cont.

	Lengths >= 80 cm				Lengths 36 to 79 cm					Length <= 35 cm				3-pt
	Females	Males	Total		Females	Males	Total			Females	Males	Total	All Lengths	Average Female SSB
2009	148.3	21.9	170.2		54.9	326.1	381.0		2.95	3.76	6.71		557.9	182.7
2010	160.6	18.3	178.8		64.0	287.3	351.3		1.15	1.44	2.59		532.7	183.5
2011	213.9	26.7	240.6		60.0	408.6	468.6		0.99	2.48	3.47		712.6	174.2
2012	350.0	44.7	394.7		94.5	617.7	712.2		4.03	5.02	9.05		1116.0	241.5
2013	143.8	56.5	200.3		131.5	439.0	570.4		5.19	6.40	11.59		782.3	235.9
2014	NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA
2015	123.9	22.1	145.9		40.0	276.8	316.8		1.06	1.33	2.39		465.1	133.8
2016	184.9	29.5	214.4		119.9	429.4	549.3		1.30	1.81	3.11		766.9	154.4
2017	24.4	12.7	37.1		92.5	284.8	377.3		0.23	0.31	0.53		414.9	111.1
2018	97.7	23.7	121.4		134.4	306.3	440.6		0.72	0.77	1.48		563.6	102.4
2019	126.0	27.6	153.6		184.8	417.8	602.7		0.42	0.51	0.93		757.2	82.7

Notes: Total equals sum of males and females plus unsexed dogfish. Data for dogfish prior to 1980 are currently not available by sex. Data have been adjusted to AL IV equivalents using weight specific HB Bigelow calibration coefficients. Average SSB for 2015 is 2013 and 2015 only. Average for 2016 is 2015 and 2016 only. Average for 2017-2019 is done as in years prior to 2014.

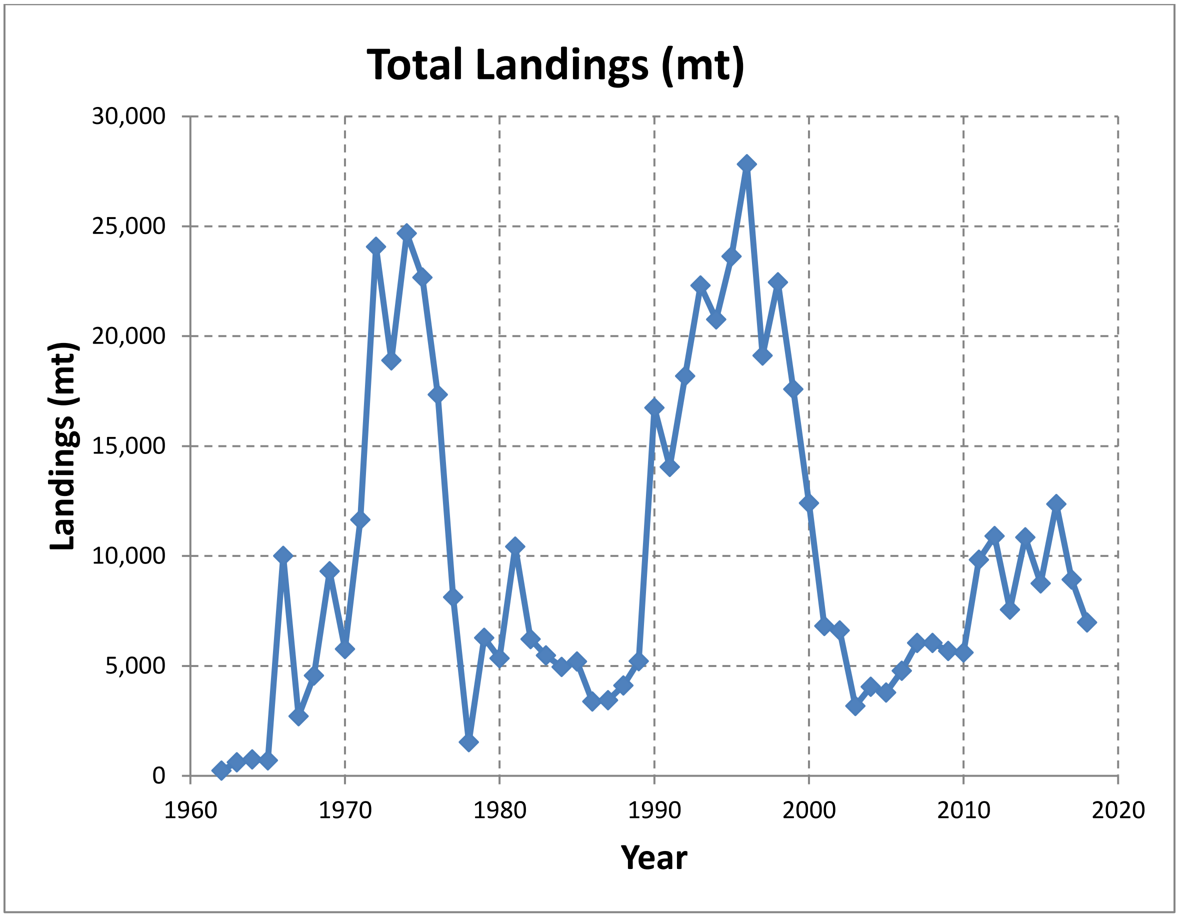


Figure 1. Estimated total landings (mt, live) of spiny dogfish in NAFO Areas 2 to 6, 1962-2018.

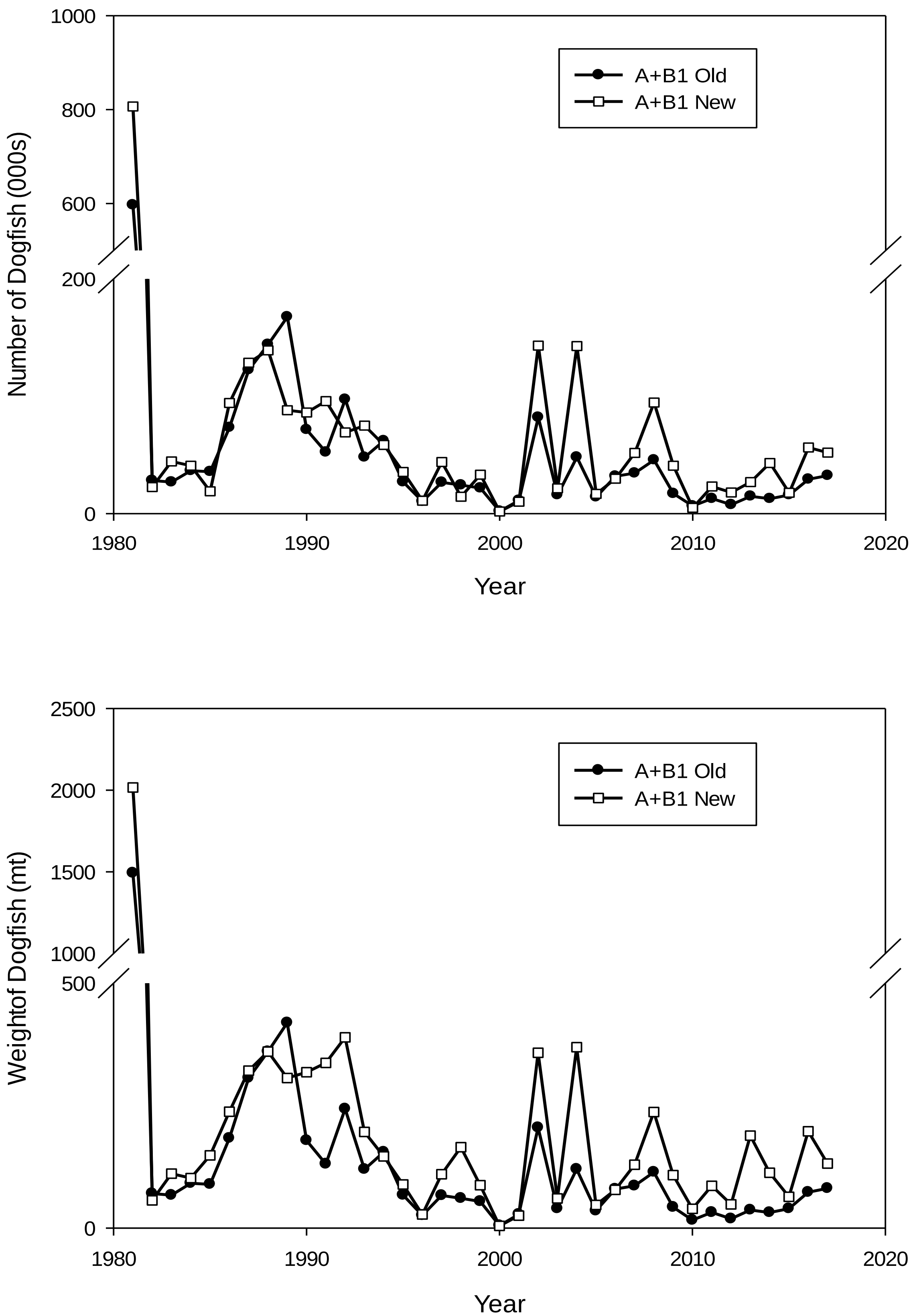
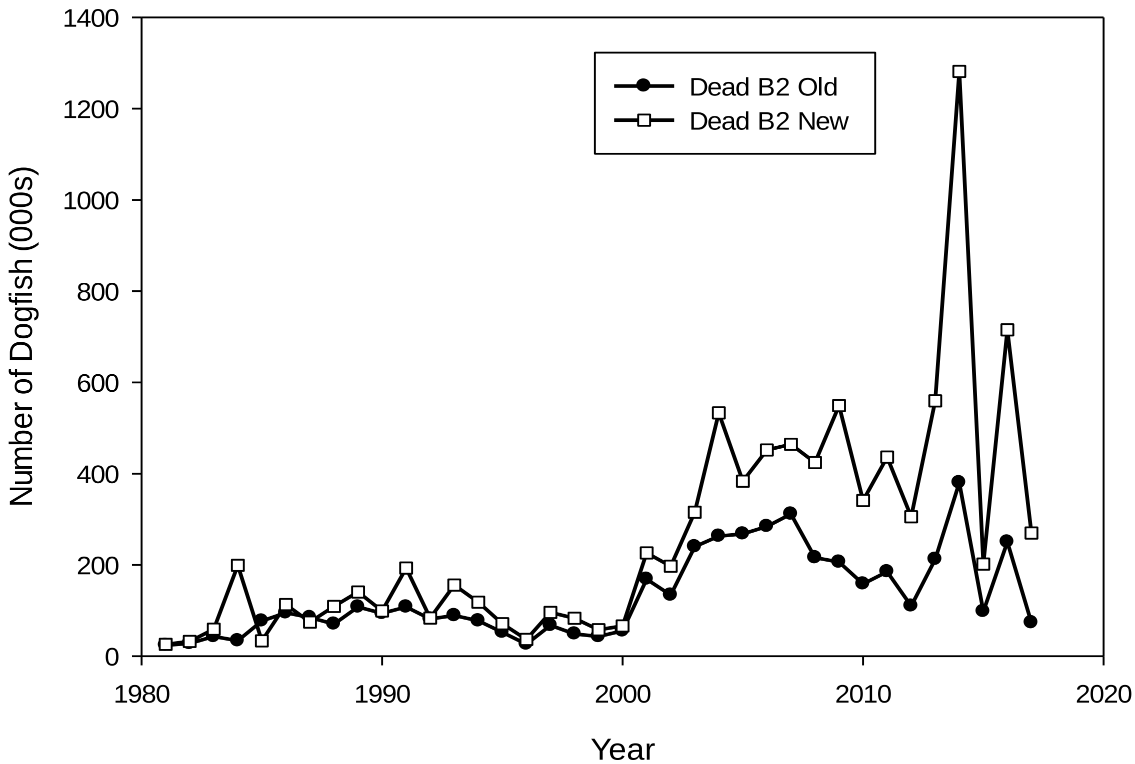


Figure 2. Comparison of old MRIP/MRFSS to new MRIP for landings with the top panel in numbers of fish and the lower panel in mt.



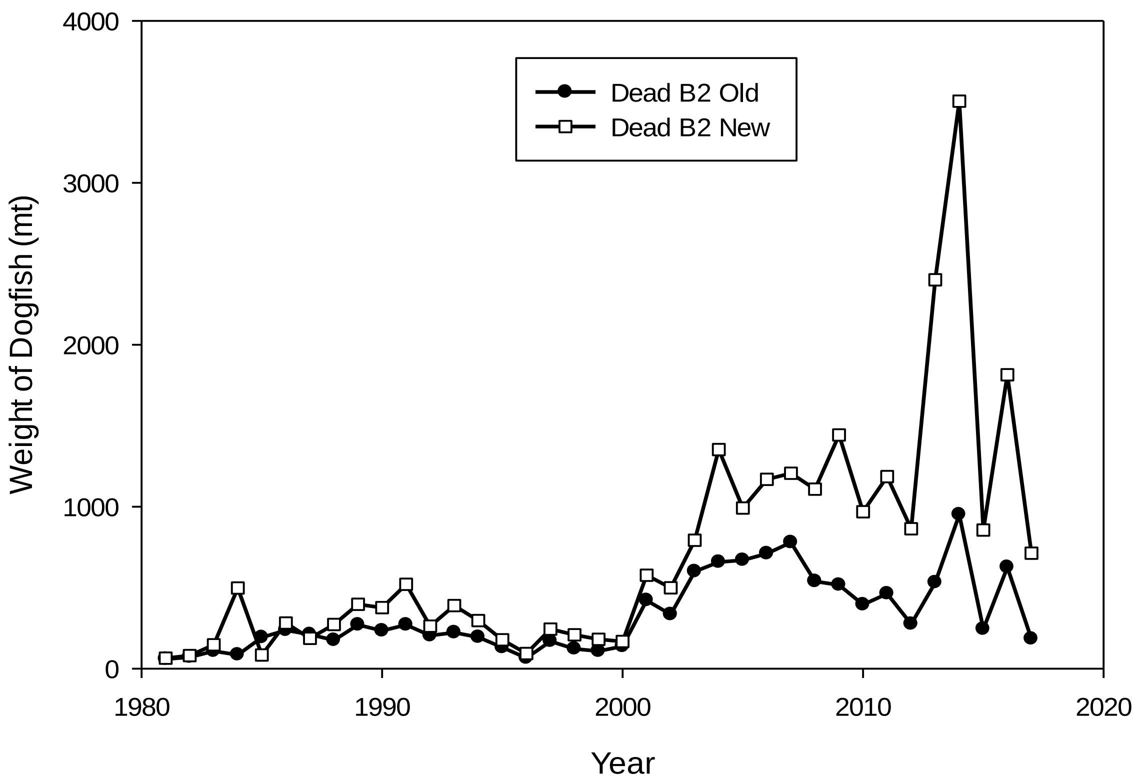


Figure 3. Comparison of old MRIP/MRFSS to new MRIP for discards with the top panel in numbers of fish and the lower panel in mt.

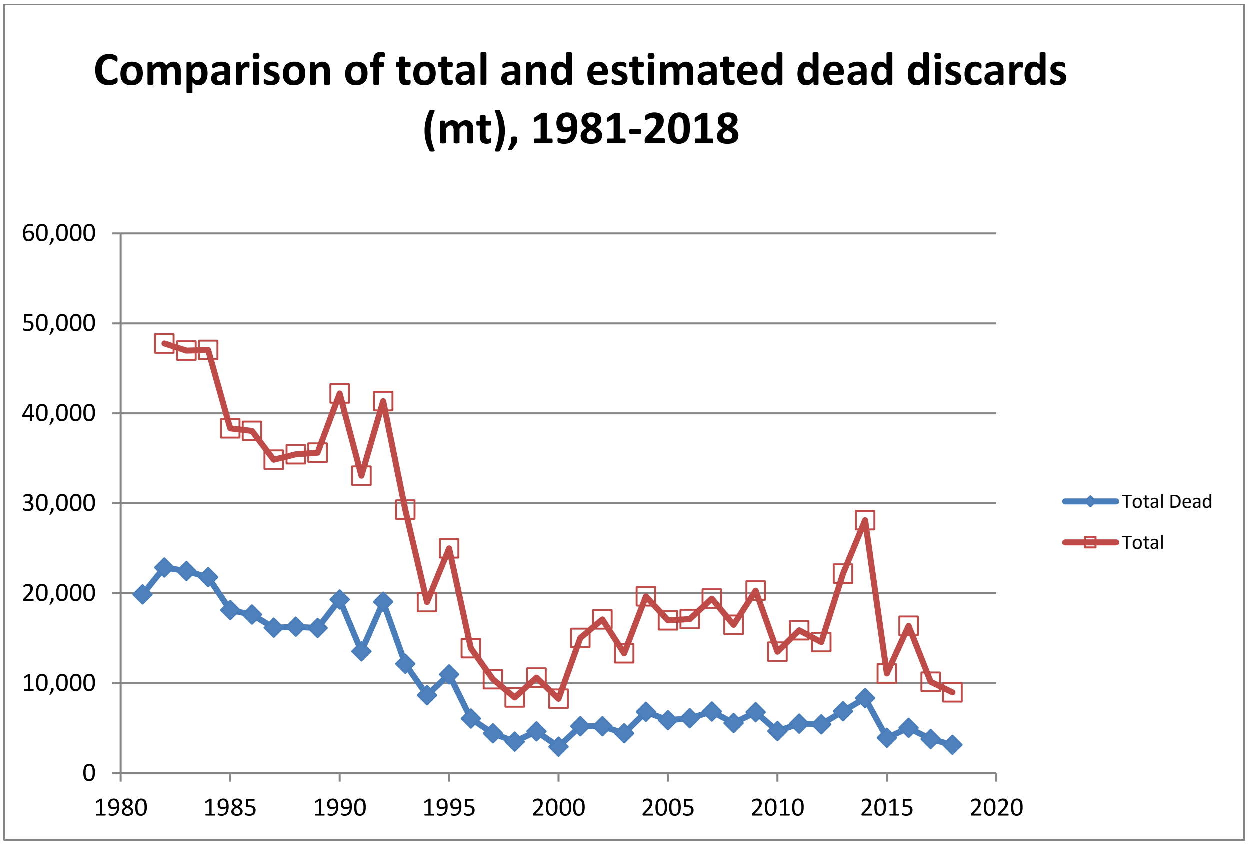


Figure 4. Estimated total and total dead discards in US, 1981-2018. Estimates for 1981 to 1989 are hindcast estimates rather than direct observations.

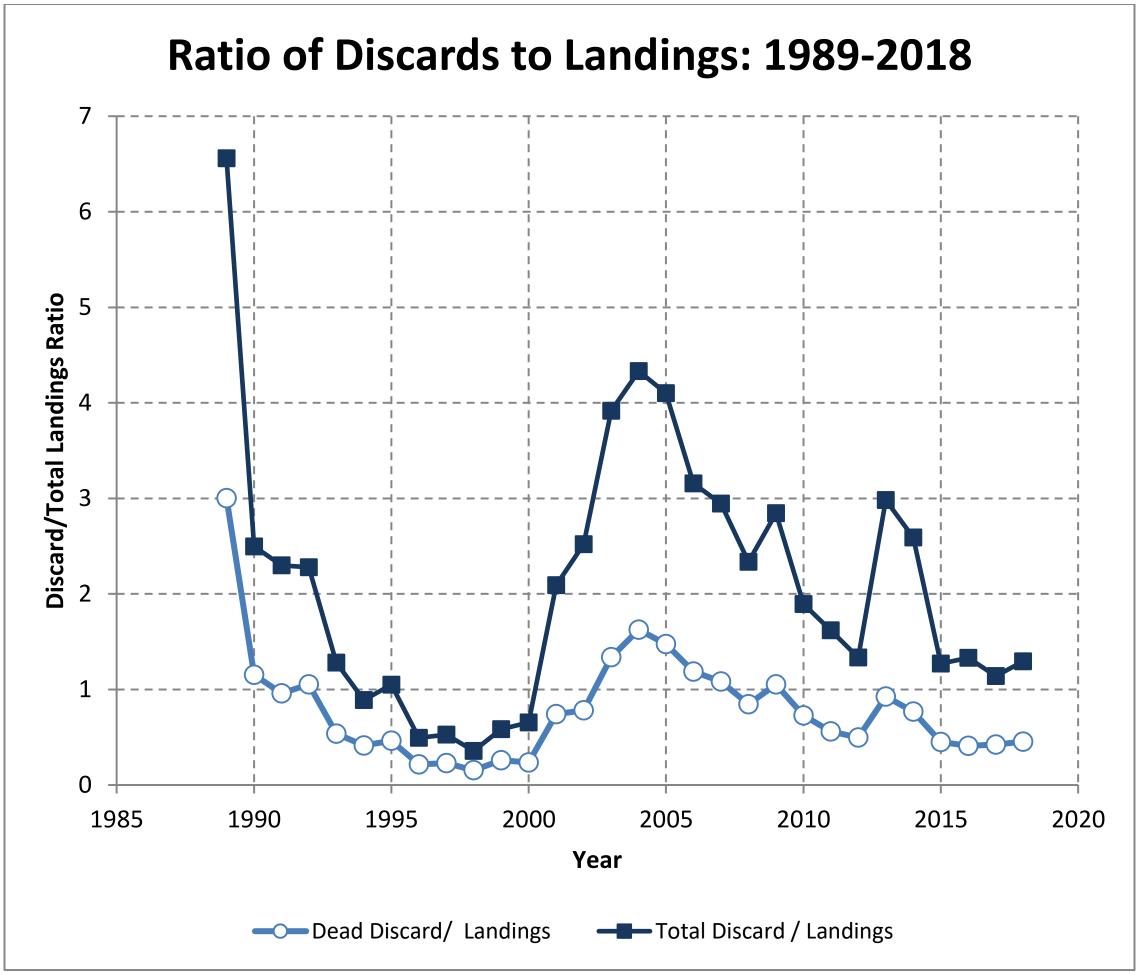
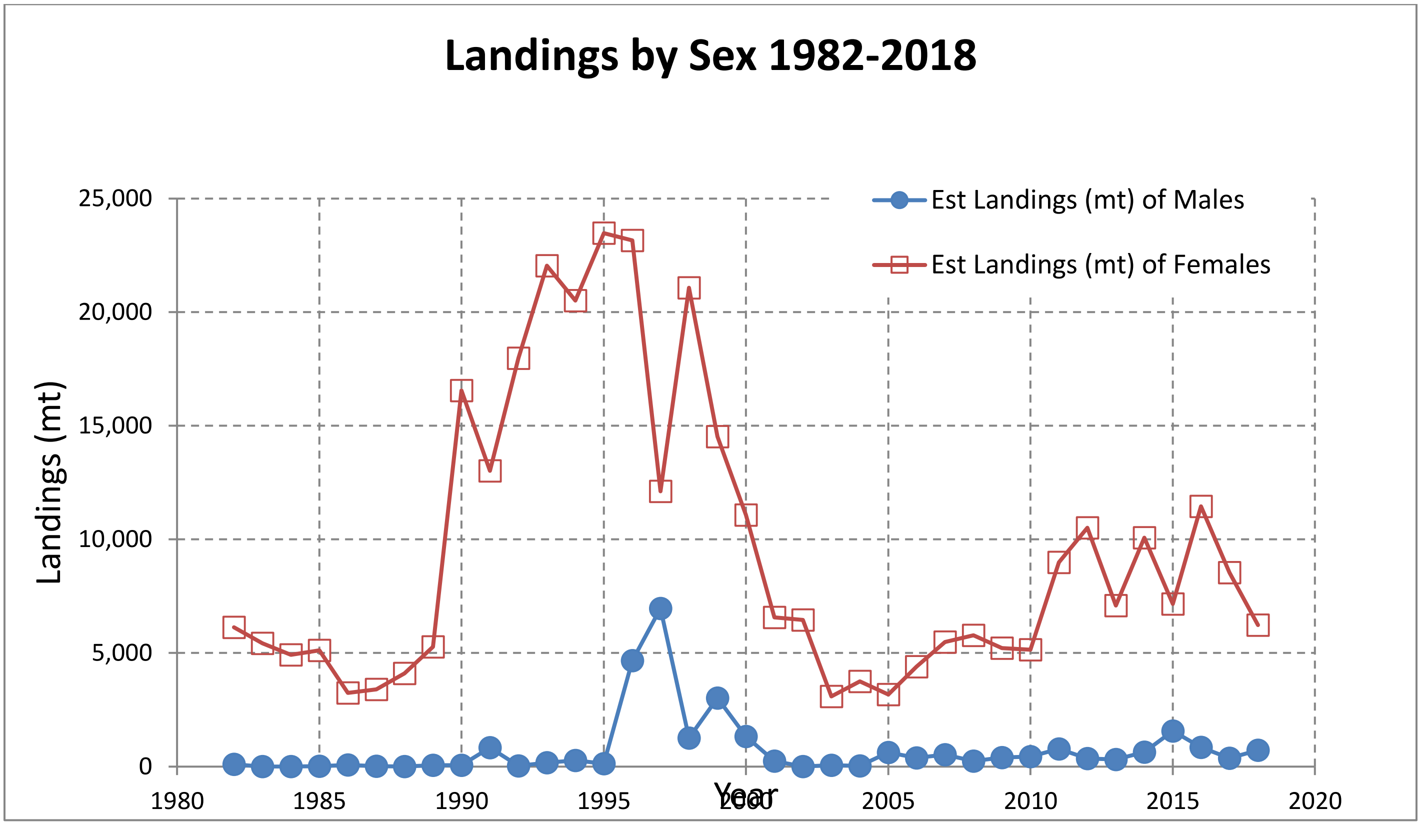


Figure 5. Trends in the ratio of total discards to landings and total dead discards to landings for spiny dogfish, 1989-2018.



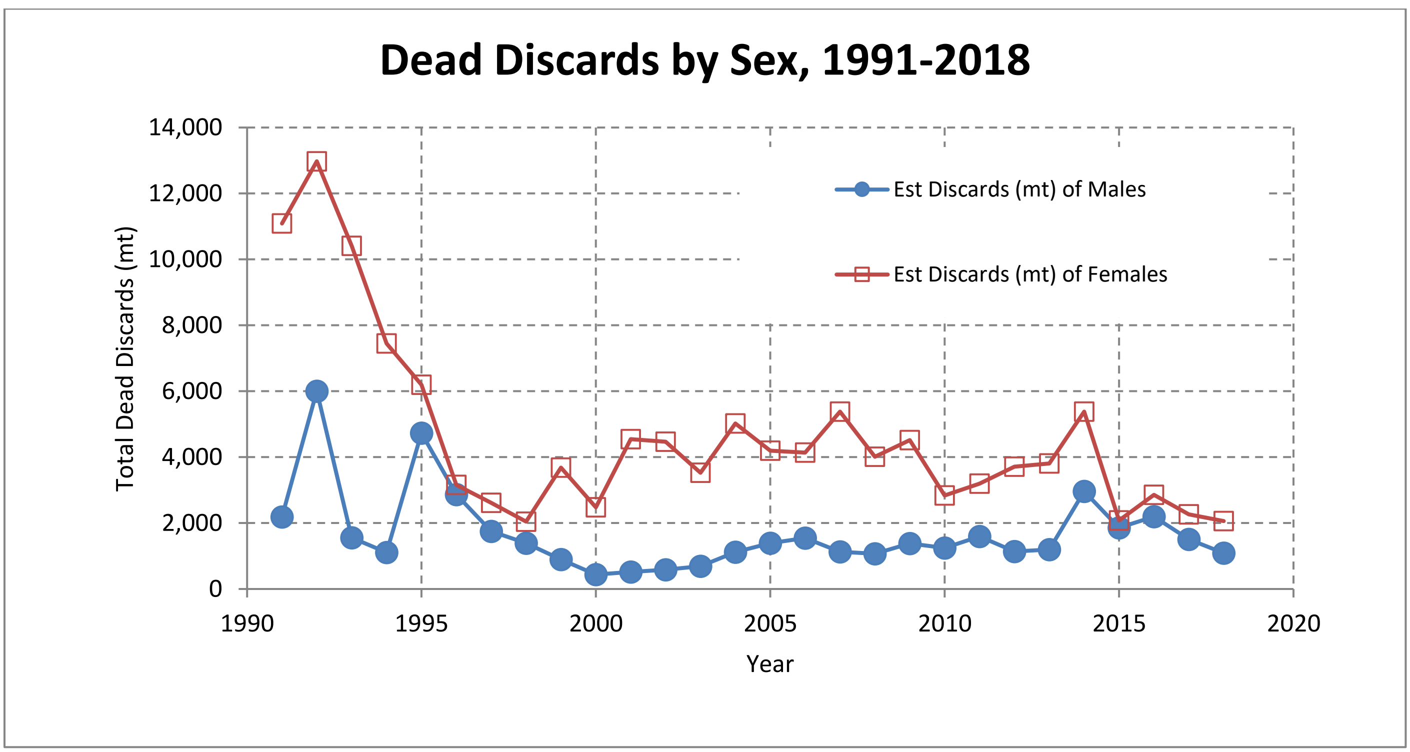


Figure 6. Estimated total landings, 1982-2018 (top) and total dead discards, 1991-2018 (bottom) in mt by sex.

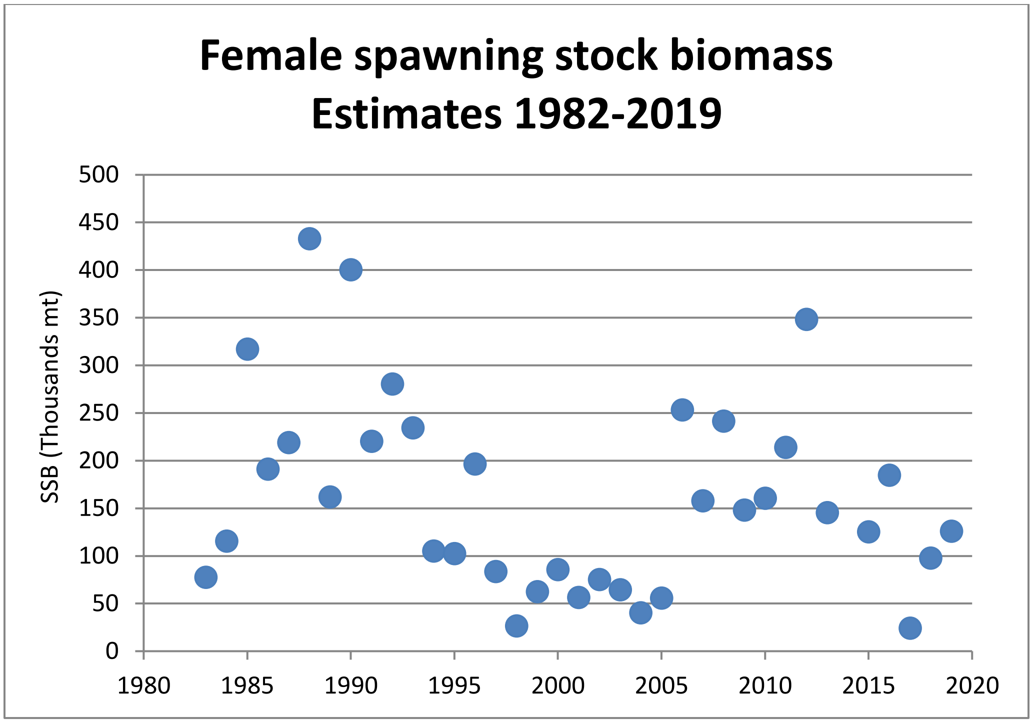


Figure 7. Swept area estimates of female mature biomass (>= 80 cm) from the NEFSC spring survey from 1980-2019.

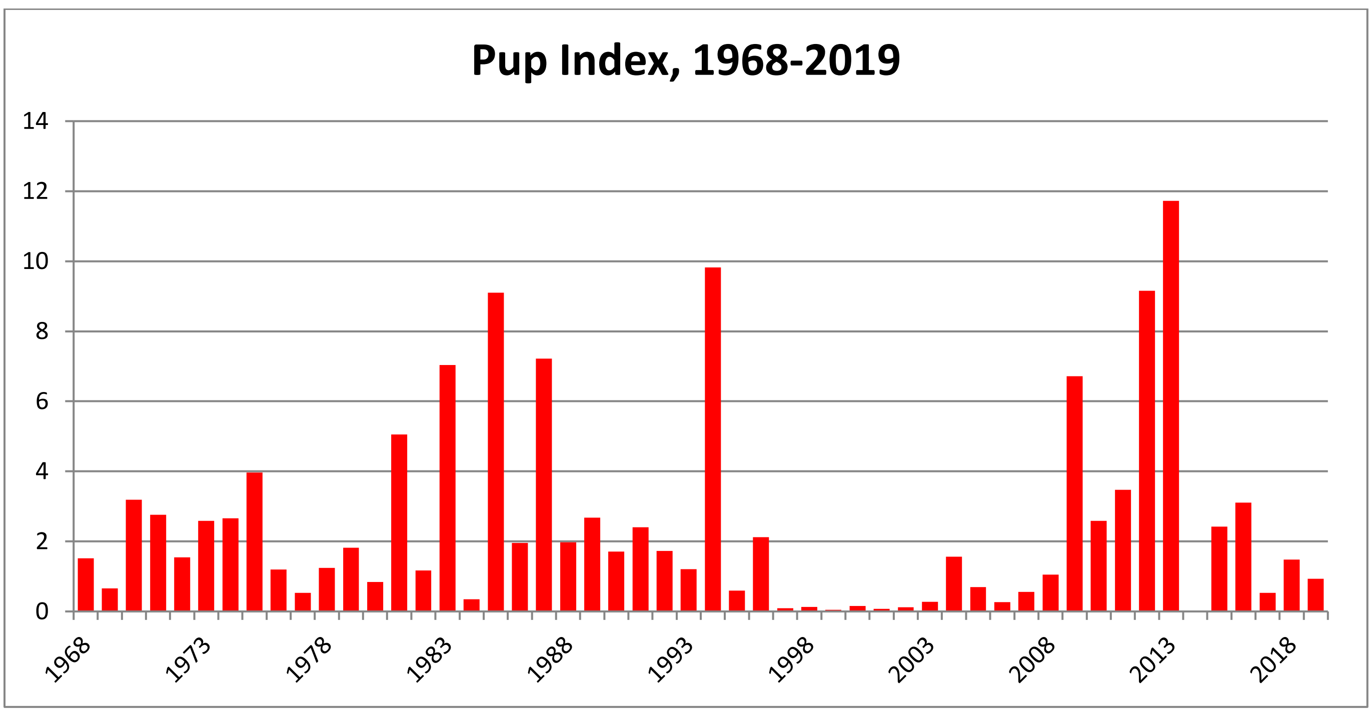


Figure 8. Estimated swept area biomass (mt) of total pups (spiny dogfish <=35 cm) captured in the NEFSC spring bottom trawl survey, 1968-2019. Survey was incomplete in 2014; no estimate available.

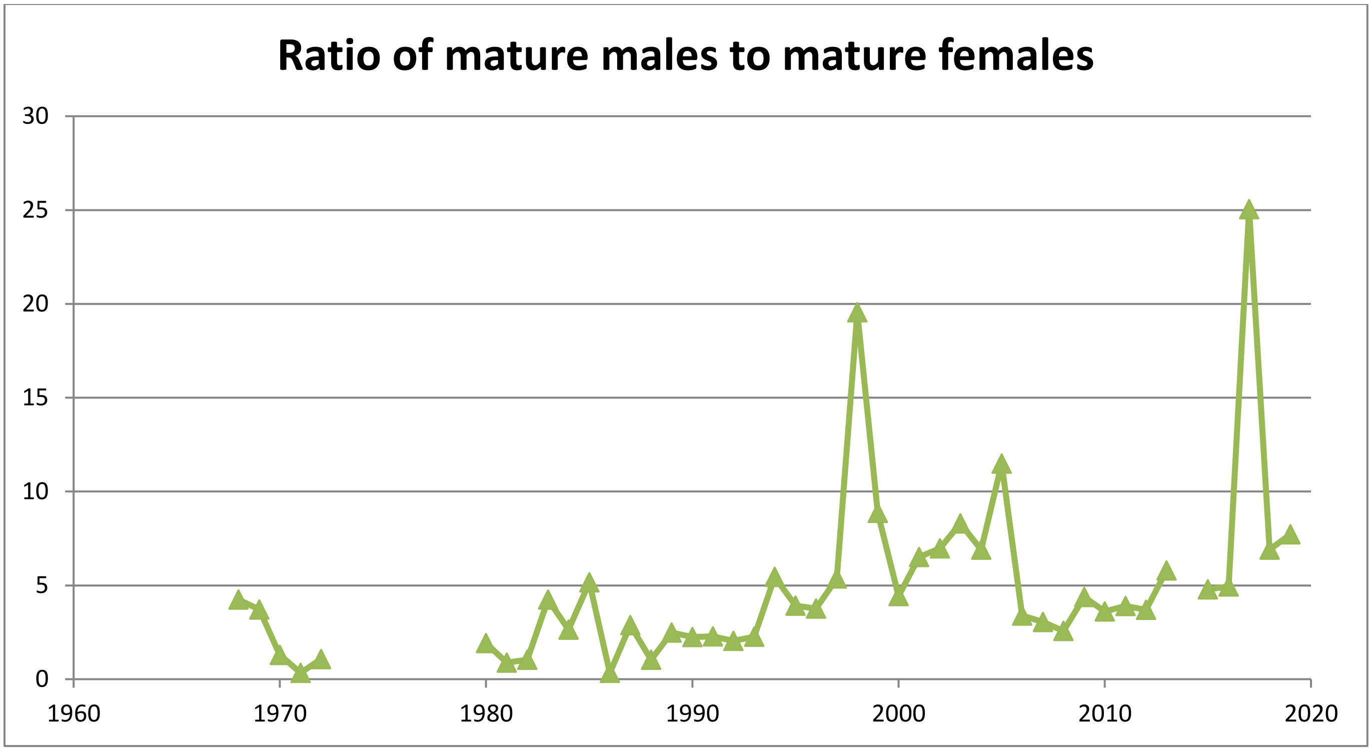


Figure 9. Annual ratios of mature males (>=60 cm) to mature females (>=80 cm) in NEFSC spring bottom trawl survey, 1968-1972, and 1980-2019. The 2014 survey was incomplete and no estimates were generated. Spiny dogfish sex was not recorded in the NEFSC database for 1973 to 1979.

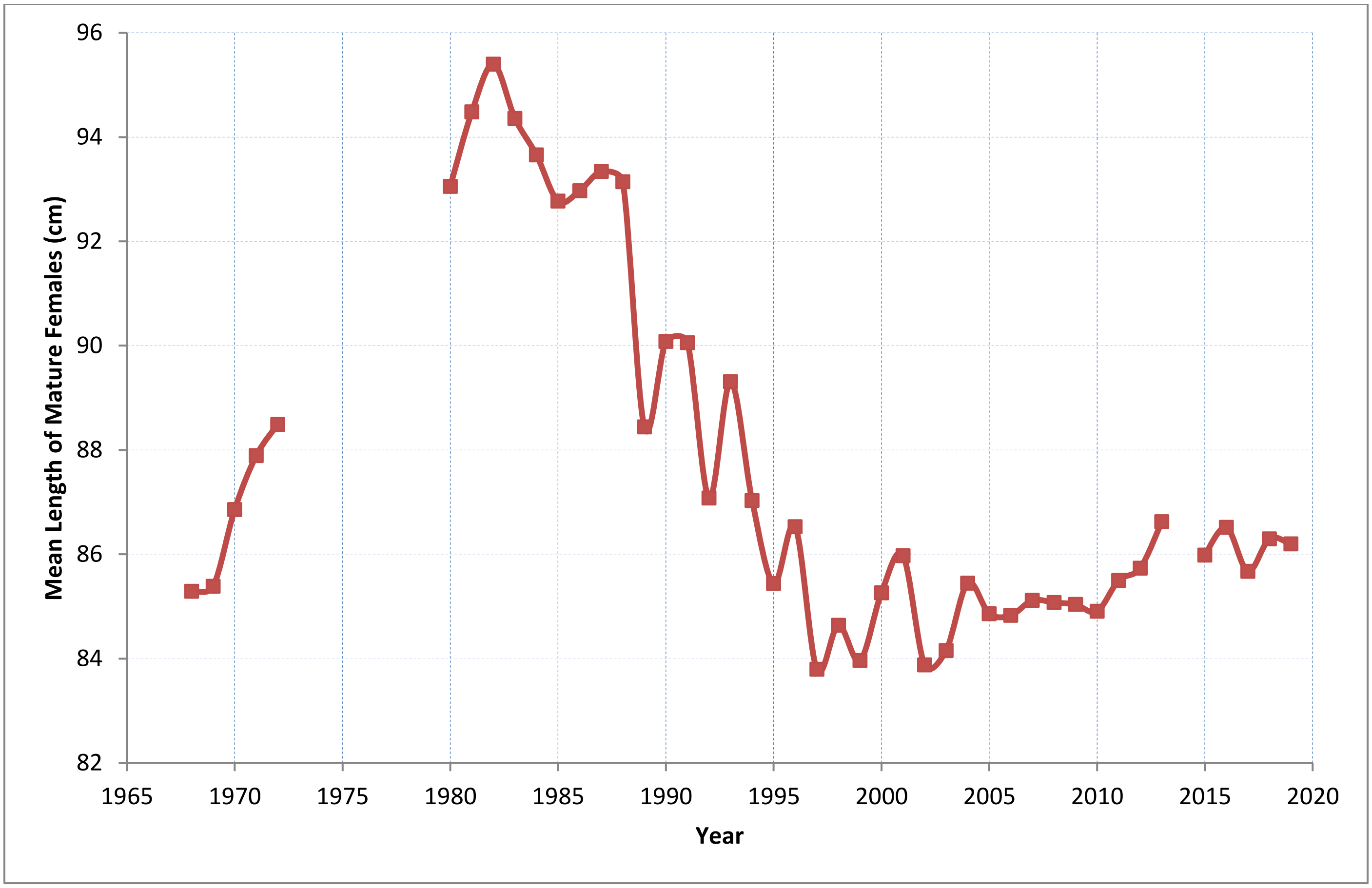


Figure 10. Mean Length of mature female spiny dogfish in NEFSC Spring bottom trawl survey, 1968-1972 and 1980-2019. Survey in 2014 was incomplete. Spiny dogfish sex was not recorded in the NEFSC database for 1973 to 1979.

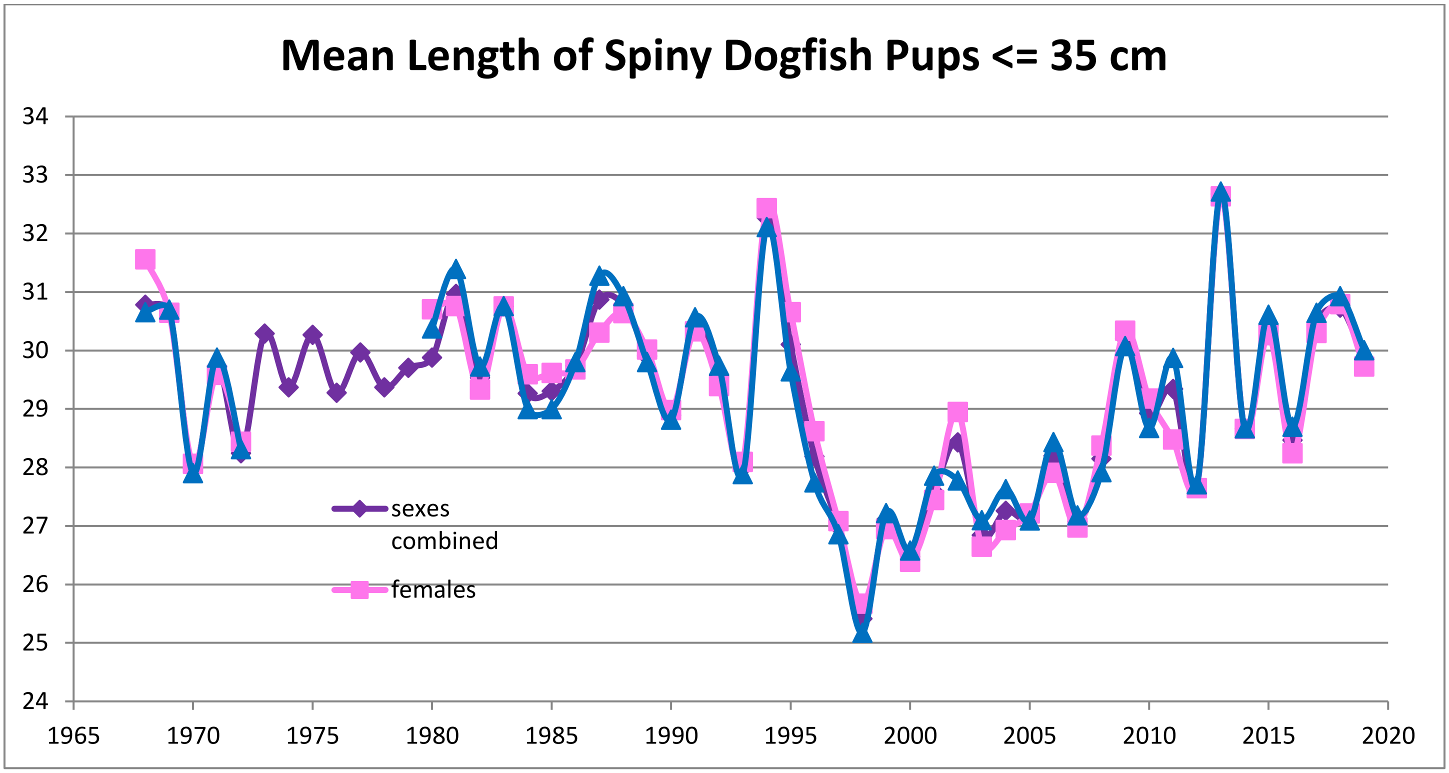


Figure 11. Mean length of male, female and sexes combined spiny dogfish pups (<=35 cm) in spring bottom trawl survey 1968-2019. Survey in 2014 was incomplete. Spiny dogfish sex was not recorded in the NEFSC database for 1973 to 1979.

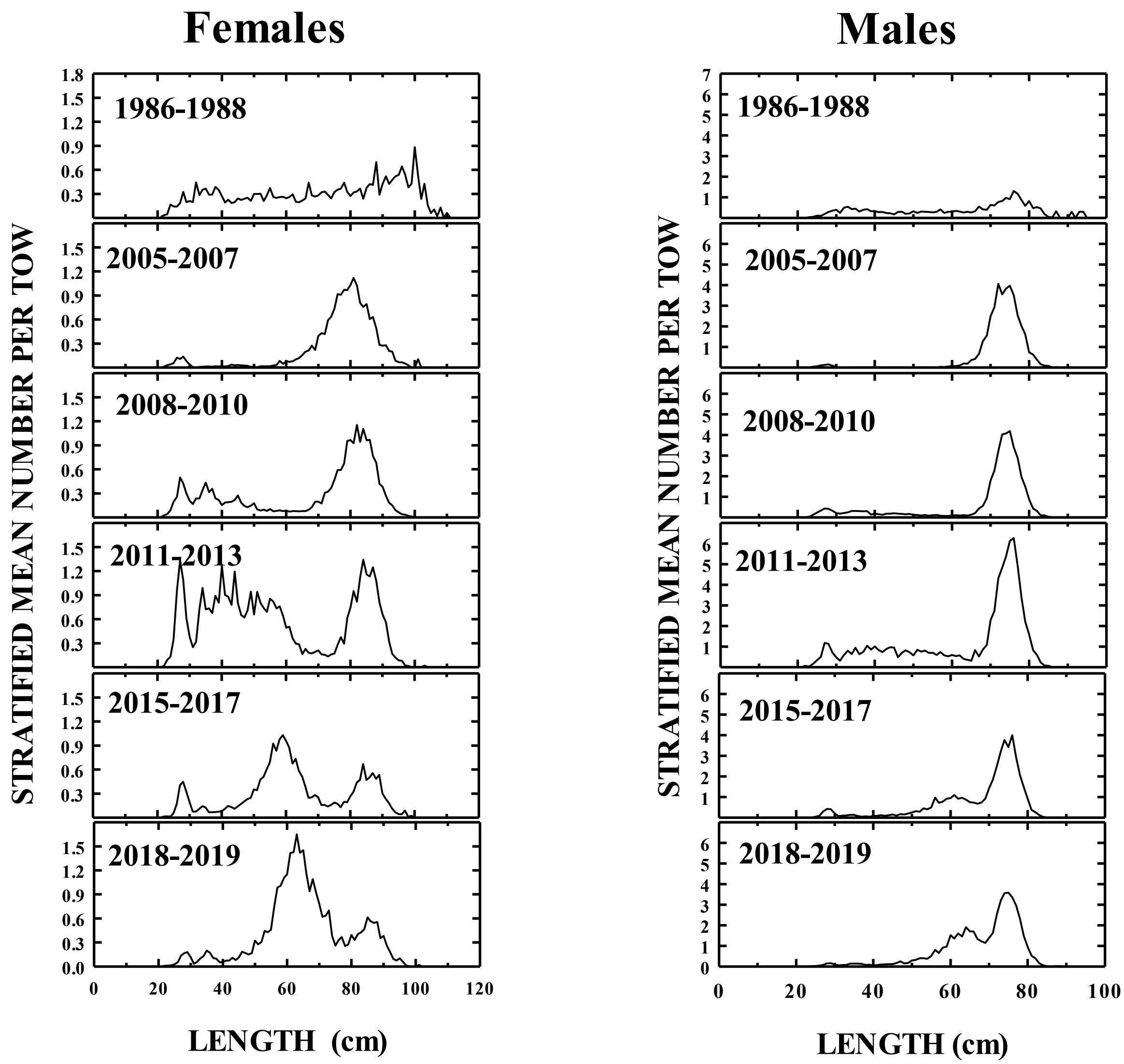


Figure 12. Composite size frequencies for female and male spiny dogfish in NEFSC spring bottom trawl survey. Survey was incomplete for 2014.

Appendix 1. Spatial Distribution of Commercial Landings

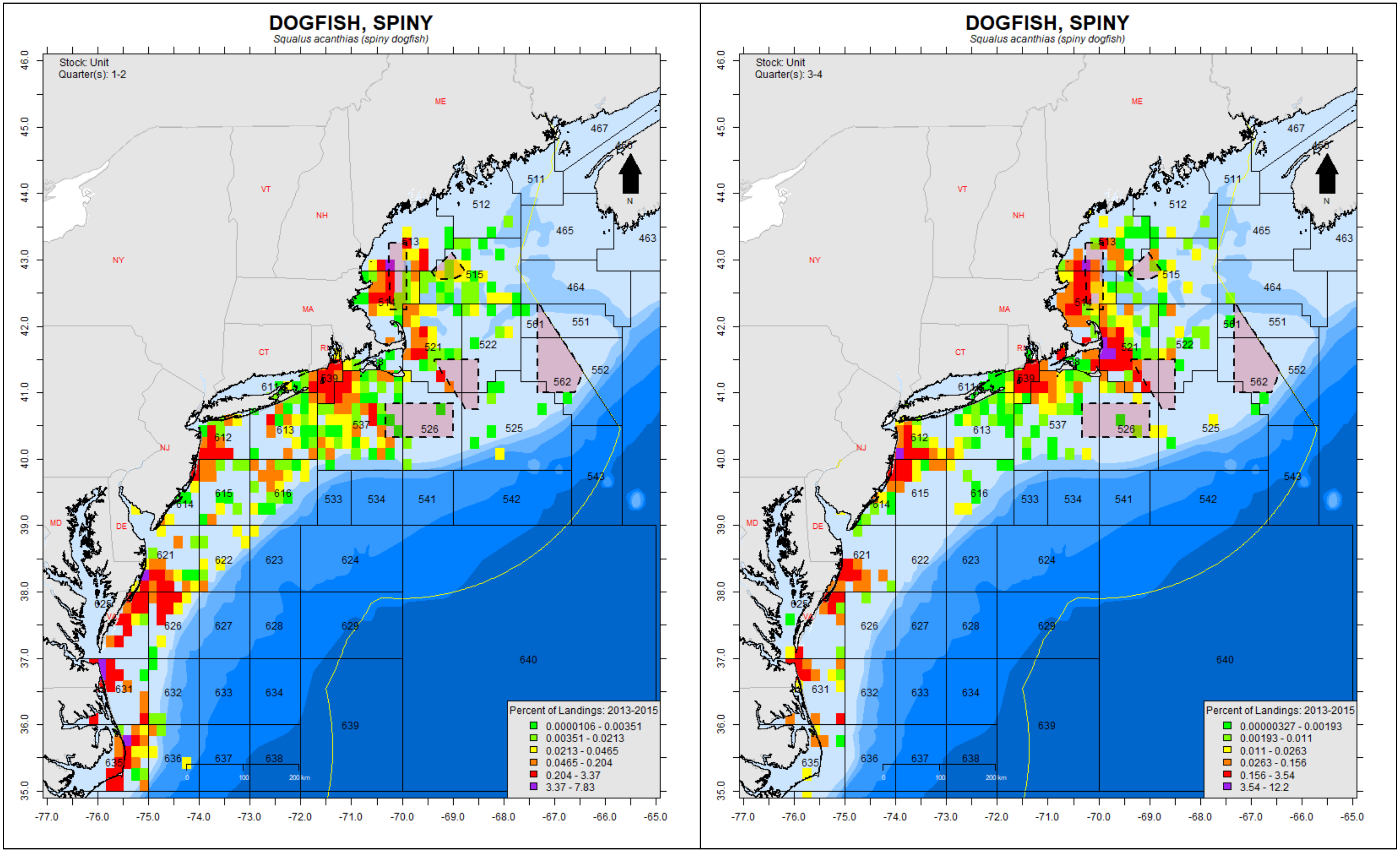


Fig 1. These maps represent commercial landings for DOGFISH, SPINY, *Squalus acanthias* from 2013-2015. Landings were reported via Dealer reports. Data have been restricted to dealer trips matched to a Vessel Trip Report (VTR) (ALEVEL=A) to ensure area information is as accurate as possible. Landings from quarters 1 and 2 are on the left (42.58% of total landings reported for these quarters) and landings from quarters 3 and 4 are in the right panel (78.57% of total landings reported for these quarters) Northeast Fisheries Science Center statistical areas are represented by numbered polygons and bathymetry is depicted in blue shading. Groundfish closed areas (dashed borders), and the Exclusive Economic Zone (yellow line) have been overlaid. Data queried on July 22, 2019.

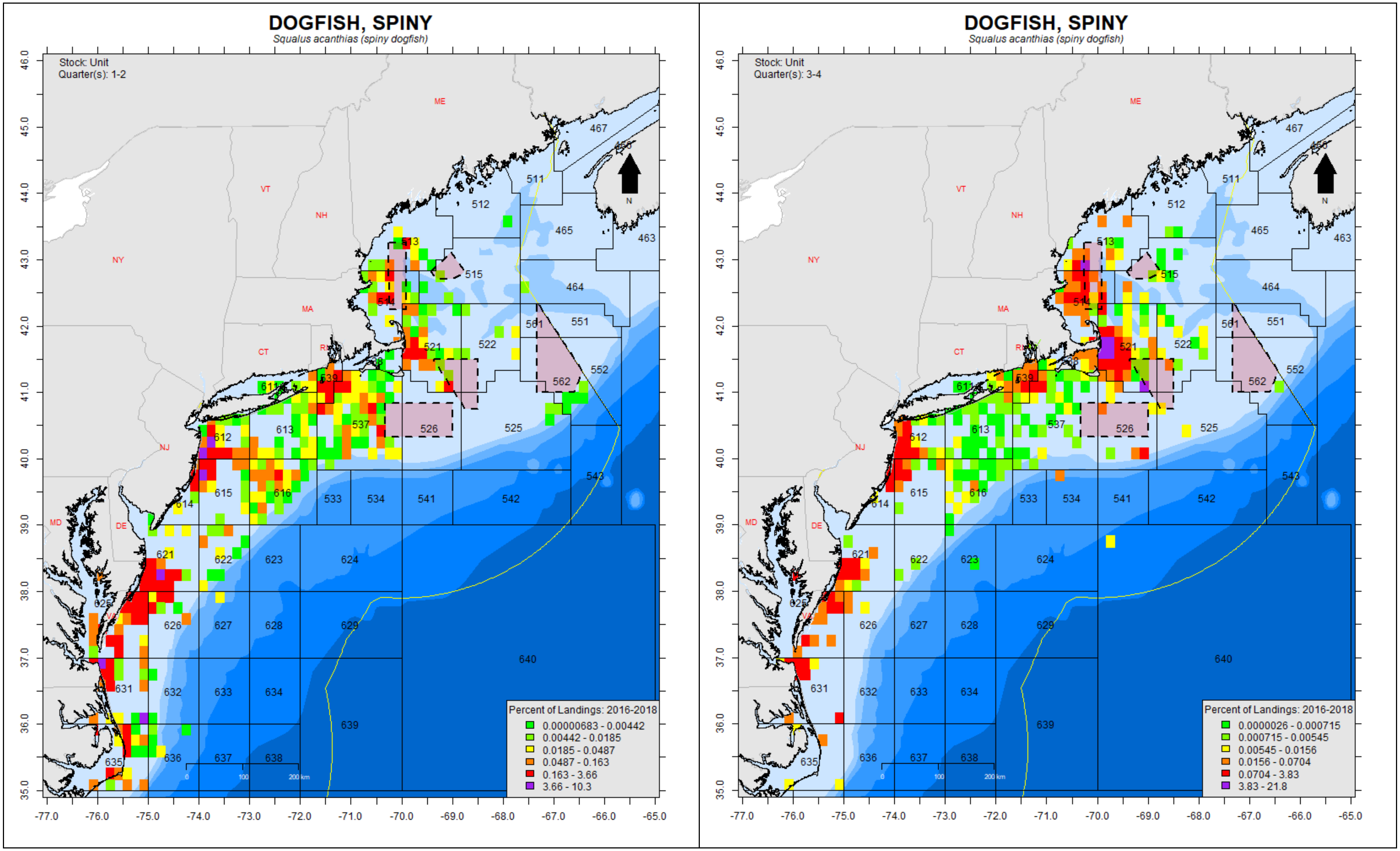
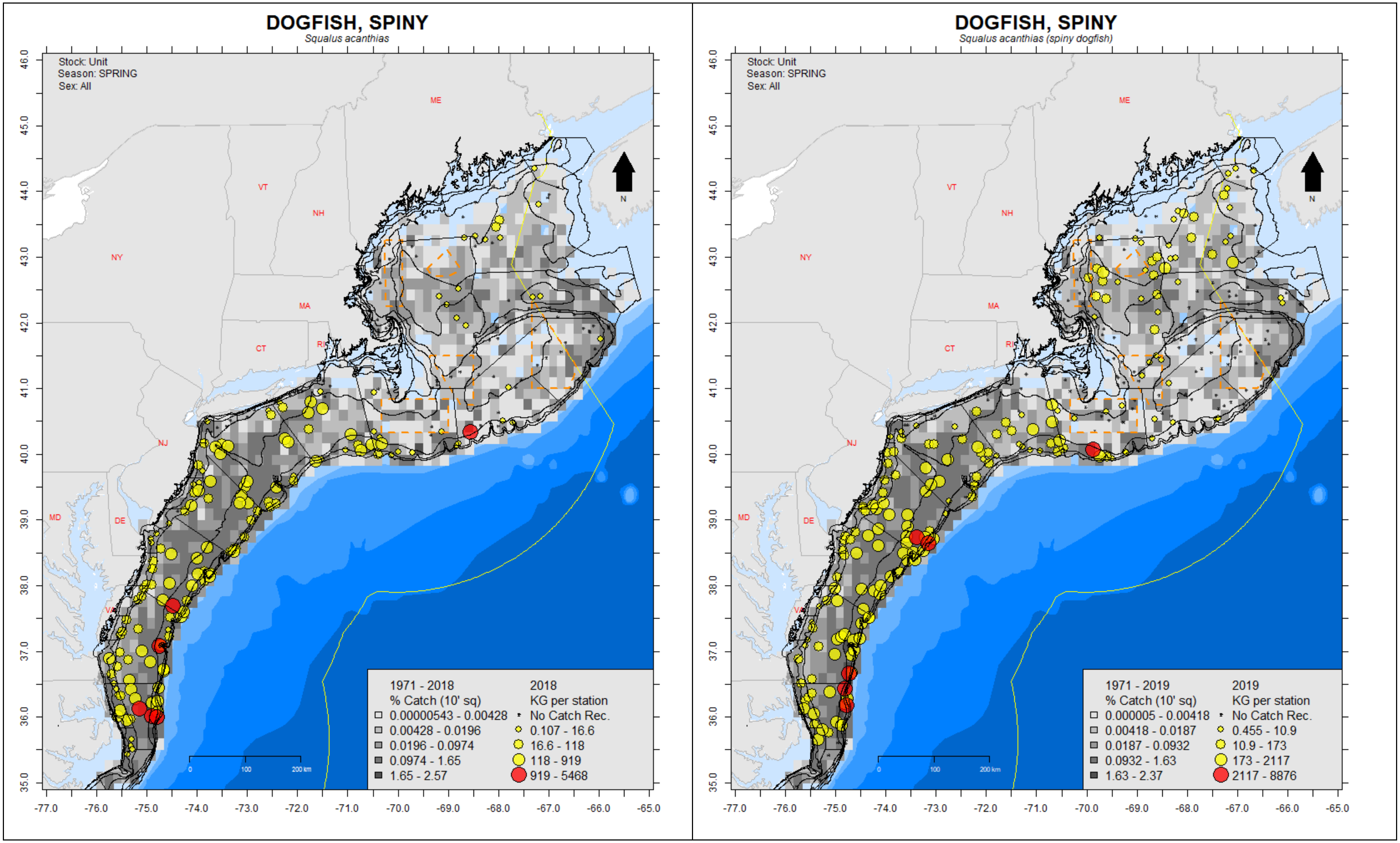
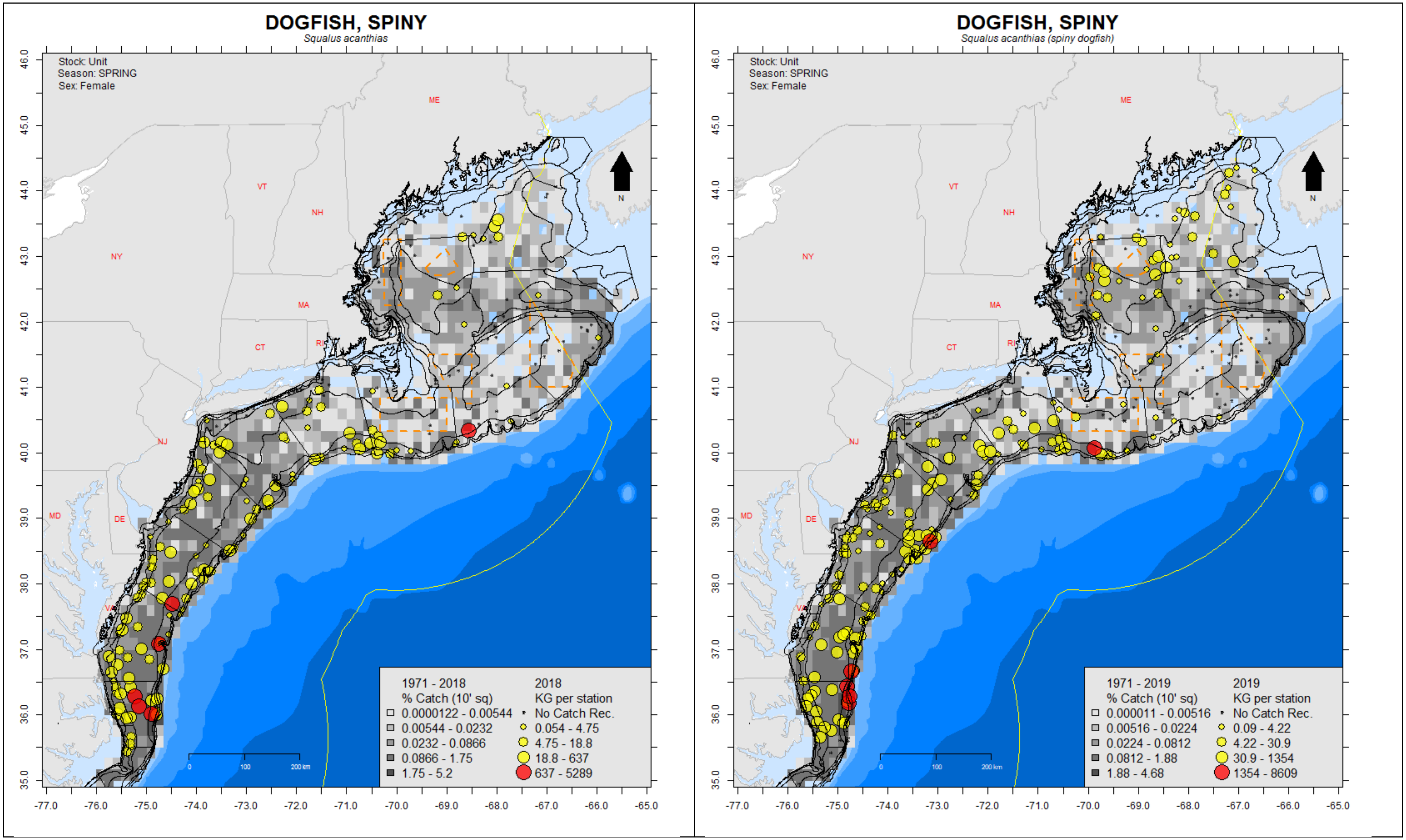


Fig 2. These maps represent commercial landings for DOGFISH, SPINY, *Squalus acanthias* from 2016-2018. Landings were reported via Dealer reports. Data have been restricted to dealer trips matched to a Vessel Trip Report (VTR) (ALEVEL=A) to ensure area information is as accurate as possible. Landings from quarters 1 and 2 are on the left (67.24% of total landings reported for these quarters) and landings from quarters 3 and 4 are in the right panel (85.78% of total landings reported for these quarters) Northeast Fisheries Science Center statistical areas are represented by numbered polygons and bathymetry is depicted in blue shading. Groundfish closed areas (dashed borders), and the Exclusive Economic Zone (yellow line) have been overlaid. Data queried on July22, 2019.

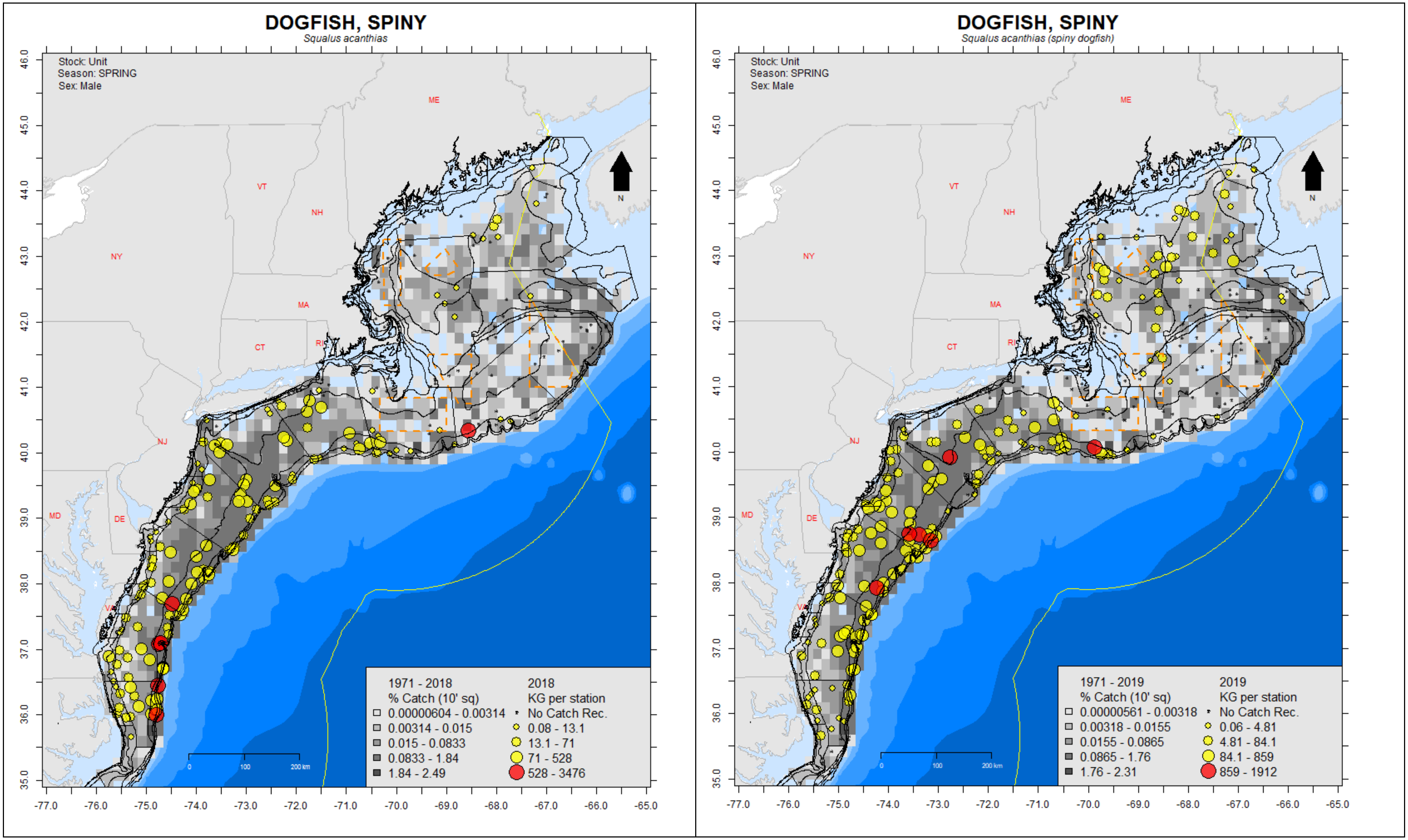
Appendix 2. Spatial Distribution of Survey Catches



These maps represent survey catches for DOGFISH, SPINY, *Squalus acanthias*. Catch includes both sexes. The shaded cells represent the percentage of catch per ten minute square for the spring NMFS NEFSC BOTTOM TRAWL SURVEY time series, from 1971 – 2018 (left panel)or 1971-2019 (right panel). The points represent catch weights for 2018 (left panel) and 2019 (right panel) of the spring NMFS NEFSC BOTTOM TRAWL SURVEY. The RED points show the locations of the 6 largest tows in the set. Weights have not been calibrated. Bathymetry is depicted in blue shading. Groundfish closed areas (dashed borders), and the Exclusive Economic Zone (yellow line) have been overlaid. Data queried on July 22, 2019.



These maps represent survey catches for DOGFISH, SPINY, *Squalus acanthias*. Only female catch is plotted. The shaded cells represent the percentage of catch per ten minute square for the spring NMFS NEFSC BOTTOM TRAWL SURVEY time series, from 1971 - 2018 (left panel)or 1971-2019 (right panel). The points represent catch weights for 2018 (left panel) and 2019 (right panel) of the spring NMFS NEFSC BOTTOM TRAWL SURVEY. The RED points show the locations of the 6 largest tows in the set. Weights have not been calibrated. Bathymetry is depicted in blue shading. Groundfish closed areas (dashed borders), and the Exclusive Economic Zone (yellow line) have been overlaid. Data queried on July 22, 2019.



These maps represent survey catches for DOGFISH, SPINY, *Squalus acanthias*. Only male catch is plotted. The shaded cells represent the percentage of catch per ten minute square for the spring NMFS NEFSC BOTTOM TRAWL SURVEY time series, from 1971 - 2018 (left panel)or 1971-2019 (right panel). The points represent catch weights for 2018 (left panel) and 2019 (right panel) of the spring NMFS NEFSC BOTTOM TRAWL SURVEY. The RED points show the locations of the 6 largest tows in the set. Weights have not been calibrated. Bathymetry is depicted in blue shading. Groundfish closed areas (dashed borders), and the Exclusive Economic Zone (yellow line) have been overlaid. Data queried on July 22, 2019

An Economic Analysis of Spiny Dogfish: Historical Trends, Future Markets, and Implications for Management Action

Prepared for:

Massachusetts Division of Marine Fisheries and its Seafood Marketing Program Steering Committee

Prepared by:

Joshua Wiersma, PhD[1]

Michael Carroll

2018

[1] Joshua Wiersma is an independent consultant, and Michael Carroll is Vice-President of The Vertex Companies. Josh.wiersma@gmail.com; mcarroll@vertexeng.com

Executive Summary

This analysis examines the history of global trade in spiny dogfish over the last 20 years to show changes in buyers and sellers, changes in price, the differences between key countries, and the differences between the frozen and fresh markets. To ground truth this data and expand upon the underlying market dynamics, we also present interviews of key dogfish stakeholders (processors and fishermen) to better understand determinants of price, constraints in the local supply chain (transportation, processing and harvesting), recommendations and advice for management, and directions for future work and market development.

Over the last 20 years, the US has become the major supplier of spiny dogfish to the EU; this includes both fresh and frozen supply, which are two separate markets. The US accounts over 90% of the global supply of dogfish, and the European Union represents over 90% of the global demand. The total exports of frozen dogfish have increased significantly since 2010, but total exports of fresh dogfish have been trending down since 2010, and now only represent about 25 percent of total sales (in 2001 fresh dogfish represented ~50% o total sales). Currently, the fresh dogfish market is supported primarily by two countries—France and Italy.

Prices of both fresh and frozen dogfish exports have been trending up over the last decade, with the price of fresh dogfish rising to an all time high in 2014-2016. Higher prices encourage more supply, but over supply of frozen dogfish in both 2011 and 2016 resulted in about 40% market correction 2012 and 2017. The ex-vessel price has remained relatively flat over the last 20 years, and has averaged around 18 -20 cents per lbs. Although spiny dogfish quota has significantly increased in recent years, according to interviewees, it is not the right time to increase trip limits. The net effect of increasing trip limits before new markets are created would be a dedicated effort by off-loaders and processors to slow fishing activity by telling boats they are not accepting fish on certain days, or significantly lowering ex-vessel price. The size of the market is currently constrained by the local processing capacity and the total maximum global demand, which was estimated at approximately 20 million lbs (whole fish).

Other changes to regulation, such as male only harvest for draggers were discussed, but would require significant upfront costs, management changes, and the development of entirely new markets to funnel supply. Regarding new markets, both fishermen and processor mentioned the interest in exploring government markets, such as prison systems or the military as potential outlets. Overall, there was more confidence that new markets would materialize here in the United States (as opposed to globally), given all the work that has been done marketing, promoting, and developing new value-added products with dogfish over the years. There might also be potential to improve existing fresh fish markets by changing to a weekly vessel limit over the course of the fresh fish season (Sept 1-April 30). This would allow vessels to increase harvests to coincide with the days that fresh fish is sold (Mondays and Fridays), and avoid days in the middle of the week when processors can't sell it, and instead, freeze it. It could also save operating and transportation costs for the vessel and off-loader if boats could catch more fish on fewer days.

INTRODUCTION:

This analysis is intended to inform the Massachusetts Division of Marine Fisheries and its Seafood Marketing Program Steering Committee about market trends and limitations affecting spiny dogfish fisheries. This information may be useful to DMF in its contributions to spiny dogfish management at the federal and interstate level. The Mid-Atlantic Council's Spiny Dogfish Advisory Panel (AP) annually addresses issues pertaining to overall quotas and daily trip limits.

This analysis concerns global market dynamics of Spiny dogfish over the last 20 years with focus on current markets and limitations. Specifically, we examine trends in export price and quantity (per lbs.) of both fresh and frozen dogfish products over time, discuss the relationship and differences between countries, evaluate the potential to recover lost markets or create new ones, and explain how management changes and changes in consumer preferences have impacted global trends. We use this information to draw conclusions about the maximum sustainable size of the global dogfish (export) market, and to make recommendations for future growth.

In addition to this analysis, we also interviewed key fishermen and processors of dogfish in New England[2] to better understand important questions raised by the Dogfish AP and the MAFMC over the last few years[3], and to update the characterization of fishing communities involved in the spiny dogfish fishery. We were particularly interested in factors that influence prices and catch rates; the relationship between different regions (e.g. the seasonality of catch); the potential benefits and costs of proposed regulations (e.g. changes in trip limits, or male only harvest); the flow of product within the domestic supply chain (from vessel to truck to processor); the constraints and costs of processing; ways to increase domestic consumption and improve value added activities; and ideas for different research or management changes.

ANALYSIS OF GLOBAL CATCH AND TRADE IN SPINY DOGFISH

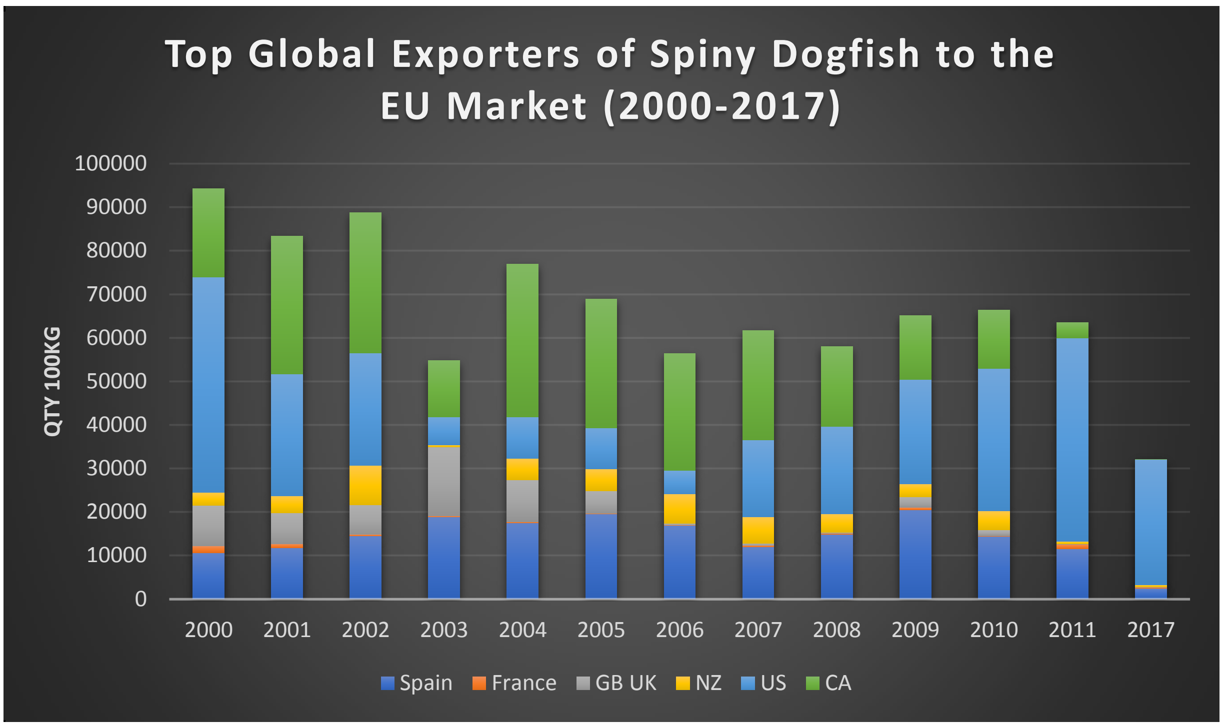
The main catches of spiny dogfish have historically been in the Northeast Atlantic and the Northwest Atlantic. Between 1950 and 1972, catch from the Northeast Atlantic (Norway, France, UK, Iceland) accounted for between 97 and 100% of the global reported catch (with a peak of 50,000 mt in 1972). Since that time the region's share has dramatically declined, especially over the last 20 years. By 2005, catch from that stock accounted for only 39% of the global catch, and by 2010 it accounted for just 7% of the global catch. Decades of overfishing in the Northeast Atlantic had reduced the spiny dogfish biomass by 95%[4], and eventually in 2011, the EU Council followed the advice of the EU Commission and ended fishing completely for dogfish in the Northeast Atlantic (Council Regulation 57/11)[5].

---

[2] Interviewees Included: Fishermen Doug Feeney; Fishermen; Fishermen Jamie Hayward; Processor Red's Best; Primary Processor Marder Trawling Inc.; Primary Processor Seatrade International; Secondary Processor Highliner.
[3]2017 Spiny Dogfish Advisory Panel (AP) Fishery Performance Report (FPR)
https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/59a6eb60893fc02cee00ad2c/1504111457029/2017-Dogfish-FPR.pdf
[4] Lack, Mary 2006. CONSERVATION OF SPINY DOGFISH SQUALUS ACANTHIAS: A ROLE FOR CITES?
https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/FINAL_Spiny_Dogfish_ImplementationRepDez06.pdf
[5] Dell'Appa, A., J. Johnson, D. Kimmel., R. Rulifson. 2013. The international trade and fishery management of spiny dogfish: A social network analysis. Journal of Ocean and Coastal Management. (80)
https://www.researchgate.net/publication/267896648_International_Trade_in_Spiny_Dogfish_A_Network_Analysis_for_the_Fishery_Management

However, 95% of the global consumer market for spiny dogfish is in the EU. So, the decline of the European stocks meant opportunity for other regions to the fill that void. In the 1990's, the United States stepped up to the plate, and rapidly expanded its domestic fishery. However, it didn't take long for the Northwest Atlantic stock of Spiny Dogfish to also become overfished. With the decline of more traditional groundfish resources in the late 80s and early 90s, the directed fishing for dogfish resulted in a nearly ten-fold increase in landings from 1987-2001. This led to a 75% decline in female spawning stock biomass, which prompted the Mid-Atlantic and New England Fishery Management Councils (Councils) to develop a fisheries management plan (FMP) for the species. With the FMP in place by 2002 (which included total allowable catch and strict trip limits), total US catch (and export) of Spiny Dogfish declined by 75% from 2000-2003.

Figure 1. Top Global Exporters of Spiny Dogfish (2000-2017)



(http://epp.eurostat.ec.europa.eu/newxtweb/)

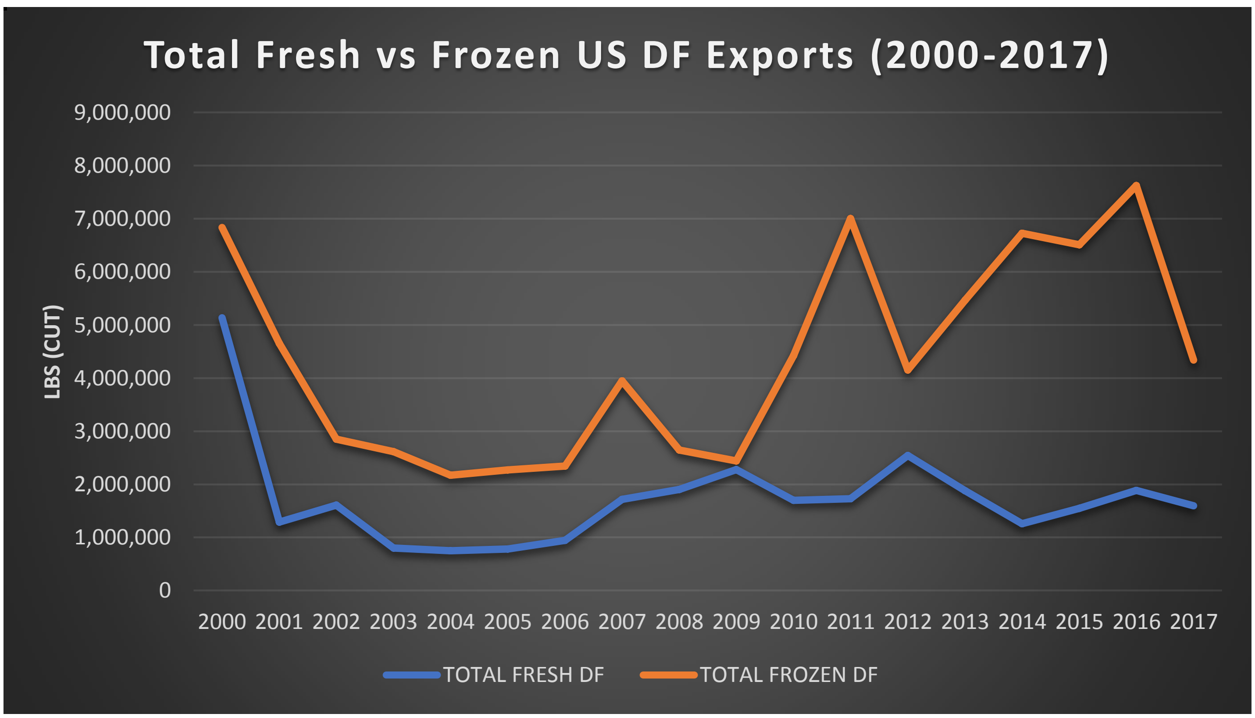
As **Figure 1** shows, between 2000-2002, the United States and Canada accounted for about 75% of all global exports to the EU. However, in 2003 when the FMP was put in place, US exports dropped by about 75% for the next five years, which once again provided opportunities for other countries to develop their fisheries. New countries increased their importance as exporters; particularly Canada and New Zealand. Also, amongst the EU27 countries, Spain became a central importer and exporter toward other west European countries (e.g. Portugal, Italy, France, and Greece) and several east European countries (e.g. Czech Republic, Poland, Bulgaria, and Slovenia). By 2010, the Northwest Atlantic spiny dogfish stock had fully recovered, and the United States regained control of most of the EU market. By 2017, the United States accounted for more than 90% of total global exports to the EU.

Market

Spiny dogfish product is known to be traded as fresh and frozen meat, including fillets; as tails; in smoked form; as fins; and as several by-products including cartilage and livers (or liver oil), hides, teeth and jaws. The 'back' represents the main body of the fish accounting for 28-30% of the total live body weight. Backs are exported for ultimate sale as fillets and steaks and for use in the fish and chips trade. 'Belly flaps' are produced during the dressing of the fish and are individually skinned and washed prior to freezing. The belly flap accounts for an additional 7% of the live weight (Personal Communication).

In the USA, the belly flaps are cut out, the fins removed, and the body is skinned leaving a white carcass or 'back' which is generally exported to Europe, particularly: France, Germany, Belgium, the UK, and Italy. Belly flaps are exported solely to Germany where they are smoked and used to prepare 'Schillerlocken'. Fins are frozen and exported to primarily to Thailand, where they are re-processed and re-distributed into the broader Asian market.

Figure 2. Total Fresh and Frozen US Spiny Dogfish Exports (2000-2017)



https://www.st.nmfs.noaa.gov/pls/webpls/FT_HELP.SPECIES

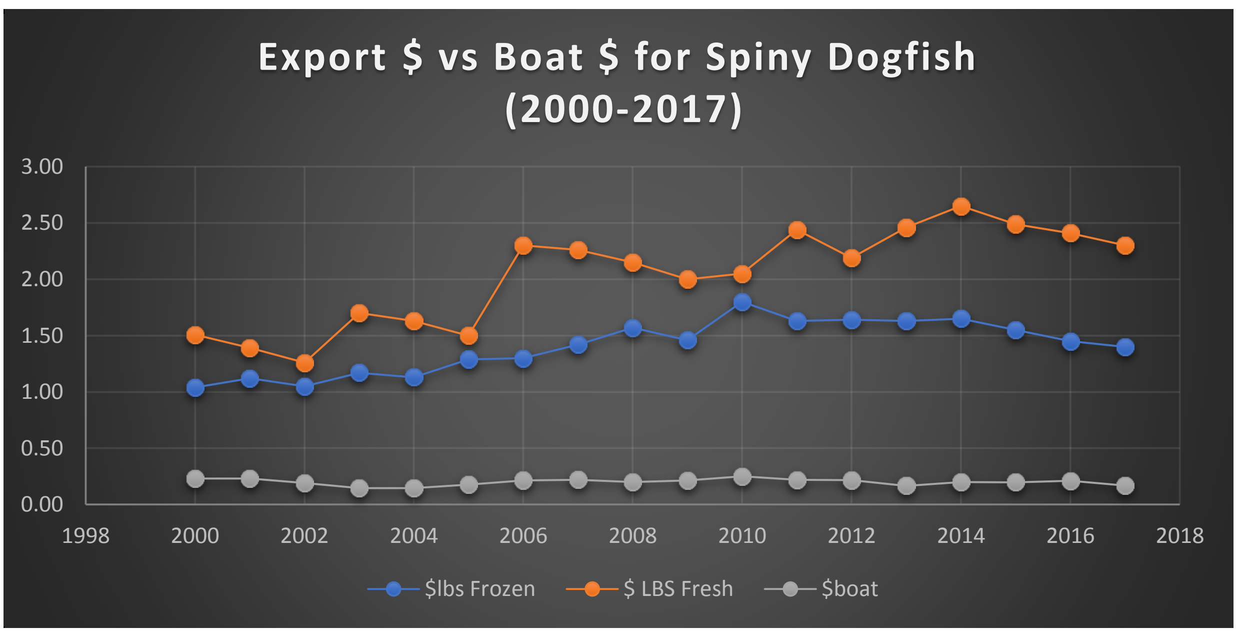
Figure 2 shows the relationship between the fresh and frozen spiny dogfish market over the last 17 years and illustrates the long-term trends in supply. As noted, US exports dropped considerably between 2000 and 2002 after the implementation of the FMP, and both frozen and fresh exports remained low until 2009. Up until this point, there also seemed to be a strong positive relationship between fresh and frozen supply, as they followed very similar trend lines. After 2009, the paths diverge considerably, and we start to see a significant increase in frozen dogfish exports. By 2016, the frozen exports were at their highest point in the last 20 years.

Meanwhile, fresh product showed a slight decline over this same period, and on average represented just 25% of the total dogfish export market (prior to 2009, the fresh market represented 50% or more of the total dogfish export each year). In 2012, we see a sharp decline in the fresh dogfish exports, which coincides with the EU concerns at that time about elevated PCB levels. However, this only seemed to impact the fresh market, as the frozen market increased sharply from 2012 all the way up until 2016, when it also crashed.

In the decade prior to 2016, the average export price (the price consumers are willing to pay) for frozen and fresh dogfish were both trending upwards. Over that same time, the total exports of frozen dogfish also increased sharply to take advantage of the higher price points (demand). Then, in 2016, the trip limit for dogfish increased to 6,000 lbs. per day, and according to processors and fishermen interviewed for this study, the domestic inventory became flooded with product (much of it ended up frozen), and the market crashed.

The quantity of US frozen dogfish exports fell by almost 40% from 2016 to 2017, and the export price of both fresh and frozen dogfish also declined. Together, the total US exports in 2016 was roughly 9.5 million lbs. of cut weight (at roughly 32% yield, this equates to about 28 million lbs. of whole dogfish quota). The consensus of both processors and fishermen interviewed for this analysis is that (for now) the global market for spiny dogfish can't support much more than 18-22 million lbs. of total catch (between 6-7 million lbs. of cut weight—backs, bellies and fins).

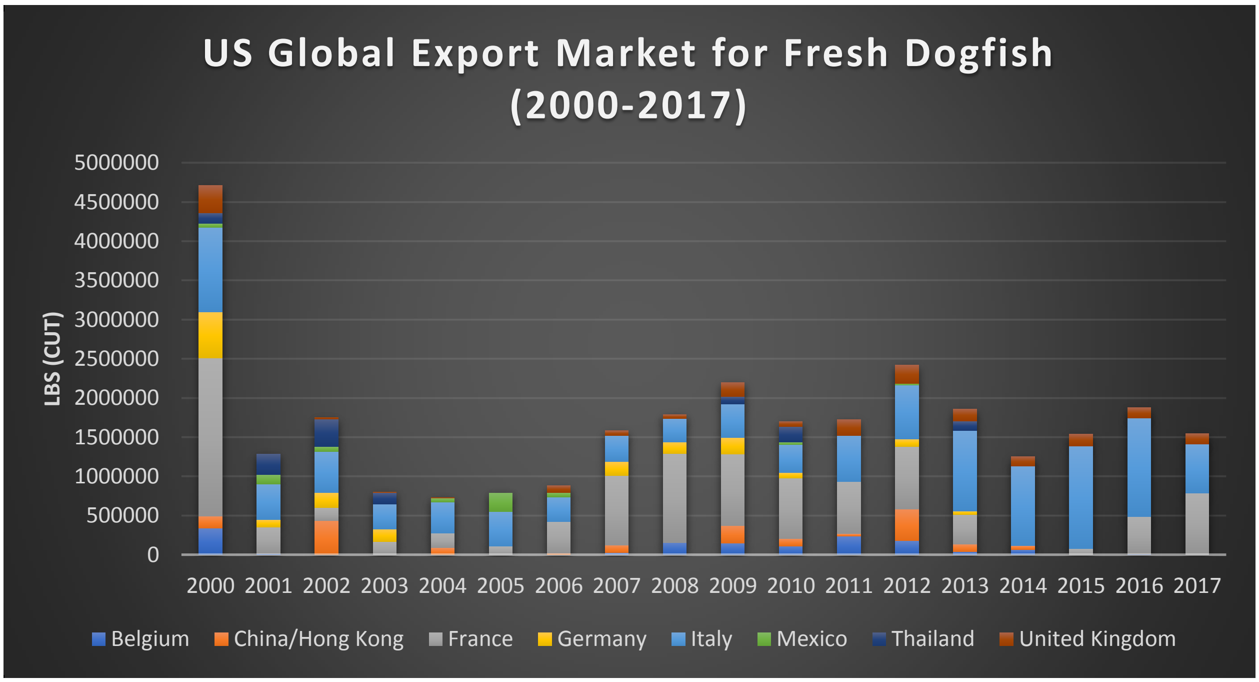
Figure 3. Export $ for Fresh and Frozen Dogfish (2000-2017)



http://epp.eurostat.ec.europa.eu/newxtweb/;https://www.st.nmfs.noaa.gov/pls/webpls/FT_HELP.SPECIES

According to **Figure 3**, the average export price for both fresh and frozen dogfish has been trending up over the last 20 years. Two separate markets exist for fresh and frozen product, and the graph shows that on average, since 2010, the price for fresh dogfish is increasing and is about 40% higher than that of frozen dogfish. But, even as the fresh price has been increasing, the total exports of fresh dogfish have fallen over this time. We would expect that higher prices would lead to increase production of fresh dogfish, but total exports (of fresh) have been trending down over the last 10 years even as prices have been trending up. Given the increases in quota and trip limits over the last ten years, it doesn't seem likely that significant constraints exist on the harvest of fresh dogfish. What's more likely is that the number of countries importing fresh dogfish has dropped. Countries who continue to buy fresh dogfish might be paying a little more for it, but by themselves, they can't make up for the loss of sales to other fresh dogfish markets.

Figure 4. US Global Export Market for Fresh Dogfish (2000-2017)

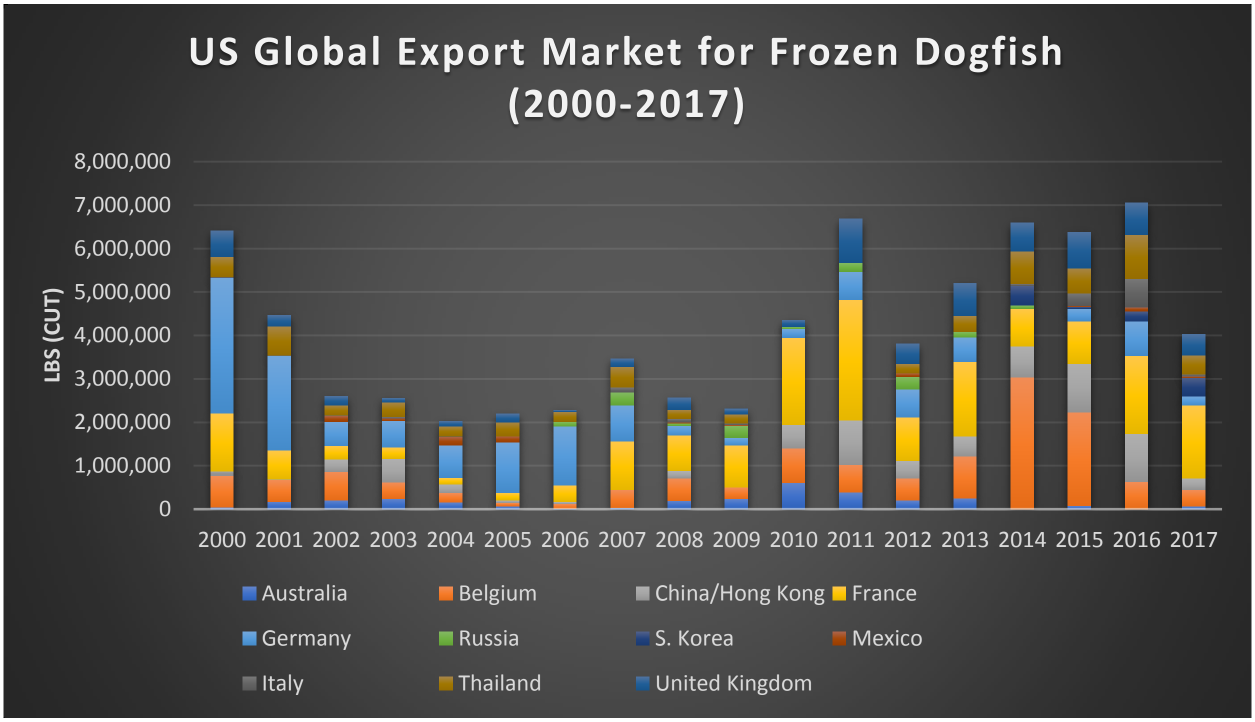


https://www.st.nmfs.noaa.gov/pls/webpls/FT_HELP.SPECIES

Figure 4 shows the change in the total US export market for fresh dogfish over the last 17 years. In 2000, prior to the implementation of the FMP, the fresh market for dogfish was about twice as high as it has been since then. In addition, in 2000, eight different countries purchased significant amounts of fresh dogfish. Exports slowed considerably between 2003-2008 while the fishery was rebuilding, but between 2009-2013, exports began to increase along with the diversity of the fresh fish market. However, ever since 2013, the diversity of the fresh dogfish market declined dramatically, and is now supported almost entirely by two countries: France and Italy (and to a much lesser extent, the UK).

It is unclear why the diversity of global buyers fell off so sharply, but again, the timing does coincide with the EU concerns about PCB in dogfish. In 2014 and 2015, France stopped purchasing fresh dogfish almost completely, and it was basically just Italy who supported the entire fresh market until 2016 when France came back in. In addition, over the last five years, there has been a concerted campaign led by EU politicians and environmental non-governmental organizations (ENGOs) to stop the sale and consumption of all shark species—including spiny dogfish. This appears to have had an impact of consumer preferences, and according to processors interviewed for this analysis, in countries like France, they stopped selling it in retail fish markets all together (to avoid labeling it as shark). The primary markets that exist now for fresh are the prepared food markets, like restaurants, where species labeling is not as predominant.

Figure 5. US Global Export Market for Frozen Dogfish



https://www.st.nmfs.noaa.gov/pls/webpls/FT_HELP.SPECIES

The global market dynamics for frozen dogfish (**Figure 5**) tell a much different story than the markets for fresh dogfish. Most notably, the global export of frozen dogfish product has dramatically increased since 2010. There is also a much greater diversity of countries who purchase frozen product than fresh product; although, not all countries consistently buy it from year to year.

Prior to 2008, Germany was the largest global buyer of frozen product (this included both backs and belly flaps). But since 2008, it appears that Germany no longer purchases backs, and only purchases a small amount of belly flaps to prepare 'Schillerlocken'. Other countries, like Russia, Mexico and China will purchase frozen dogfish for a few years in a row, and then stop all together.

Nowadays, the most consistent countries purchasing frozen dogfish are once again France and Italy. Belgium has also been a consistent buyer over the years, as has Australia, who purchases 2-300,000 lbs. of backs per year. And as discussed earlier, the (frozen) shark fin market is predominantly dominated by Thailand, although exports are also sent to Hong Kong for re-processing and distribution throughout Asia.

In 2017, the market for frozen dogfish crashed by roughly 40%, but it doesn't appear this is a result of entire markets disappearing. Instead, the same diversity of countries bought frozen dogfish in 2017 as in 2016—the difference is that each country just purchased less. This puts frozen dogfish in a better position to recover than fresh dogfish because at least the markets still exist. According to the processors interviewed for this analysis, once you lose the market, it is almost impossible to get back. This seems to be the case for now for the fresh market.

Summary of Global Trade Analysis

The Europeans developed a robust domestic market for spiny dogfish more than 80 years ago and sustained local demand primarily with local catch from Norway, Iceland, and the UK all the way up until the 1990s when the Northeast Atlantic stock began to decline. To meet EU demand, the northwest Atlantic stock was also severely depleted during the 1990s, but thanks to the world's first fishery management plan (FMP) for spiny dogfish developed by the NEFMC and MAFMC (and implemented in 2001) the stock was saved from collapse. Eventually, the FMP led to a massive rebuild of the northwest Atlantic stock, which positioned the United States to become the primary supplier of both fresh and frozen dogfish products to the EU and the rest of the world.

There are two primary dogfish products—fresh and frozen, which are characterized by significantly different prices, and a different mix of buyers. Over the last 10 years, the export price of both fresh and frozen dogfish has been increasing; however, only the frozen supply has significantly increased over this time frame. Frozen supply continued to increase until 2016, when the market significantly crashed due to oversupply—at this time, total exports equated to roughly 28 million lbs. of whole fish supply (quota). The combination of increased trip limits and new processors entering the market contributed to the oversupply.

Although fresh dogfish prices have been increasing over the last 10 years, the total supply of fresh product has been trending downward, and the number of global buyers has significantly declined. The entire fresh market is now mostly supported by two countries—France and Italy. It is unclear why the diversity of the fresh dogfish market has declined so dramatically, but it might be related to changes in consumer tastes and preferences—and to the overall shark conservation movement.

Still, historical data shows that alternative fresh markets have existed over the years in places like Latin America, China, and Belgium—which might present future opportunities for re-development. Based on the data, it is apparent that the fresh and frozen markets are entirely different; so, it could be possible to develop new fresh markets and increase the supply into those markets without negatively impacting the price or dynamics of the frozen markets. However, increasing the supply of frozen appears to be much more sensitive. In 2011 and in 2016, the total US exports of spiny dogfish exceeded 26 million lbs (whole weight), and both times the following year, the market crashed by roughly 40% (see Figure 3). Based on these analysis and interviews with processors and fishermen, until new markets are developed, the maximum sustainable size of the US export market is roughly 18-22 million lbs (whole weight) per year.

RESULTS OF INTERVIEW QUESTIONS

To better understand the market dynamics of spiny dogfish, especially as it relates to changes in management, we interviewed the four major processors (and exporters) of spiny dogfish in the United States—Marder Trawling, Seatrade, HIghliner, and Red's Best. We also received feedback on our interview questions from key industry participants Doug Feeney and Jamie Hayward, who spoke with us at length. To inform the management process, we developed a set of questions based primarily on comments and inquiries raised by the Dogfish AP in the 2016-2017 Dogfish Performance Reports. We also conducted an extensive literature review to derive additional questions and to validate answers of interviewees. To protect the confidentiality of interviewees, answers are grouped together under each question.

Questions for Processors and Fishermen

1. What are the biggest determinants of ex-vessel price for dogfish?

Ex-vessel price is primarily determined by the domestic processing capacity, the amount of inventory in the freezer, and the global demand of the European market. Prices are set by the processor to smooth landings over the course of the year so that daily processing capacity is not exceeded, and some scarcity remains in total inventory. Given the lack of global buyers, if buyers determine that freezer capacity is full, they will low ball export prices, and if processors hold out for a better price, they are at risk of losing the market altogether as buyers will readily substitute away from dogfish for another low value fish. This dynamic trickles back to the fishing vessel, and processors will continue to lower prices to the boat (off-loader) to slow fishing to clean out excess inventory.

As the number of processors increase, the risk of low ex-vessel prices also increases. For example, two years ago, there were four major processors, and a global market that could support ~20 million lbs. However, with an increase in daily trip limit to 6,000 lbs, the fishery landed about 28 million lbs., and inventory for all four major processors were exceeded. The global buyers had significant leverage in this situation, prices fell, and vessels were shut down by the off loaders in the major ports in New Hampshire, Massachusetts, Rhode Island, New Jersey, and Virginia. In 2018, the number of major processors has dropped back down from four to two, which has constrained total inventory and the daily processing capacity. This leaves some excess demand from global buyers, which should have a positive impact on prices and allows vessels to continue to fish.

2. What is the seasonality of dogfish landings across regions (fishing communities)?

The dogfish fishery is a seasonal fishery, which follows the migration of the larger female schools of fish from New England to Virginia. Starting in June, the dogfish begin to show up in waters of New England, and fishermen begin fishing for it heavily in July through October. By November, the schools have moved south to Rhode Island and make it to New Jersey by December. From there, they continue to migrate south to Virginia in January and February, and by March and April they have begun to migrate north again and can be found off the coast of New Jersey again. Eventually, they make their way back up north in May through June and the cycle repeats.

3. What is the relationship/difference between the fresh and frozen dogfish markets?

As shown in the trade data analysis, the fresh and frozen markets are completely different markets with significantly different price points. On average, the export price of frozen product has been roughly $1.50 per lbs, and the export price of fresh product has been around $2.25. At these prices, processors only make any real money from the fresh product. However, the fresh market doesn't exist until Sept 1, and then lasts throughout the winter months until April.

Most of the dogfish caught by New Hampshire and Massachusetts vessels occurs over the summer, especially during the months of July and August, where fishermen can declare out of the ground fish fishery and declare into the exempted dogfish fishery (where they can target dogfish without having to be on a sector trip). Almost all this dogfish is frozen.

Developing a summer fresh dogfish market would be hard, for a few reasons. First, European demand drops significantly for all fish in the summertime, and most Europeans tend to take the entire month of August off (including the European buyers). Second, it would require an extra investment by the vessel to carry more ice for the dogfish, which is hard to justify at the very low ex-vessel price. Finally, dogfish are highly perishable, even when packed for shipment, marginal increases in temperature that can occur during transport (like waiting on the Tarmac at the airport) significantly impact the quality of the dogfish product. Each year, processors expect a certain loss from spoiled dogfish, even during the fall/winter months.

Although some of the fresh market is supplied by Massachusetts and New Hampshire vessels in September and October, most of the fresh fish market is supplied by mid-Atlantic vessels from Rhode Island to Virginia. Even though processors make significantly more money from fresh dogfish than frozen dogfish, the ex-vessel price to the vessel/off-loader doesn't change—in fact, northern vessels on average make more money per lbs. than southern vessels (fresh fish vessels) because the increased transportation cost to ship the fish from the mid-Atlantic region to New England comes off the top of the price per lbs. processors pay off-loaders.

On average, this year, northern vessels are making 18-22 cents per lbs., and southern vessels are making 14-16 cents per lbs. Processors pay around 32 cents per lbs to the off-loader. In the mid-Atlantic, 12 cents per lbs comes off the top for transportation, 5-6 cents per lbs goes to the offloader, and the remaining 14-16 cents per lbs goes to the vessel. In New England, the proximity to processors reduces transportation costs, and results in less money coming off the top and higher prices to the vessels.

Processors can't pay differentially more for fresh fish than frozen fish because it is uncertain ahead of time how much of the fresh catch can be sold into the fresh market, and if it can't be sold into the fresh market, if it will be frozen and added to the frozen inventory. The frozen market is based on pennies and there is no guarantee that these pennies will be positive, so processors rely on profits from the fresh market to make money. Because the fresh and frozen products are intermingled at the processor level, the prices paid to the vessel are based an average of the revenue from both fresh and frozen products.

4. Would you support an increase in the daily trip limit for dogfish?

The consensus amongst all processors and fishermen interviewed was that an increase in the daily trip limit would not result in more money to the boat. Because capacity to process dogfish is constrained (120k per day), and over supply of frozen inventory can quickly lead to low-ball prices from global buyers, the net effect of increasing trip limits at this time would be a dedicated effort by off-loaders and processors to slow fishing activity by telling boats they are not accepting fish on certain days. According to all processors interviewed for this analysis, the dogfish markets are slowly recovering this year, but an increase in trip limits at this time could seriously jeopardize the progress being made to bring the markets back.

5. Would you support a 'male only' winter harvest by draggers?

In general, both processors and fishermen had concerns about the viability and market effects of a directed male dogfish fishery over the winter. In the end, both agreed that the only way this would work is if an entirely new market was developed first–where the smaller (lower dragger quality) males could be sold. None of the processors currently accept dragger dogfish due to the lower quality, and because the males are significantly smaller, the processing costs for males would be significantly higher. One processor mentioned that if a new market could be found to accept the males, the only way it would work from a processing standpoint is by developing an automatic cutting machine. However, utilizing such a machine for small males would destroy the belly flaps, and reduce the overall price of the dogfish product. Therefore, the price paid to the boat would be significantly less (12-14 cents per lbs.), and any new market that was created would have to be large enough, so it became a pure volume fishery. In this way, draggers could target as much fish as they could each trip (no trip limits) and make more money the more fish they caught. From an ecosystem perspective, this idea was interesting just to get the dogfish out of the ocean. But there are significant upfront costs, potential market risks, and regulatory changes that would need to occur to make this a viable option.

6. What are the chances that new markets for dogfish can be developed, or old markets re-developed?

The consensus among both processors and fishermen matched what the US export data showed, that the European markets for dogfish have changed significantly over the past 10 years, especially for the fresh market, and due to changing consumer tastes and preferences (and negative 'shark' PR), these fresh markets will be difficult to recapture-many fish markets and grocery stores in Europe won't display 'shark' products anymore. For the frozen market, there is a greater diversity of buyers and the potential for continued growth (see **Figure 2**). This might be because it is more versatile and can be used for more (behind the scenes) prepared products.

As the data shows, significant attempts have been made over the years to develop new markets in places like China, Russia, and Latin America—but these markets have not been sustainable. For example, both fishermen and processors interviewed have made large efforts in China, in particular. However, everyone came to the same conclusion—although the Chinese eat a lot fish, they still seem to not really like the dogfish product. Efforts are continuing in some of these places, and there is optimism that global markets could still materialize under the right conditions (and with continued exposure to the product, or to new value-added products). Part of the evolution could come about when the older generation of global buyers give way to a younger generation of buyers who have less experience with dogfish and are willing to learn more about it and take chances on this MSC certified product.

Still, everyone interviewed agreed that the highest likelihood of new markets is right here in the United States. Significant efforts have been made over the last ten years to increase awareness and change tastes and preferences for dogfish. For example, local universities are now purchasing a few hundred thousand lbs. per year, CSF programs (like New Hampshire Community Seafood) are offering dogfish as part of the rotation of fish to both consumer and restaurants, and multiple grants have been awarded to groups (especially on the Cape) to develop new value-added products with dogfish.

According to fishermen and processors interviewed, turning dogfish into value-added products could have the most significant impact on developing new long-term sustainable markets. Fishermen on the Cape have done the most work developing these markets, and over the last 10 years have received multiple federal grants for these purposes. The newly formed, Chatham Harvester Group is working with processors via 2-million-dollar grant from the USDA to develop multiple products, including: a fish burger, fish sticks, and fish nuggets. There is optimism that these products could form the basis of entirely new markets and increase prices that could trickle back to the boat.

In addition to value added products, all processors and fishermen also mentioned the potential for working directly with the prison system or the Defense Department to establish long-term contracts for dogfish purchases. Even though these avenues seem like logical options to explore, no one interviewed is aware of any work being done to develop these markets. It would probably take the efforts of a dedicated lobbyist, or marketing professional working full time (along with financial support, like another grant project).

7. Do you have any ideas for management changes that could improve the dogfish markets?

Most interviewees thought that there was no need to change any management regulations at this time. However, one respondent suggested an option that might make sense for the southern boats and the fresh market. Currently, processors send trucks down south to pick up fish three times a week—Monday, Wednesday and Friday. They do so because the daily trip limit forces fishermen to fish all week long to maximize landings. However, processors can only take product for the fresh market on Monday's and Fridays. This means that almost all fish that gets shipped up on Wednesday is put directly into the frozen inventory, which could lead to over-capacity in the freezer, overall lower prices and risk of market collapse. However, according to the processors interviewed if they had more fresh product on Mondays and Fridays, they could almost certainly sell it. The existing trip limits constrain boats from catching significantly more on Mondays and Fridays, but if there was a way to modify trip limits – either through regulation or informally dealer-imposed differential daily limits that might be accommodated through a flexible weekly limit regulation – on those days, fishermen and processors might be able to make more money.

One option for doing this is to go to a seasonal weekly trip limit during the fall-winter period (October-April) when catches are more variable due to weather and the Mid-Atlantic ports see most of the landings. This would allow fishermen to focus their efforts to load up the trucks on Monday and Friday and would likely allow them to save a trip or two in the middle of the week (saving fuel costs and other operating expenses). For processors, they save money only having to send a truck two days a week. And by receiving more fresh fish on Mondays and Fridays, they could more consistently fill orders, and potentially grow new markets for fresh fish. Because processors make more money selling fresh fish, profits should increase. And less 'winter harvest' dogfish going into the frozen inventory helps to keep frozen fish prices stable, and potentially increase, due to increase scarcity.

KEY OUTCOMES AND NEXT STEPS

- The global market for spiny dogfish is still the EU, with frozen dogfish representing 75 percent of all sales. Frozen dogfish also has a greater diversity of global buyers than fresh dogfish, and total exports have been increasing over the last 10 years—as opposed to exports of fresh dogfish, which has been trending down over the last 10 years.
- The total size of the global market for spiny dogfish is estimated at around 20 million lbs. (whole fish); and it appears that if exports increase significantly past this breaking point, the frozen market crashes (as it did in 2012 and 2017).
- The cost of processing dogfish is very expensive and requires specialized cutters. This constrains daily processing capacity to roughly 120,000 lbs per day for the major processors. If new markets were developed, it might be worth exploring the use of automatic cutting machines to reduce costs and increase capacity.
- Given the constraints of global demand and processing costs, an increase in trip limits at this time will likely lead to lower prices to the boat and time off the water.
- The biggest opportunities for new markets are likely here in the United States through prepared foods, or continued expansion to the 'local' food markets; especially schools, hospitals and CSFs.
- Management changes to allow a 'male only' harvest for draggers over the winter season would require significant upfront investment to develop new markets, testing of new methods of cutting (automated), and would necessitate significant flexibility in daily catch limits.
- The 'fresh' dogfish season doesn't really start until October (when the temperature outside drops) and runs through April; and most fresh dogfish is supplied by Mid-Atlantic vessels. Anything that doesn't sell into the 'fresh' market during this period is frozen and adds to the frozen inventory accumulated over the summer.
- There might be opportunity to increase sales to the fresh market without negatively impacting the frozen market by moving to a seasonal 'weekly' vessel limit. By coordinating with processors, fishermen might be able to prioritize harvest (land more) for Mondays and Fridays to coincide with the days of the week that processors sell fresh dogfish.

Next Steps

- Explore the potential for developing new government and institutional markets, like military and prisons.
- Explore the potential size and scope of new value-added markets, and determine key questions:

  -Who is developing these markets (e.g. Highliner, US Foods, Reds Best, Chatham Harvesters Group)? Would higher prices for value added products trickle down to the fishermen? Would new value-added markets significantly increase the amount of potential harvest? Would management regulations need to change to accommodate?
- Explore the historical use/future development of automatic cutting machines, and determine benefits and costs, including the potential to reduce processing costs and increase capacity to meet future value-added markets.
- Explore the benefits and costs of new fish handling and sorting techniques on the vessel, including: pre-processing and icing and bleeding. Compare shelf life and product characteristics (smell, taste, look) of pre-processed/pre-bled product to traditional product that has not been pre-processed.

REFERENCES

Appleman, M., P. Burns, T. Moore, G. Skomal, (2017) 2017 Review of the Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plan for Spiny Dogfish. http://www.asmfc.org/uploads/file/59f0eaa1SpinyDogfishFMPReview_2017.pdf

Atlantic States Marine Fisheries Commission (ASMFC), 2008 Atlantic States Marine Fisheries Commission (ASMFC) Species profile: spiny dogfish stock rebuilding hinges on robust spawning stock Excerpted from ASMFC Fisheries Focus, 17:4 (2008), pp. 1-6

Atlantic States Marine Fisheries Commission (ASMFC), 2009 Atlantic States Marine Fisheries Commission (ASMFC) Interstate Fishery Management Plan for Spiny Dogfish (2009) http://www.asmfc.org/uploads/file/spinyDogfishFMP.pdf

Costa-Pierce, B.A., (2017) Optimum Utilization of Spiny Dogfish, Squalus acanthias, through Industry Partnerships and Product Development and Marketing. Saltonstall-Kennedy Grant Program (FINAL REPORT). rich.maney@noaa.gov

Dell'Appa, A., J. Johnson, D. Kimmel., R. Rulifson. 2013. The international trade and fishery management of spiny dogfish: A social network analysis. Journal of Ocean and Coastal Management. (80)

https://www.researchgate.net/publication/267896648_International_Trade_in_Spiny_Dogfish_A_Network_Analysis_for_the_Fishery_Management

IUCN, 2006. The International Union for Conservation of Nature. In: Squalus Acanthias. The IUCN Red List of Threatened Species. http://www.iucnredlist.org/apps/redlist/details/39326/0 (November 2012)

Lack, Mary 2006. CONSERVATION OF SPINY DOGFISH SQUALUS ACANTHIAS: A ROLE FOR CITES? TRAFFIK INTERNATIONAL https://www.wwf.de/fileadmin/fm-wwf/PublikationenPDF/FINAL_Spiny_Dogfish_ImplementationRepDez06.pdf

MAFMC, 2016. Fishery Performance Report. https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/58a5f666d482e90918c44ce2/1487271527557/2016+Spiny+Dogfish+FPR.pdf

MAFMC, 2017. Fishery Performance Report. https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/58a5f666d482e90918c44ce2/1487271527557/2016+Spiny+Dogfish+FPR.pdf

Perkins, F. 1982. Virginia's Winter Shark Fishery: A promising Alternative. Marine Resource Bulletin, College of William and Mary, Virginia Institute of Marine Science, Vol XIII (4) http://www.vims.edu/GreyLit/SeaGrant/vmrb14-1.pdf

St. Gelais, A.T., Costa-Pierce, B.A., (2015) Mercury concentrations in Northwest Atlantic winter-caught, male spiny dogfish (Squalus acanthias): A geographic mercury compari..., Marine Pollution Bulletin (2015), http://dx.doi.org/10.1016/j.marpolbul.2015.12.009

TRAFFIC, 2010. CITES CoP15 Prop 18 Analysis. In: Inclusion of Spiny Dogfish Squalus Acanthias in Appendix II. Proponent: Sweden, on behalf of the European Community's Member States acting in the interest of the European Community. http://www.traffic.org/cites-cop-papers (April 2013)

Wallace, S.S., McFarlane, G.A., Campana, S.E., King, J.R., 2009. Status of spiny dogfish in Atlantic and Pacific Canada. In: Gallucci, V.F., McFarlane, G.A., Bargmann, G.G.(Eds.), Biology and Management of Dogfish Sharks. American Fisheries Society, Bethesda, Maryland, pp. 313e33

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

TO: Spiny Dogfish Management Board

FROM: Kirby Rootes-Murdy, Senior FMP Coordinator

DATE: October 1, 2019

SUBJECT: Public Comment Summary on Spiny Dogfish Draft Addendum VI

The following pages represent a draft summary of all comment received by ASMFC on Spiny Dogfish Draft Addendum VI as of 5:00 PM (EST) on September 23, 2019 (closing deadline).

A total of 7 written comments were received on Draft Addendum VI. These included two organizations and the remainder from commercial fishermen and concerned citizens. Three public hearings were held in two jurisdictions, one virtually (webinar). Six individuals are estimated to have attended the hearings.

There were few comments provided specific to the proposed options and scoping question in Draft Addendum VI. Two individuals and one organization (Sustainable Fisheries Association) indicated their support for Option 2: Allow Quota Transfers between all states and regions. Reasons cited in support of this option were an interest in fully utilizing the coastwide quota and allowing all jurisdictions to benefit from quota transfers. One individual representing the New Hampshire Commercial Fishermen's Association supported Option 1: Status Quo. No reasons were cited.

Regarding the public scoping question on whether the federal commercial trip limit should be eliminated and replaced by state and regional trip limits, one individual supported maintaining the federal trip limit and another individual supported eliminating the federal trip limit. Reasons cited in support of maintaining the federal trip limit focused on concern about flooding the market. Eliminating the federal trip limit may lead to states setting higher trip limits which might lead to more landings, ultimately resulting in a lower price per pound. They indicated that regardless of the market incentives, fishermen would likely fish at a higher trip limit if allowed. Additionally, the individual noted concern that although states manage the commercial fishery using a quota system, eliminating the federal trip limit may result in a 'derby' fishery.

Reasons cited in support of eliminating the federal trip limit focused on challenges the market currently poses to the fishery, specifically, that it's not economical to make fishing trips when the trip limit is low and price per pound is also low. Other points of concern included that the

M19-76

current federal trip limit constrains the states from collectively achieving the annual coastwide quota and results in high discard rates. Lastly, the individual noted that allowing the states the same flexibility to set trip limits similar to how state quotas are managed in the summer flounder, scup, and black sea bass FMP would likely work well.

The New England Fishery Management Council expressed a number of concerns about the Commission's process in collecting public comment on the scoping question regarding eliminating the federal trip limit. It stated that it was not appropriate for the Commission to seek public comment on this question as the topic is not currently under development for changes in management by either the New England or Mid-Atlantic Fishery Management Councils. Additionally, it was noted that the Addendum does not identify a problem that needs to be addressed by a change in the possession limit and cited concern that the Commission's process for collecting public comment on this topic is too limited given there were only two public hearings and a public hearing webinar.

In addition to comments specific to the proposed management in Draft Addendum VI, the following general comments were also provided:

• Individual who regularly does bottom fishing around Block Island has seen high abundance of spiny dogfish and wants Addendum VI to be as liberal as possible to allow the biomass to be maximally harvested.
• Individual stated he/she does not want full utilization of the quotas. Instead, wants the quota cut by 50% immediately in all regions.
• Individual who gillnet fishes for spiny dogfish and is in favor of shifting state quota transfers to other states in an effort to achieve a better price.
• Individual takes issue with the NEFSC trawl survey; states that 80% of the female population are not surveyed by the trawl gear due it being off the bottom and 90% of the male population are not in the survey area. Indicates that management is based on incorrect science, which has led to lower quotas and has forced the closing of processing plants in the south. The reduced quotas created a market opening in Europe for other countries producing dogfish. The individual wants information on the amount of spiny dogfish imported into the U.S. and requests that ASMFC Staff be required to provide import data. The individual indicates that ASMFC must comply with Article 1 Section 1 of the Commission's Compact to prevent physical waste by mandating an industrial use for spiny dogfish. Additionally, the individual wants to do away with Draft Addendum VI and require a processing plant be opened in North Carolina or Virginia with supplemental funding from NOAA NMFS, the Regional Councils, and ASMFC. Requests that the ASMFC and MAFMC research how to rename spiny dogfish rather than completing Draft Addendum VI. States that historical dogfish in 1890s (biomass) comprised 17% of the biomass (target); in 2016, (biomass) comprised 80% of biomass target. Reiterates need to stop development of Draft Addendum VI

Summaries of the public hearings can be found next and are ordered from north to south. This is then followed by letters sent by organizations and letters sent by individuals.

Draft Addendum VI to the Spiny Dogfish Interstate Fishery Management Plan
New Hampshire Public Hearing

September 3, 2019
Urban Forestry Center
Portsmouth, NH
Commissioners: Doug Grout and Cheri Patterson (NH FG)
5 participants

3.1 Quota Transfers Options

- 1 individual, representing the NH Commercial Fishermen's Association, supported Option 1: Status quo.
- The New England Fishery Management Council (NEFMC) currently has no position on Quota Transfers Options.

Public Scoping Question

- The NEFMC opposes ASMFC's process in garnering comments for an unclear problem and circumvents the Council public process with which the fishing industry has a large voice in determining whether the federal FMPS' possession limits of dogfish be eliminated. Written statement from the NEFMC is attached for the record.

Draft Addendum VI to the Interstate Fishery Management Plan for Spiny Dogfish for Public Comment

Atlantic States Marine Fisheries Commission

September 3, 2019

Portsmouth, New Hampshire

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Tom Niles	NEFMC	Portsmouth NH
Ellen Goethel		Hampton NH
Peter Whelan		Portsmouth NH
Jeremy Hawkes	NHFG	

Draft Addendum VI to the Spiny Dogfish Interstate Fishery Management Plan
Rhode Island Public Hearing

September 16, 2019

Narragansett RI

Staff: Conor McManus and Scott Olszewski (RIDEM DMF)

Commissioners: Jason McNamee (RIDEM DMF) and David Borden (AOLA)

Summary: The hearing was held, but no one from the public attended to provide comments on the issues at hand.

Draft Addendum VI to the Spiny Dogfish Interstate Fishery Management Plan Public Hearing Webinar

September 18, 2019
1 Participant

Staff: Kirby Rootes-Murdy (ASMFC)

Other: Chris Batsavage (NC DMF), Nichola Meserve (MA DMF), Jason Didden (MAFMC)

3.1 Quota Transfer Options → 1 supports Option 2: Allow Quota Transfer between all states and regions

- 1 individual indicated their preference for Option 2: Allow Quota Transfer between all states and regions. Reason cited was that states should not be penalized if they close their fishery early and that available quota should be able to transferred across the coast between states and regions. They also cited how quota transfers have been very effective and helpful in other fishery, such as for bluefish, and that extending this management tool for states and regions involved in the spiny dogfish fishery would be best.

Public Scoping Question

- 1 individual indicated their preference for not eliminating the federal trip limit. Reason cited was the current market conditions: there are only two fish processing facilities along the coast; the price per pound is currently low; and while there is interest in trying to catch a higher trip limit, there is concern that would further lower the price. Another dynamic is that while the trip limit could be raised, doing so might introduce smaller, lower quality fish into the market, which could potentially affect the price as well.

  While the individual acknowledged there are state and regional quotas in place to constrain landings through the Commission's FMP, they expressed concern that a higher trip limit could result in a more 'derby' style fishery. Additionally, this individual believed that fishermen would fish at a higher trip limit even if it resulted in lower price per pound as result of 'flooding the market'. In summary, they expressed concern that eliminating the federal trip would create a scenario where spiny dogfish fishermen would be landing more fish for less money.

Good Evening. My name is Thomas Nies. I am the Executive Director of the New England Fisheries Management Council and I am here speaking on behalf of the Council.

The fishery for Spiny Dogfish in federal waters is managed by a fishery management plan that was adopted under the provisions of the Magnuson-Stevens Act (MSA). This is a joint fishery management plan of the Mid-Atlantic and New England Fishery Management Councils. The Mid-Atlantic Council is the lead Council for this FMP. Most spiny dogfish landings are harvested under the provisions of this FMP - we estimate that roughly 90 percent of dogfish landings are by federal permit holders.

The New England Council does not yet have a position on the quota transfer provisions that are being considered in Addendum VI to the Interstate Fisheries Management Plan for Spiny Dogfish. We are, however, concerned that this scoping hearing is seeking public comment on eliminating the federal FMP's possession limits. The Mid-Atlantic and New England Councils have not yet decided to pursue an action that would consider changes to the federal possession limit. It does not seem appropriate for ASMFC to ask a question about a management measure that is not yet under development at the same time as the Commission is seeking comments on a change to the ISFMP. We are concerned that this may confuse fishermen about the actions under development, and/or those fishermen who are not closely following the Commission process will not respond to the scoping question. The Addendum also does not identify a problem that needs to be addressed by a change in the possession limit, leaving unanswered what the rationale is for the proposal. Finally, only one option is presented for comment, suggesting a pre-determined response to an undefined problem.

The Spiny Dogfish Advisory Panel met via webinar on August 19, 2019 to develop a Fishery Performance Report. The purpose of that document is to provide the Scientific and Statistical Committee information about fishing effort, market trends, etc. During the course of that meeting, AP members briefly discussed the ASMFC idea to eliminate the federal trip limit and rely on states to set trip limits. Only two advisors voiced an opinion; both were against this suggestion. Some AP members expressed the concern that all fisherman's voices would not be accounted for in the ASMFC process. Given the limited number of scoping hearings that are being held, this is also a concern of the New England Council. It is our understanding that only two public hearings and one webinar are being held for a fishery that takes place from Maine to North Carolina.

In summary, the NEFMC prefers comments and suggestions on federal management be obtained through the Council process, not ASMFC scoping hearings on an unrelated action.

September 23, 2019

Kirby Rootes-Murdy
Senior Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission
1050 N. Highland St, Suite A-N
Arlington, VA 22201

VIA EMAIL ONLY

Re: Comments to Spiny Dogfish FMP – Draft Addendum VI

Dear Kirby:

I am writing to you on behalf of the members of the Sustainable Fisheries Association (SFA) regarding the Spiny Dogfish Fishery Management Plan Draft Addendum VI.

The SFA supports Draft Addendum VI as it has been proposed to allow commercial quota to be transferred between all regions and states to enable the full utilization of the coastwide commercial quota and avoid quota payback for unintended quota overages.

Thank you for your consideration of and attention to this issue.

Sustainable Fisheries Association, Inc.
By
/s/
John F. Whiteside, Jr.
General Counsel
John@JWhiteside.com

Sustainable Fisheries Association, Inc.
678 State Road
Dartmouth, MA 02747
(508)991-3333

Kirby Rootes-Murdy

From: Comments
Sent: Friday, September 6, 2019 3:47 PM
To: Kirby Rootes-Murdy
Subject: FW: spiny dogfish draft addendum VI

Follow Up Flag: Follow up
Flag Status: Completed

From: Richard Pastore [mailto:rpengri@gmail.com]
Sent: Thursday, August 22, 2019 1:58 PM
To: Comments <comments@asmfc.org>
Subject: spiny dogfish draft addendum VI

I regularly bottom fish the waters around and south of block island ri. spiny dogfish are the biggest pain in the ass I've run into during my entire 69 years of fishing. not only are their numbers overwhelming when they're on the bite but they will suck down a squid bait in heartbeat out competing everything else around including cod, fluke,scup and black sea bass. additionally they perform their shark death spin when they're next to the boat and have an amazing ability to spear me with their caudal fin spike as they whip it around like an alligator when I'm trying to de-hook them. amendment VI should be as liberal as possible to allow the "biomass" aka "pain-in-the-ass" to be maximally harvested . PLEASE!
regards

Richard L. Pastore P.E.
RP Engineering, Inc
121 Suffolk Drive
North Kingstown, RI 02852
401 885 7255
www.RPENGRI.COM

Kirby Rootes-Murdy

From: Comments
Sent: Friday, September 6, 2019 3:47 PM
To: Kirby Rootes-Murdy
Subject: FW: Comment On Spiny Dogfish Management Proposal

Follow Up Flag: Follow up
Flag Status: Completed

From: jean public [mailto:jeanpublic1@gmail.com]
Sent: Saturday, August 24, 2019 12:40 PM
To: Comments <comments@asmfc.org>; PETA Info <info@peta.org>; The Pew Charitable Trusts <info@pewtrusts.org>; humanelines <humanelines@hsus.org>; INFORMATION@sierraclub.org
Subject: Re: Comment On Spiny Dogfish Management Proposal

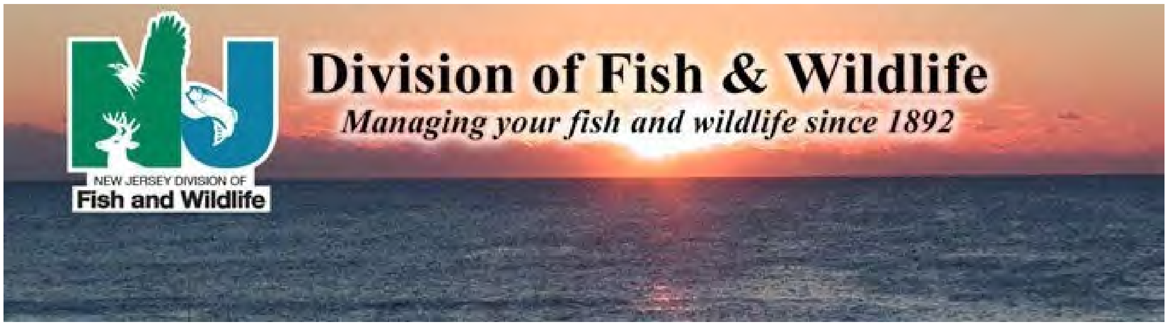
public commetn on spinry dogfish overfishing plan

i do not want to enable full "utilizatoin" of quotas. i want quota cut by 50% immediately in all regions. the overfishing going on per this sneaky asmfc organizatoin, which is slanted to commercial fish profiteers and not workinf in the best interests of the entire american public citizenry. this is the first time i have ever seen anything allowed for the public to comment on anything this sneaky asmfc does. usually this sneaky slanted biased organization working only for commercial fish profiteers doesnt want the public to knoiw what they do in secret. asmfc is a very sneaky closed orgaqnziation. hard to find out anything about what they do. this comment is for the public record. please receipt. jean publiee jeanpublic1@gmail.com

To All Applicable Commercial Spiny Dogfish Fishermen: The Atlantic States Marine Fisheries Commission (ASMFC) has released draft addendum VI to the spiny dogfish fishery management plan for public comment. Public comments will be received and considered until September 23, 2019, at 5pm. Comments on the draft addendum should be submitted via email to comments@asmfc.org and should include the subject line, "Spiny Dogfish Draft Addendum VI", via fax to (703) 842-0741, or to the address: Kirby Rootes-Murdy 1050 N. Highland St, Suite A-N Arlington, VA 22201 A public hearing will be held online and by phone by the ASMFC on September 18th, 2019, at 6pm. To attend the hearing by phone, dial (888) 585-9008 and enter room number 853-657-937. To attend the online webinar, please visit https://attendee.gotowebinar.com/register/1750824234161238785. The complete draft addendum can be found on the ASMFC website at http://www.asmfc.org/aboutus/public-input. Below is a summary of the proposed changes to the management plan: The Draft Addendum proposes allowing commercial quota to be transferred between all regions and states to enable the full utilization of the coastwide commercial quota and avoid quota payback for unintended quota overages. The Commission's FMP allocates the coastwide quota to the states of Maine-Connecticut as a regional allocation and to the states of New York-North Carolina as state-specific allocations. Currently, the FMP only allows quota transfers between states with individual allocations, with regions excluded from benefitting from quota transfers. The 2019-2020 coastwide quota was reduced by 46% due to declining biomass. If landings in the 2019-2020 fishing year remain the same as 2018-2019 landings, the coastwide quota may not be exceeded but some states could face early closures due to reaching their allocation and being unable to access available unused quota from the northern region through quota transfers. The Draft

Addendum also includes a scoping question on whether the federal commercial trip limit should be eliminated and replaced by state and regional trip limits. This issue is under consideration due to concern that the coastwide quota has been substantially underutilized over the past seven years and the federal commercial trip limit is viewed by some as an additional constraint on the fishery beyond the commercial trip limits implemented for state permit holders. The Commission does not establish the federal

On Fri, Aug 23, 2019 at 12:26 PM Division of Fish and Wildlife <NJFishandWildlife@public.govdelivery.com> wrote:



Attend public hearing via phone or online

The Atlantic States Marine Fisheries Commission (ASMFC) has released Draft Addendum VI to the Spiny Dogfish Fishery Management Plan for public comment. A public hearing will be held online and by phone by the ASMFC on September 18 at 6:00 p.m.

Attend by phone: Call 888-585-9008 and enter room number 853-657-937

Attend online

Complete draft addendum

Summary and comment instructions (pdf)

NEW JERSEY DIVISION OF
Fish and Wildlife
www.njfishandwildlife.com

Questions? Contact Us

SUBSCRIBER SERVICES:
Manage Preferences | Unsubscribe | Help

Kirby Rootes-Murdy

From: Comments
Sent: Friday, September 6, 2019 3:46 PM
To: Kirby Rootes-Murdy
Subject: FW: spiny dogfish draft addendum VI

Follow Up Flag: Follow up
Flag Status: Completed

From: Donald Miller [mailto:stickmanmiller@gmail.com]
Sent: Wednesday, August 28, 2019 9:33 AM
To: Comments <comments@asmfc.org>
Subject: spiny dogfish draft addendum VI

I Donald Miller am for the new management plan of the spiny dogfish of shifting state quota transfers to other states. I gill net out Barnegat Light N.J. , and yes we target the dogfish. We all are looking for a better price we need help there. Thank You. stickmanmiller@gmail.com

Kirby Rootes-Murdy

From: Comments
Sent: Thursday, September 19, 2019 10:20 AM
To: Kirby Rootes-Murdy
Subject: FW: dogfish comments & Re: James Sulikowski Arizonan do you have email & phone

I think I sent you this before but I'm not sure. This is the last one we received.

-----Original Message-----
From: James Fletcher [mailto:unfa34@gmail.com]
Sent: Friday, September 13, 2019 9:44 AM
To: JASON DIDDEN; Comments
Subject: dogfish comments & Re: James Sulikowski Arizonan do you have email & phone

ANY NEWS ON JAMES: IS IT POSSIBLE nmfs COMMERCE OR THE DEPARTMENT OF STATE ARRANGED A BETTER POSITION SO HIS EXPERTISE ON CHIPFISH WOULD DISAPPEAR?
WE NOW HAVE A DOGFISH PLAN THAT DOES NOT ACCOUNT FOR 80% OF FEMALE NOT SURVEYED BY TRAWL GEAR DUE TO BEING OFF BOTTOM & 90% OF MALE CHIP FISH DUE TO BEING IN NON SURVEYED AREA. ALSO A STATEMENT THAT 80% OF DOGFISH STOMACH CONTENT IS CTENOPHOREA IS TOTALLY INCORRECT.
PREVIOUS MANAGEMENT BASED ON INCORRECT SCIENCE CREATED LOWER QUOTAS & FORCED CLOSING OF PROCESSING PLANTS IN SOUTH.
LOWER QUOTAS BASED ON 80% INCORRECT [SCIENCE BASED ASSUMPTIONS} CREATED A MARKET OPENING IN EUROPE FOR IMPORTS FROM OTHER COUNTRIES PRODUCING DOGFISH.
INCORRECT SCIENCE MISSING 80% OF FEMALES & UNKNOWN PORTION OF MALES AS NO SURVEY IS CONDUCTED FOR MALES. CREATED A EXCUSE FOR CONSERVATION GROUPS TO REQUEST SHIPPING LINES NO LONGER ALLOW SHARK PRODUCTS TO BE SHIPPED BASED ON INCORRECT SCIENCE.
NO AGENCY HAS COME FORWARD WITH THE AMOUNT OF SHARK / DOGFISH PRODUCTS IMPORTED INTO U.S. IF ANY. ASMFC STAFF SHOULD BE REQUIRED TO PROVIDE IMPORT INFORMATION.
THE SCIENCE SET QUOTAS THAT CAUSED LOGISTIC PROBLEMS WHEN SHIPPING FROM SOUTH TO THE BLESSED NORTHERN PROCESSORS.
ASMFC MUST COMPLY WITH ARTICLE 1 SECTION 1 OF COMPACT PREVENT PHYSICAL WASTE BY MANDATING A INDUSTRAL USE FOR DOGFISH OR RENAMING THE FISH SO AMERICAN CONSUMMERS WILL UTILIZE.
SCRAP DRAFT ADDENDUM VI
REQUIRE A PROCESSING PLANT BE OPENED IN N.C. OR VA WITH SUPPLEMENTAL FUNDS FROM NOAA NMFS COUNCIL & ASMFC MANDATED TO SUPPLY MONEY TO COMPENSATE THE PROCESSOR OR PROCESSORS.
ASMFC & COUNCIL SHOULD RESEARCH HOW TO RENAME THIS FISH RATHER THAN DOING ADDENDUM VI.
HISTORICALLY DOGFISH IN 1890'S COMPRISED 17% OF BIOMASS NOW 2016 ABOVE 80% OF BIOMASS IN OCEAN AND ASMFC PROPOSES QUOTA TRANSFERS INSTEAD OF RENAMING THE FISH FOR MARKET ACCEPTABILITY, SCRAP ADDENDUM VI focus instead on ASMFC RENAMING THE FISH TO CONSUMER ACCEPTABLE NAME. JAMES FLETCHER UNFA 123 APPLE RD MANNS HARBOR NC. 27953

On 8/19/2019 4:32 PM, Didden, Jason wrote:
> Not right now, but I just send him a facebook friend request so maybe soon.
>
> -----Original Message-----
> From: James Fletcher <unfa34@gmail.com>
> Sent: Monday, August 19, 2019 12:28 PM
> To: Didden, Jason <jdidden@mafmc.org>
> Subject: James Sulikowski Arizonan do you have email & phone

>
> Jason do you have any contact information?   Where do we gain any science NOW?   UP A SCIENCE CREEK & NO HONEST SCIENCE!
> DO Tagw show males stay off bottom more inshore than females?
>
> --
> James Fletcher
> United National Fisherman's Association
> 123 Apple Rd.
> Manns Harbor, NC 27953
> 252-473-3287
>

--
James Fletcher
United National Fisherman's Association
123 Apple Rd.
Manns Harbor, NC 27953
252-473-3287

Kirby Roots
ASMFC
1050 North Highland St., Suite 200 A-N
Arlington, VA 22201

Dear Mr. Roots

I have been a long term fisherman out of Rhode Island and have fished for 40 plus year in the monkfish, skate, black sea bass, summer flounder, lobster and scup fisheries. During that time I have also fished for dogfish commercially on a number of occasions. I was unable to attend the recent public hear and offer the following comments.

In regards quota transfers, I support option 2 provided all states mutually agree to the amount and timing. This a nothing more than common sense, - since you want to have a system that allows the full quota to be harvested annually.

The public scoping issues is more complex, but to be sure, I support RI and the other states recommending the elimination of the federal trip limit. The State of Rhode Island, Marine Fisheries staff, should have the flexibility to work with fishermen like myself, to craft state specific regulations that are tailored to our different circumstances. I have listened to a number of the advisory panel discussions over the years and am convinced that the federal trip limit constrains the ability to catch the annual quota, as well as supply enough product to attract buyers. Dogfish are a low value product (generally 15 cent a pound to the boats) which at a 6000 pound trip limit x .15 cent pound only generate $900. This is an inadequate incentive to target dogfish especially when they move offshore and cost go up, which they do seasonally. It is also not economic for dealers to truck them to New Bedford, given the low trip limit and the fact that very few fishermen want to participate in the fishery, as it is way too much work to earn a few hundred dollars at best.

RI fishermen only have limited access to dogfish in State waters for a month or so in the spring and fall and in order to have a fishery we need to be able to target then in federal waters. Costs go up when you go that far and it is just not economic to chase them to gross $900 a day. Discards have been significant in most years and could be reduced with higher trip limits.

My last point relates to flexibility. States have different views on the preferred commercial trip limit for their respective jurisdictions, and the current one size fits all federal trip limit has proven limiting for many states leading to a substantial under-harvesting of the coastwide quota. States in the Mid Atlantic area have the ability to adjust their trip limit in state waters and address some of the concerns noted above for RI, and we should have the same options. Reason being, The States agencies have more flexibility to tailor their regulations to meet the individual state needs of their respective constituents. This concept works well in summer flounder, scup, and black seas bass fishery, and I have no doubt it will work well in dogfish.

So my response is yes your question : Should the Commission recommend that the federal commercial trip limit be eliminated and replaced by the state-by-state trip limits where they exist (NY–NC) and a regional trip limit where it exists (Northern Region of ME-CT)?c

I am happy to discuss by phone if needed. (401-935-8372)

Sincerely '

Kevin Sullivan,

Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201, Dover, DE 19901
Phone: 302-674-2331 | FAX: 302-674-5399 | www.mafmc.org
Michael P. Luisi, Chairman | G. Warren Elliott, Vice Chairman
Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: October 3, 2019

To: Council

From: Jason Didden, staff

Subject: *Illex* permits without any *Illex* landings

Staff received several requests for the number of *Illex* permits that had no *Illex* landings during requalification periods. NMFS staff was able to run the numbers. There are currently 76 *Illex* moratorium limited access MRIs/permits, and the numbers of those MRIs/permits with no *Illex* landings during several potential requalification periods are provided in the table below.

Potential requalification periods	MRIs/ Permits with no landings in period
1997-2018	**14**
1997-2013	**16**
2004-2013	**23**

Wednesday, October 2, 2019 1:19 AM

Name: David Dow

Topic(s): Other

Comments: Comprehensive Five Year (2020-2024) Research Priorities:

I wanted to comment on a socioeconomic component (loss of the working waterfront in coastal communities) and an Ecosystems Approach to Fisheries Management (EAFM) component (sustainability) from the perspective of being a retired biological oceanographer and grassroots environmental activist living on Cape Cod, Ma.

We are experiencing a migration of forage fish species and Summer Flounder/Scup/Black sea bass from the Mid-Atlantic region into Nantucket Sound and an emigration of Winter flounder; American lobsters; etc. into the rapidly warming Gulf of Maine (which includes Cape Cod Bay). As our coastal waters warm during the Summer and attract more migrating forage fish, it increases our seal populations which are fed upon by great white sharks which pose threats to beach goers which hurts our "Blue Economy". Whale watching is an important component of our economy which has been hurt by the Unusual Mortality Events (UME)for right, humpback and minke whales. Acute and chronic gear entanglements of these whale species has impacted whale watching and fixed gear lobster fisheries which has lead the NOAA Fisheries GARFO launching both MMPA (Marine Mammal Protection Act) DEIS to reduce gear entanglements and an ESA (Endangered Species Act) section 7 consultation for North Atlantic right whales (which migrate from Winter breeding grounds off the southeastern US coast) to Summer feeding grounds in the Gulf of Maine/Gulf of St. Lawrence where increased mortalities have lowered the population to 400 animals.

The "sustainability" component of EAFM should include not only changes in the marine food chain due climate change (warming waters and increased ocean acidity), but also changes in the shifting ocean baseline (Gulf Stream flow rates; North Atlantic Oscillation; Atlantic Meridional Overturning Circulation; etc.) which effect growth; metabolism; recruitment and other components of the flow of energy from the plankton up to Apex predators, The EMaX carbon flow study on the Northeast Continental Shelf Ecosystem provides examples of changes in the marine food chain required to balance primary production with the yield of Living Marine/Protected/Natural Trust resources. The link between cod recruitment and the NAO is an examples of how shifts in the jet stream/Arctic ice melting cause shifts in the ocean baseline. Similar effects are likely to occur in the Mid-Atlantic ocean as species shift in time and space which alters predation and competition patterns and the balance between the grazing food chain/microbial food web in the plankton. These change in the water column ecosystem and ocean forcing factors should be reflected in the productive capacity of Essential Fish Habitat (EFH) and the "natural mortality" component of fishery population dynamics models which help set the targets for FMP quotas and to determine whether overfishing is occurring.

The whale UMEs and shifts in natural trust resources (seabirds) should also be a component of the "sustainability dialog", since the ocean is an open dynamic system which is not at equilibrium (unlike the steady state, equilibrium conceptual model used currently in fisheries management). Environmental groups like the Sierra Club include such factors in their national Sustainable Fisheries Policy. Other marine conservation groups have similar concerns in protecting marine biota and their habitats/increasing ocean biodiversity.

Since many coastal areas are losing their working waterfronts to tourism and economic development that is not water dependent, this has negative consequences for both commercial and recreational fishing. Since saltwater angling on Cape Cod includes head boats/charter vessels for tourists and fishing by residents from their own vessels, I feel that the economic multiplier effect on our local economy is greater for recreational fishing than for commercial fishing activities. The same appears to be true in Ocean County, NJ where my extended family lives. The prevailing socioeconomic models assume that commercial fishing is more important to the "Blue Economy" of coastal areas than is recreational fishing which creates counter intuitive financial incentives from local/state governments. Some proponents of "sustainable fishing" in the European Union want to concentrate fish harvesting in coastal areas and leave the offshore regions to act as marine preserves to support coastal stocks. I don't know if this is a viable concept under the Magnuson-Stevens Sustainable Fisheries Act, but we need a better integration of socioeconomic and EAFM models to manage fisheries in an era of changes in the marine food chain and shifts in the ocean forcing baseline (biological, chemical and physical).

Email: ddow420@comast.net

Operational Assessment of the Black Sea Bass, Scup, Bluefish, and Monkfish Stocks, Updated Through 2018 *

by the Northeast Fisheries Science Center

*This is a **Prepublication Copy** of the August 2019 Operational Stock Assessment Report. This report is currently "in preparation" for publication by the NEFSC. This pre-publication copy is intended for use by Fishery Management Council staff and SSC. (~~8/23/2019~~ 9/4/2019 : BSB chapter had some revisions)

Contents

Preface

This document represents the findings of an Operational Assessment of Black sea bass, scup, bluefish, and monkfish. The meeting was held August 5-7, 2019 at the Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, MA. The Review Panel comprised Thomas Miller (chair), Jean-Jacques Maguire, Kate Siegfried, and Michael Wilberg. Dr. Siegfried is from the Southeast Fisheries Science Center, while the other reviewers are members of the New England or Mid-Atlantic Fishery Management Councils' Science and Statistical Committees. Comments by the Operational Assessment Review Committee are included in their entirety in this report.

The Terms of Reference for the Operational Assessments were based on the 2011 Operational Assessment Process White Paper developed by the NRCC, with some revisions made by the NEFSC SAW Chair on June, 3, 2019. The Assessment Oversight Panel (AOP), which included Paul Rago and Jason McNamee and Russ Brown, met on May 20, 2019 to review the assessment plans. The full AOP report is attached as an Appendix to this report.

Thanks to the assessment scientists and colleagues for their efforts to implement this operational assessment. I also thank the review panel and especially the Chair, for their timely and insightful reviews. This document is part of an overall program to streamline the stock assessment process and provide more timely information to the New England and Mid Atlantic Fishery Management Councils and the Atlantic States Marine Fisheries Commission. I thank the executive staff of the NEFMC and MAFMC for their efforts to identify, coordinate, and support the peer review panel. All meetings of the AOP and Review Panel were open to the public and we appreciate the valuable input we received.

James Weinberg
NEFSC Stock Assessment Workshop Chairman
August 13, 2019

Northeast Regional Coordinating Council (NRCC). 2011. A new process for assessment of managed fishery resources off the Northeastern United States. Unpublished white paper. 26 pages.

Report of the 2019 Operational Assessment Review Committee (OARC) (Aug. 2019)

Thomas J. Miller[1] , Jean-Jacques Maguire[2] , Kate I. Siegfried.[3], Michael J. Wilberg[1]

1. University of Maryland Center for Environmental Science Chesapeake Biological Laboratory, Solomons, MD. & Mid-Atlantic Fishery Management Council Scientific and Statistical Committee
2. Quebec City, Quebec, G1T 2E4, Canada & New England Fishery Management Council Scientific and Statistical Committee
3. NOAA/NMFS Southeast Fisheries Science Center Beaufort Laboratory

The 2019 Operational Assessment Review Committee (OARC) met at the Northeast Fisheries Science Center in Woods Hole, MA on August 5-7th. The OARC were asked to provide technical reviews of operational assessments for monkfish (*Lophius americanus*), black sea bass (*Centropristis striata*), scup (*Stenotomus chrysops*) and bluefish (*Pomatomus saltatrix*). The assessments for these four species were prepared under guidelines prepared by 2019 Assessment Oversight Panel (AOP). These guidelines provided a structured pathway for transitioning assessments for each species from a previously accepted benchmark assessment to one that incorporates the most recent data and understanding of the biology of the species being assessed. The 2019 Assessment Oversight Panel considered monkfish to be a level 2 assessment and the other three species were considered level 3 assessments. As a result of this designation, the assessments for all four species required peer-review.

We wish to thank Dr. Russ Brown (Population Dynamics Branch Chief), Dr. Jim Weinberg (SAW/SARC Process Chair), and Michele Traver (Stock Assessment Coordinator) for their support during the meeting. We thank the staff of the Population Dynamics Branch at NEFSC for the open and collaborative spirit with which they engaged the OARC. Our thanks extend not only to the analysts directly responsible for each assessment, but to the members of the Population Dynamics Branch who participated actively during the meeting. Finally, the OARC also wishes to thank the IT and other staff at NEFSC for supporting the logistics during the meeting.

The OARC endorsed the assessments for all four species presented at the meeting. An analytical assessment for monkfish was not possible as a result of challenges of ageing this species. Instead, the lead assessment analyst brought forward a swept area-based approach that estimated a multiplier that could be used to adjust the current ABC by the PDT, SSC and Council of the New England Fishery Management Council as was done in the previous stock assessment. Analytical assessments were produced for black sea bass, scup and bluefish, each of which used a statistical catch at age model. In each case the OARC endorsed the model and the inferences that resulted as representing the best scientific information available (BSIA), thereby providing a foundation for staff, the SSC and the Mid-Atlantic Fishery Management Council to evaluate stock status and provide scientific advice.

OARC Comments on 2019 Operational Assessment: Monkfish

The OARC determined that the 2019 operational assessment for monkfish represents the best available scientific information and provides an appropriate foundation to provide scientific advice to managers. The assessment represents the BSIA for this stock for management purposes. No analytical model was presented because of challenges of aging monkfish and so no stock status determination was possible. The OARC agrees with the assessment report that an ad hoc approach to updating catch advice is appropriate for monkfish.

A length-based analytical approach for monkfish using the SCALE program in the National Fishery Toolbox (NFT) was first accepted in 2007 (NEDPSWG 2007 a,b) and continued for monkfish at SARC 50 (NEFSC 2010). This model was used to evaluate stock status and biological reference points until age and growth work (Bank 2016) indicated that the growth information was in error. The 2016 Operational Assessment Panel concluded that the SCALE model used previously could no longer be considered a reliable basis to estimate stock status and provide management advice.

The 2016 Operational Assessment Panel concluded that an *ad hoc* "Plan B" approach, using the changes in the most recent three years in the NEFSC Autumn and Spring biomass estimates to adjust the North and South management areas TACs should be used instead (Richards 2016). Adoption of this approach precludes a determination of stock status.

The 2019 OARC had no basis to disagree with the conclusions of the 2016 Operational Assessment Panel. The 2019 operational assessment for monkfish is an update of the ad hoc Plan B approach adopted in the 2016 operational assessment (Richards 2016). Applying this approach in 2016 implied essentially status quo in both management areas. This year, because of the recruitment of the strong 2015 year class, particularly in the north management area, the approach implies a relatively large (~20%) increase in the TAC for the north management area. While biomass (kg/tow) continued to increase through the 2018 autumn survey, abundance (numbers/tow) peaked in 2016 and decreased in later years. In the spring survey, both biomass and abundance indices peaked in 2018 and decreased in 2019. The OARC is concerned that biomass in the autumn survey may also have peaked in 2018 and that the approach might exaggerate the allowable increase in TAC for the north area. In the future it may be useful to evaluate approaches that would limit the variability in TAC adjustments as an alternate plan B.

The 2019 OARC concludes that the *ad hoc* Plan B operational assessment for monkfish is sufficient to provide scientific advice, but might exaggerate the allowable increase in TAC for the north area. The OARC notes that the results of the 2019 Operational Assessment and the recommendations of this OARC report will be used by the NEFMC PDT to develop recommendations that will be reviewed by the NEFMC SSC. The Panel expects that these concerns will be taken into account by the PDT and SSC.

Operational Assessment Terms of Reference: Monkfish

Stock assessments normally include 6 Terms of references. Not all ToRs were met because the Operational Assessment for monkfish was based on the Plan B approach accepted in the 2016 Operational Assessment,

1. *Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment.*

This ToR was completed successfully. No new data sources were added to the assessment. Commercial landings and fishery-independent survey data from the NEFSC spring and fall surveys were updated.

2a. Estimate annual fishing mortality, recruitment, and stock size for the time series ("Plan A"). Include estimates of uncertainty, retrospective analyses (both historical and within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

This ToR was not met. An analytical, length-based assessment using the NFT SCALE assessment model could not be developed because of uncertainties in ageing of monkfish and thus in growth parameters which are essential to the application of SCALE. Accordingly, no estimates of F, recruitment, and stock size for monkfish were produced.

2b. Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "Plan A" assessment were to not pass review.

As agreed by the Assessment Oversight Panel, Plan B was used for monkfish as in the previous Operational Assessment in 2016. This ad hoc approach uses a slope value estimated from a regression analysis of the last three years of the fishery-independent surveys. Slope estimates for both the northern and southern regions are developed by appropriate sampling of stations from the NEFSC surveys. The exponentiated value of this slope is used as a multiplier to update the TAC for both the northern and southern regions.

3. Update the values of biological reference points (BRPs) for this stock.

This ToR could not be met as there is no accepted assessment model for monkfish.

4a. Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

There are no accepted biological reference points for monkfish and, thus, this ToR could not be met.

4b. Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

This ToR was met.

5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at F_{MSY} or at an F_{MSY} proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

This ToR could not be met as there is no accepted assessment model for monkfish.

6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

This ToR was met. SARC 34 (NEFSC 2002) recommended, "*Surplus production modeling should continue with special emphasis placed on uncertainty in under-reported catches and population size prior to 1980*." SARC 50 (NEFSC 2010) concluded: -*"Bayesian surplus production was explored unsuccessfully for SAW 40 (NEFSC 2005) and NDPSWG (2007)."* The Data Poor Working Group for monkfish (NDPSWG 2007) concluded that long-term production models were inappropriate for status determination of monkfish because of the general lack of correspondence between reported catch and survey trends.

Recent developments in general production modeling (JABBA, Winker et. al. 2018; SPiCT, Pedersen and Berg, 2016) may have addressed the concerns expressed in SARC 50. In particular, these modeling approaches allow for observation and process errors which make it possible to improve the estimate of the stock size and fit to the indices. The OARC suggests that these methods be investigated in the next research track assessment as an alternative to age/length based methods regardless of whether the age and growth problems have been resolved.

The OARC also recommend that the next assessment review and revise, if appropriate, the Plan B approach based on approaches in the DLMtool (http://www.datalimitedtoolkit.org/) and on the approaches used by ICES (https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/Introduction_to_advice_2018.pdf).

Major sources of uncertainty: Monkfish

Recent studies using mtDNA did not find differences between the north and south management areas, suggesting that there is a single stock. This is not a major source of uncertainty under the current Plan B, but could become so if and when a new analytical approach is adopted. At that time, stock structure should be evaluated carefully and both hypotheses (i.e., a single stock area, or a multiple area model) should be evaluated.

As indicated above, the three-year smoother may be risky since recruitment after the 2015-year class is estimated to have been average or less. Given previous large fluctuations in biomass, an increase of 20% or more may not be sustainable if the recruitment remains below average.

References

Bank, C. (2016). Validation of age determination methods for monkfish (Lophius americanus). Master of Science Thesis, School of Marine Science and Technology, Univ. Mass.

Northeast Data Poor Stocks Working Group. 2007a. Monkfish assessment summary for 2007. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 07-13; 12 p.

(Northeast Data Poor Stocks Working Group. 2007b. Monkfish assessment report for 2007. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 07-21; 232 p.Northeast Fisheries Science Center. (2002). Report of the 34th Northeast Regional Stock Assessment Workshop (34th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. 02-06; 346 p.

Northeast Fisheries Science Center (2005). 40th Northeast Regional Stock Assessment Workshop (40th SAW). 40th SAW assessment report. US Dep Commer, Northeast Fish Sci Cent Ref Doc. 05-04; 146 p.

Northeast Fisheries Science Center. (2010). 50th Northeast Regional Stock Assessment Workshop (50th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 10-17; 844 p.

Pedersen, M. W. and Berg, C. W. (2017). A stochastic surplus production model in continuous time. Fish and Fisheries, 18(2):226–243.

Richards RA. 2016. Monkfish Operational Assessment. US Dept Commer, North-east Fish Sci Cent Ref Doc. 16-09; 109 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/

Winker, H., Carvalhoc, F. Kapurc, M. (2018). JABBA: Just Another Bayesian Biomass Assessment. Fisheries Research 204 (2018): 275-288.

OARC Comments on 2019 Operational Assessment: Black Sea Bass
The operational assessment for black sea bass is an update to the 2017 benchmark assessment accepted by the SARC-62 Panel (NEFSC 2017).

The OARC concludes that the 2019 operational assessment for black sea bass is technically sufficient to evaluate stock status and provide scientific advice. The assessment represents the BSIA for this stock for management purposes. The OARC agrees with the assessment report that black sea bass is not overfished and overfishing is not occurring.

In 2017, the SARC-62 Panel approved a single stock, two area model developed to determine stock status, biological reference points (BRPs) and proxies, and to project probable short-term trends. $F_{40\%}$ proxy was recommended as a proxy for F_{MSY}. Although the two-area model had a more severe retrospective pattern in opposite directions in each area sub-unit than when a single unit was assumed, it provides reasonable model estimates after the retrospective corrections and combining the two spatial units. Thus, even though reference points are generated and stock status determinations are conducted for each subunit, the combined projections should be used.

Operational Assessment Terms of Reference: Black Sea Bass
The 2019 operational assessment updated the SARC-62 model under guidelines provided by the 2019 Assessment Oversight Panel (see appendix report from May 20, 2019) and the following Terms of references (TORs).

1. *Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment.*

This TOR was completed satisfactorily. The analyst updated all data streams consistent with the Benchmark, including the new MRIP estimates of recreational landings and discards. The new MRIP estimates are 9% to 161% larger than the previous estimates and are the only change in methodology for this TOR.

2a. Estimate annual fishing mortality, recruitment, and stock size for the time series ("Plan A"). Include estimates of uncertainty, retrospective analyses (both historical and within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

This TOR was completed satisfactorily. The uncertainty around SSB and F was provided. Although the two-area model had a moderate retrospective pattern in each area sub-unit (which mostly cancel one another out when the two areas are combined), it provides reasonable model estimates after the retrospective corrections. Using retrospective corrections is also consistent with the practices in the Benchmark.

2b. Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "Plan A" assessment were to not pass review.

This TOR was completed satisfactorily. The OARC was provided a brief overview of the Plan B model, though it was not thoroughly discussed or considered for use.

3. Update the values of biological reference points (BRPs) for this stock.

This TOR was completed satisfactorily. The BRPs were carried over from the Benchmark and recalculated using the 2019 Operational Assessment model results.

4a. Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

This TOR was completed satisfactorily. The report provides the biomass and fishing status based on the F_{MSY} proxy ($F_{40\%}$).

4b. Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

This TOR was completed satisfactorily. The report provides a qualitative description of stock status based on species distribution, survey series trends, and recruitment.

5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at F_{MSY} or at an F_{MSY} proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

This TOR was completed satisfactorily. The report provides OFL projections using a 2019 ABC that has been adjusted to reflect the new MRIP estimates. The 2020 and 2021 projected catches are based on the $F_{40\%}$ value from the Operational Assessment.

The OARC note the following important sources of scientific uncertainty

i. The MRIP recalibrated data received a thorough examination by the 2019 OARC. The lead assessment analyst drew attention to a large estimate in 2016 that was considered implausible. The impact of this observation on overall model results is uncertain. Various treatments of the anomalous MRIP data point (smoothing, exclusion, etc.) did not qualitatively affect the overall model results. However, the uncertainty in the MRIP estimates is not an input to the model.

ii. The reweighting of likelihood components during model fitting was not well described. It is unclear what weights, if any, were applied to the likelihood components. This adds to the uncertainty of the overall reliability of the model.

iii. As the weights-at-age have been changing over time, using a five year running average may have an important effect on the reference points, adding uncertainty to the reliability of model results.

iv. Uncertainty in the indices was characterized by the CVs of the standardization.

v. The retrospective pattern was large enough to need the corrections (outside the 90% confidence intervals), and the additional uncertainty caused by applying the correction is unclear. The model for the northern area has a larger retrospective pattern than the model for the southern area.

vi. The combination of the values from the northern and southern areas is done without weighting based on landings or biomass. It's unclear whether or how the uncertainty should be treated when the BRPs are combined using simple addition.

6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

This TOR was completed satisfactorily. The report outlines three main areas of research interest: examining recruitment events, distribution shifts and the changing environment, management strategy evaluations.

The OARC note the following recommendations for future work.

i. A re-evaluation of splitting the stock into two area subunits is warranted. This evaluation should include evaluating:

   a. Whether year classes can be tracked in a single stock model, as the inability to do this was a major factor motivating the decision to use the two area subunits;

   b. Genetic evidence on the structure of the population north of Cape Hatteras;

   c. Movement estimates from traditional and acoustic tagging.

ii. The fishery-independent indices included in the model should be re-examined. Only the ones that are a priori considered to capture the trends in the stock should be considered.

iii. Evaluation of natural mortality (M) used in the model. The protogynous life history of black sea bass may suggest a constant M at age is not appropriate for this species.

iv. Consideration of the impacts of range expansion on coverage of the stock in surveys and model applicability.

v. The 2011-year class was dominant in the northern area, whereas the 2015-year class was strong throughout the stock area. Exploration of the causes of the pattern and magnitude of recruitment in black sea bass is warranted.

References

Northeast Fisheries Science Center. (2017). 62nd Northeast Regional Stock Assessment Workshop (62nd SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-03; 822 p. doi: 10.7289/V5/RD-NEFSC-17-03

OARC Comments on 2019 Operational Assessment: Scup

The Operational Assessment Review Committee (OARC) determined that the 2019 operational assessment for scup represents the best available scientific information and provides an appropriate foundation to a) provide stock status determination and b) provide scientific advice to managers.

The OARC considered the analyses conducted within the guidelines provided to the NEFSC assessment scientists by the 2019 Assessment Oversight Panel (see appendix report from May 20, 2019). Scup have been assessed within a statistical catch at age framework at the Data Poor Working Group assessment (NDPSWG 2009), the 60th SAW (NEFSC 2015) , in a 2017 model update and now at the 2019 Operational Assessment Review in all cases using ASAP. The structure of the SCAA model for scup has remained largely unchanged over these assessments. This most recent assessment added 2017-2018 fishery and research survey data which included new calibrated MRIP data for 1981-2018.

Operational Assessment Terms of Reference: Scup

1. *Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment*.*

This TOR was completed successfully. Incorporation of the new MRIP data indicated that the removals of scup are now comprised of ~60% commercial (landings and discards) and 40% recreational (landings and discards). The new calibrated MRIP data indicated relatively consistent increases in recreational catch and discard for the first 2/3 of the times series. However, MRIP recreational catch and discard levels diverge increasingly from the previous estimates after 2000, particularly so for recreational discards. This pattern of divergence was expected given the hypothesized causes for the differences between the MRIP mail and phone surveys.

2a. *Estimate annual fishing mortality, recruitment, and stock size for the time series ("Plan A"). Include estimates of uncertainty, retrospective analyses (both historical and within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.*

This TOR was completed successfully. The bridging of assessment models from the SAW 60 assessment to the 2019 operational assessment was appropriate. Fit of the 2019 operational SCAA model to the new data revealed no substantially anomalous model diagnostics and accordingly, the model provides a suitable foundation for management. The 2019 Operational Assessment for scup indicates higher stock abundance and SSB and lower Fs than in earlier assessments. Neither internal retrospective biases, evaluated using a 7-year data peel, nor external retrospective biases, evaluated using a comparisons of sequential assessments, were substantial and no bias corrections were necessary.

2b. Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "Plan A" assessment were to not pass review.

This ToR was completed successfully. The OARC reviewed the *ad hoc* "Plan B" approach, but considers the analytical statistical catch at age model a more reliable foundation for management

3. Update the values of biological reference points (BRPs) for this stock.

This ToR was completed successfully. Biological reference points were estimated. The F_{MSY} proxy ($F_{40\%}$) estimate was similar to that estimated in earlier assessments. MSY and SSB_{MSY} were also similar to earlier estimates, although expected recruitments were higher. Based on model results, stock status for scup is not overfished and overfishing is not occurring.

4a. Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

The OARC agrees with the stock status determination for scup derived from the 2019 operational assessment that the stock is not overfished and overfishing is not occurring.

4b. Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

This ToR was completed successfully.

5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at F_{MSY} or at an F_{MSY} proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

This TOR was completed successfully. Short term projections were made for 2020 and 2021. These projections assume the 2019 ABC will be caught (after adjustment of the recreational catch for the new MRIP estimates of recreational catch and discard), and relied on recruitments sampled from 1984-2018.

The OARC notes the following *Important Sources of Scientific Uncertainty*

1. Following the record 2015-year class, recruitments in 2016, 2017 and 2018 have all been below the time series mean. If this trend continues, short-term projections, which assume random values from the recruitment distribution over the 1983-2018 time series, may become overestimate allowable catches.
2. The record high 2015-year class has contributed to high rates of discarding in the commercial fishery. These can be expected to decline as this year class recruits to the fishery and is fished down. The effects of this on estimates of SSB and F are uncertain.
3. The scup SCAA uses multiple selectivity blocks. The final selectivity block (2006-2018) is the longest in the model. The applicability of the most recent selectivity block to the current fishery condition is uncertain. If the fishery selectivity implied in this block changes, estimates of stock number, spawning stock biomass and fishing mortality become less reliable.

4. Most of the fishery-independent indices used in the model provide estimates of the abundance of scup < age 3. One consequence is that much of the information on the dynamics of scup of older ages arise largely from the fishery catch at age and from assumptions of the model and are not conditioned on fishery-independent observations. As a result, the dynamics of these older fish remains uncertain. Knowledge of the dynamics of these older age classes will become more important as the age structure continues to expand.

6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

The OARC notes the following recommendations for additional research or data collection.

1. Explore the applicability of the pattern of fishery selectivity in the model to the most recent catch data to determine whether a new selectivity block in the model is warranted.
2. Mean weights at age and age at maturity have declined in recent years. Continued monitoring of both is warranted to determine if these are reversible density-dependent responses or arise from a different mechanism.
3. It was conjectured that the increase in stock biomass since 2000 resulted from increased recruitments resulting from the imposition of gear restriction areas (GRAs) to minimize interactions between scup and squid fisheries and from increases in commercial mesh sizes. Low frequency climate variations is a potential alternative explanation for increased recruitments from 2000-20015. Research to explore the validity of both hypotheses is warranted.

References

Northeast Data Poor Stocks Working Group. 2009. The Northeast Data Poor Stocks Working Group Report, December 8-12, 2008 Meeting. Part A. Skate species complex, deep sea red crab, Atlantic wolffish, scup, and black sea bass. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-02; 496 p.

Northeast Fisheries Science Center. (2015). 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-08; 870 p. doi: 10.7289/V5W37T9T

OARC Comments on 2019 Operational Assessment: Bluefish

The operational assessment for bluefish is an update of the approach adopted in the 2015 benchmark assessment. A statistical catch-at-age approach was adopted for bluefish at SARC 60 (NEFSC 2015) and was updated for this operational assessment.

The OARC concludes that the 2019 operational assessment for bluefish is technically sufficient to evaluate stock status and provide scientific advice. The assessment represents the BSIA for this stock for management purposes. The OARC agrees with the assessment report that bluefish is overfished but overfishing is not occurring. The OARC notes that if retrospective adjustments were applied to the assessment results, the stock biomass would be even further below the overfished definition. However, the standard procedures used by stock assessment analysts at the NEFSC would not call for the application of a retrospective correction as the retrospectively adjusted values do not exceed the 90% confidence intervals for the base model output.

Terms of Reference: Bluefish

1. *Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment.*

The OARC determined that TOR 1 was addressed sufficiently. The primary change to the previous benchmark was the updated estimates of recreational landings and discards. These estimates differed both in their magnitude and trend from the previous estimates, with the new estimates being higher in magnitude and showing a somewhat different trend in the most recent years. In addition, all the other data series were updated, and the model fits and diagnostics seemed reasonable.

The committee noted that the revised MRIP time series did not decrease to the original estimates in the early 80s as would be expected if the original MRFSS telephone survey was accurate. Additionally, the relative differences in catches were different for bluefish than for the other species reviewed. It was not clear why there was a large increase in the new MRIP estimates in the early 1980s. The difference between the old and new MRIP estimates was different for retained catch and discards. It was not clear why this difference occurred, but it was noted that supplemental data programs are used to describe the length composition of discards because discarded fish are larger on average than kept fish.

Additionally, the committee noted that there was a recent increase in average weight at age. This increase may be due to changing availability of large offshore fish. Changing availability of these large fish may also explain the recent decrease in commercial catch.

2. *a.) Estimate annual fishing mortality, recruitment, and stock size for the time series ("Plan A"). Include estimates of uncertainty, retrospective analyses (both historical and within-*

model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

The OARC agreed that TOR 2 was met. The updated stock assessment included estimates of fishing mortality rates, recruitment and stock size. The updated stock assessment also included estimates of uncertainty, retrospective analyses and bridge runs to document changes from the benchmark.

The largest change in the updated stock assessment was an increase in the scale of the population that was caused by the substantially higher estimates of recreational catch. Additionally, the stock assessment results indicated somewhat different trends in fishing mortality rates and biomass from the previous benchmark with fishing mortality rates remaining high (instead of decreasing) and biomass decreasing (instead of remaining relatively flat). These changes in the trends of fishing mortality and biomass were caused by the changes in the trends of the new recreational catch time series while the indices were unchanged.

2. *b.) Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "Plan A" assessment were to not pass review.*

The OARC looked at the plan B for information purposes only because the updated stock assessment was accepted.

3. Update the values of biological reference points (BRPs) for this stock.

The OARC agreed that this TOR was met. The fishing mortality rate reference point ($F_{35\%}$) was very similar to the estimate from the previous benchmark. However, the SSB reference points approximately doubled from the previous benchmark values. This increase in the SSB reference points was caused by the increased scale of the population estimates when the new MRIP estimates were used.

4. a.) Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

b.) Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

The OARC agreed that this TOR was met. The stock assessment results indicated that overfishing was not occurring, but the stock is overfished because of the increase $B_{Threshold}$. The committee notes that adjusting the estimates for the model's retrospective pattern resulted in the same determination of overfished for stock status (although the retrospective corrections were not applied because the adjusted values fell within the 90% confidence intervals). Qualitative descriptions of stock status were included.

5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at F_{MSY} or at an F_{MSY} proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

The OARC agreed that this TOR was met. Projections were conducted to calculate potential OFLs and MCMC was used to characterize uncertainty in the OFL. Short term projections were made for 2020 and 2021. These projections assume the 2019 ABC will be caught.

The revised MRIP estimates are an important new source of uncertainty. In particular, the trend of the recreational catch estimates has an important influence on recent estimates of biomass and on the stock status estimates. The revised MRIP estimates had a different trend (relative to the old estimates) than was present for the other species reviewed. The pattern in the new MRIP data are an important source of uncertainty in determination of stock status and in short term projections.

The assumption that the 2019 ABC will be fully caught is a source of uncertainty in the model projections, as the bluefish ABC has not been attained in recent years.

6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

The OARC agreed that this TOR was met. In addition to the research ideas presented in the report, the committee highlights that a primary source of uncertainty is the recreational catch time series. The MRIP trend does not seem consistent with hypothesized reasons for differences between the mail and phone surveys. This historical correction to the MRIP estimates for bluefish should be explored further to evaluate the causes of differences from other species and to consider their plausibility.

References

Northeast Fisheries Science Center. 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-08; 870 p. doi: 10.7289/V5W37T9T

OARC Recommendations for Process Improvements

The OARC makes the following suggestions to improve the process for peer review of operational assessments.

1) Documentation of model fits and diagnostics. The Operational Assessment Review Committee was asked to determine whether the operational assessments under consideration were "technically sufficient to (a) evaluate stock status and (b) provide scientific advice." The OARC believe that such a determination requires access to appropriate statistics and diagnostic plots of model fit. Without such information, the OARC believes it would not be possible to evaluate the performance of the updated assessments required to make the determinations requested of the committee. The model fit and diagnostic materials should be provided routinely to OARC members in the future. These do not need to be included in the assessment summary or in the presentations, but appropriate output files should be available for the review committee to review. More specifically, there is a need to identify explicitly descriptions of the decisions regarding likelihood components, coefficients of variation on data inputs and restrictions on estimability of individual parameters.

2) The OARC received an assessment summary and a detailed presentation that provided many of the technical details of the operational assessments under consideration. The OARC believes strongly that both the assessment summary and the detailed presentations be published as a record of the review meeting.

3) The terms of reference for this meeting did not specifically include a ToR that addressed documenting and evaluating the principal sources of scientific uncertainty associated with the assessment for each species. Such an evaluation would be very useful to the relevant SSCs and Councils in developing management recommendations. The OARC recommends that a ToR that explicitly addresses scientific uncertainty as it relates to biological reference points and projections be added in the future.

4) In developing guidelines for each assessment, the AOP should charge the assessment team to respond explicitly to the sources of uncertainty identified by the relevant SSC related to the estimation to the distribution and point estimates of OFL associated with the previous assessments. It is expected that the update assessment will not be able to address all important sources of uncertainty identified by the SSC, deferring action on these questions to a future research or benchmark assessment. In such cases, the update assessment report would simply conclude "Action to address this source of uncertainty is beyond the scope of an update assessment and is deferred to a subsequent research track assessment." However, where progress has been made, it should be noted and clearly reported to the staff, SSC and members of the relevant Council.

Stock Assessment Terms of Reference

Operational Stock Assessment TORs for Aug. 2019 Review
(Based on: 2011 Operational Assessment Process White Paper, and NEFSC edits. v.6/3/2019)

1. Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment*.

2. a.) Estimate annual fishing mortality, recruitment, and stock size for the time series ("Plan A"). Include estimates of uncertainty, retrospective analyses (both historical and within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

   b.) Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "Plan A" assessment were to not pass review.

3. Update the values of biological reference points (BRPs) for this stock.

4. a.) Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

   b.) Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at F_{MSY} or at an F_{MSY} proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

* Major changes from the previous stock assessment require pre-approval by the Assessment Oversight Panel.

A: Black Sea Bass Operational Assessment for 2019
(Lead: Gary Shepherd)

State of Stock
This assessment of black sea bass (*Centropristis striata*) is an update through 2018 of commercial and recreational catch data, research survey and fishery-dependent indices of abundance, and the analyses of those data. The black sea bass stock was not overfished and overfishing was not occurring in 2018 relative to the updated biological reference points (Figure A1). Spawning stock biomass (retro adjusted SSB) was estimated to be 33,407 mt in 2018, about 2.4 times the updated biomass target reference point SSB_{MSY} proxy = $SSB_{40\%}$ = 14,092 mt (Table A1, Figure A2). There is a 90% chance that SSB in 2018 was between 25,946 and 41,932 mt. Fishing mortality on the fully selected ages 6-7 fish was 0.42 in 2018 after adjusting for retrospective biases, which was 91% of the updated fishing mortality threshold reference point F_{MSY} proxy = $F_{40\%}$ = 0.46 (Table A1, Figure A3). There is a 90% probability that the fishing mortality rate in 2018 was between 0.32 and 0.60. The average recruitment from 1989 to 2018 is 36 million fish at age 1. The 2011 year class was estimated to be the largest in the time series at 144.7 million fish and the 2015 year class was the second largest at 79.4 million fish. Recruitment of the 2017 year class as age 1 in 2018 was estimated at 16.0 million, well below average (Table A1, Figures A2 & A4). The 2018 model estimates of F and SSB adjusted for internal retrospective error are outside the model estimate 90% confidence intervals and so the terminal year estimates have been adjusted for stock status determination and projections (Figure A1).

OFL Projections
Projections using the 2019 Operational Assessment ASAP model (data through 2018) were made to estimate the OFL catches for 2020-2021. The projections assume that the 2019 ABC of 6,716 mt in the north and 1,200 mt in the south (both adjusted for new MRIP estimates) will be taken in 2019 and sampled from the estimated recruitment for 2000-2018. The OFL projection for combined regions uses F_{2020}-F_{2021} = updated F_{MSY} proxy = $F_{40\%}$ = 0.46. The OFL catches are 8,795 mt in 2020 (CV =20%) and 7,377 mt in 2021 (CV =17%).

OFL for 2020-2021
Catches and SSB in metric tons

Year	Total Catch	F	SSB
2019	7,917	0.33	27,659
2020	8,795	0.46	22,699
2021	7,377	0.46	20,379

Catch
Reported 2018 commercial landings were 1,515 mt = 3.338 million lbs. Estimated 2018 recreational landings were 4,008 mt = 8.836 million lbs. Total commercial and recreational landings in 2018 were 5,522 mt = 12.174 million lbs. Estimated 2018 commercial discards were 722 mt = 1.591 million lbs. Estimated 2018 recreational discards were 1,033 mt = 2.277 million lbs. The estimated total catch in 2018 was 7,277 mt = 16.043 million lbs.

In July 2018, the Marine Recreational Information Program (MRIP) replaced the existing estimates of recreational catch ('Old' MRIP) with a calibrated 1981-2017 time series ('New' MRIP) that corresponds to new survey methods that were fully implemented in 2018. For comparison with the existing estimates noted above, the New MRIP estimate of 2017 recreational landings is 5,692 mt = 12.549 million lbs, 2.6 times the Old estimate. The New MRIP estimate of 2017 recreational discards is 1,634 mt = 3.603 million lb, 2.8 times the Old estimate. The New MRIP recreational catch estimates increased the 1981-2017 total catch by an average of 73% (from 1,687 mt = 3.719 million lb to 2,927 mt = 6.453 million lb), ranging from +9% in 1995 to +161% in 2017. The increase in 2017 was from 2,802 mt = 6.177 million lb to 7,327 mt =16.153 million lb. The 2019 updated assessment model includes the New MRIP estimates of recreational landings and discards (Catch and Status Table below; Table A2).

Catch and Status Table: Black Sea Bass
(Weights in mt, recruitment in millions, arithmetic means, includes New MRIP estimates)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Commercial landings	523	751	765	782	1,027	1,088	1,113	1,133	1,808	1,514
Commercial discards[2]	167	134	227	116	278	459	423	757	1,027	722
Recreational landings	2,525	3,502	1,421	3,162	2,685	3,510	4,448	6,131	5,692	4,008
Recreational discards[2]	623	733	358	1,048	749	839	985	1,391	1,634	1,033
Catch used in assessment	3,838	5,121	2,771	5,108	4,739	5,896	6,969	9,412	10,162	7,277
Spawning stock biomass	11,125	14,061	14,129	16,730	23,657	34,712	33,242	30,736	26,176	22,199
Recruitment (age 1, millions)	34.1	34.4	39.6	144.7	47.8	26.2	34.2	79.4	47.3	10.1
F full[3]	0.67	0.76	0.41	0.60	0.57	0.42	0.33	0.35	0.52	0.39

Year	Min[1]	Max[1]	Avg[1]
Commercial landings	523	1,808	1,152
Commercial discards[2]	10	1,027	213
Recreational landings	681	6,131	2,399
Recreational discards[2]	99	1,634	583
Catch used in assessment	2,263	10,162	4,274
Spawning stock biomass	3,044	34,712	11,499
Recruitment (age 1, millions)	10.1	144.7	36.1
F full[3]	0.33	114	0.66

[1] Years 1989-2018

[2] dead discards

[3] Average F on fully selected ages 6-7. Note that table values are not retro adjusted.

Stock Distribution and Identification
The Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plan for black sea bass defines the management unit as all black sea bass from Cape Hatteras, North Carolina northeast to the US-Canada border (MAFMC 1999). The stock was partitioned into two sub-units to account for spatial differences in the assessment model. The sub-units are not considered to be separate stocks.

Assessment Model
The assessment models (separate north and south models) for black sea bass is a complex statistical catch-at-age model (ASAP SCAA; Legault and Restrepo 1998; NFT 2013) incorporating a broad range of fishery and survey data (NEFSC 2017). The model assumes an instantaneous natural mortality rate (M) = 0.4. The fishery catch in each region is modeled as two fleets: trawl catch and non-trawl catch, which includes recreational landings, recreational discards, commercial fish pot and hand-line catch and catches from other non-trawl sources.

Indices of stock abundance for the north region used in the model were from NEFSC Albatross spring, MA DMF spring trawl, RI DFW spring trawl, CT DEEP spring Long Island trawl, New York DEC juvenile seine, NEFSC Bigelow spring, NEAMAP spring bottom trawl and MRIP catch per angler trip. The indices of abundance for the southern region were from NEFSC Albatross winter, NEFSC Albatross spring, New Jersey DEP spring trawl, DE DFW spring trawl, MD DNR spring coastal bays trawl, VIMS Chesapeake Bay juvenile trawl, NEAMAP spring trawl, NEFSC Bigelow spring trawl and MRIP catch per angler trip. Indices for both regions were comparable to those used in the 2016 benchmark assessment.

There remains a significant retrospective pattern in both the northern and southern assessment models. The retrospective pattern in the north over-estimates F by 44% over the last 5 terminal years and under-estimates SSB by 43%. In the southern region, the opposite pattern prevails where F is under-estimated by 22% and SSB is over-estimated by 22%. The 2018 regional model estimates of F and SSB were adjusted for internal retrospective error (north F (0.46) adjusted for retrospective = 0.32, north SSB (15,924 mt) adjusted for retrospective = 28,063 mt; south F (0.38) adjusted for retrospective = 0.49, south SSB (6,539 mt) adjusted for retrospective = 5,361 mt). Since the retrospective corrected values generally fell outside the 90% confidence intervals of the terminal year estimates, the retrospective adjusted values were used for status determination and OFL's. The historical retrospective analysis (comparison between assessments) indicates that the trends in spawning stock biomass, recruitment and fishing mortality have been consistent between the benchmark assessment (2016) and the 2019 update.

Biological Reference Points (BRPs)
Reference points were calculated using the non-parametric yield and SSB per recruit long-term projection approach. The cumulative distribution function of the 2000-2018 recruitments (equivalent to years used in 2016 benchmark assessment) was re-sampled to provide future recruitment estimates for the projections used to estimate the biomass reference point.

The existing biological reference points for black sea bass are from the 2016 SAW 62 benchmark assessment (NEFSC 2017). The reference points are $F_{40\%}$ as the proxy for F_{MSY}, and the corresponding $SSB_{40\%}$ as the proxy for the SSB_{MSY} biomass target. The $F_{40\%}$ proxy for F_{MSY}

=0.36; the proxy estimate for SSB_{MSY} = $SSB_{40\%}$ = 9,667 mt = 21.312 million lbs; the proxy estimate for the ½ SSB_{MSY} biomass threshold = ½ $SSB_{40\%}$=4,834 mt = 10.657 million lbs; and the proxy estimate for MSY = $MSY_{40\%}$ = 3,097 mt=6.828 million lbs.

The $F_{40\%}$ and corresponding $SSB_{40\%}$ proxy biological reference points for black sea bass were updated for this 2019 Operational Assessment. The update fishing mortality threshold $F_{40\%}$ proxy for F_{MSY} = 0.46. The updated biomass target proxy estimate for SSB_{MSY} = $SSB_{40\%}$ = 14,092 mt = 31.067 million lbs. and the updated biomass threshold proxy estimate for ½ SSB_{MSY} = ½ $SSB_{40\%}$ = 7,046mt = 15.534 million lbs. The update proxy estimate for MSY = $MSY_{40\%}$ = 4,773 mt =10.522 million lbs.

Qualitative status description

The distribution of the fishery and catches has shifted north over the past decade. Most survey aggregate biomass indices are near their time series high. Recent survey indices suggest the recruitment of a large 2011 year class in the northern region and a strong 2015 year class in both regions. Modest catches over the past few years would indicate that current mortality from all sources is lower than recent recruitment inputs to the stock, which has resulted in a spawning biomass that is well above the management target. Despite uncertainty associated with the most recent year estimates, exploitable biomass is expected to decrease in coming years due to poor recruitment by the 2017 cohort along with declining abundance of the 2015 cohort.

Research and Data Issues

The recent recruitment of large year classes in the assessment time series (the 2011 and 2015 year class) has contributed to increases in catch, particularly in the northern region. Additional research examining recruitment events, distribution shifts and the changing environment should be explored.

Spatial differences in recruitment and fisheries have been accounted for with independent assessment models for north and south regions. A single model which tracks the spatial differences in the population dynamics should be developed.

Allocation issues continue to be an important management issue. Development of a Management Strategy Evaluation (MSE) model could be helpful in determining the best approach.

References

Legault CM, Restrepo VR. 1998. A flexible forward age-structured assessment program. ICCAT. Col. Vol. Sci. Pap. 49:246-253.

Mid-Atlantic Fishery Management Council. (MAFMC). 1999. Amendment 12 to the summer flounder, scup, and black sea bass fishery management plan. Dover, DE. 398 p + appendix.

Northeast Fisheries Science Center (NEFSC). 2017. 62th Northeast Regional Stock Assessment Workshop (62th SAW) Assessment Report. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 17-03; 822 p.

NOAA Fisheries Toolbox (NFT). 2013. Age Structured Assessment Program (ASAP) version 3.0.11. (Internet address: http://nft.nefsc.noaa.gov).

Tables

Table A1. Summary Black Sea Bass assessment results; Spawning Stock Biomass (SSB) in metric tons (mt); Recruitment (R) at age 0 in millions; Fishing Mortality (F) for age of peak fishery selection, ages 6-7. North-South averages, unadjusted for retrospective bias.

	SSB	R	F
1989	3,181	24,387	1.14
1990	3,044	29,781	1.09
1991	3,134	34,070	1.04
1992	3,433	29,042	0.93
1993	3,449	19,965	1.06
1994	3,475	28,660	0.87
1995	4,089	36,892	0.74
1996	4,308	26,613	0.92
1997	4,131	26,816	0.84
1998	4,636	22,880	0.60
1999	5,893	37,237	0.55
2000	7,483	46,765	0.54
2001	9,557	27,538	0.62
2002	10,081	31,597	0.66
2003	9,580	19,697	0.58
2004	8,247	15,713	0.57
2005	7,771	16,564	0.52
2006	6,443	30,816	0.55
2007	6,726	35,359	0.55
2008	9,544	45,513	0.49
2009	11,125	34,059	0.67
2010	14,061	34,419	0.76
2011	14,129	39,651	0.41
2012	16,730	144,684	0.60
2013	23,657	47,802	0.57
2014	34,712	26,240	0.42
2015	33,242	34,338	0.33
2016	30,736	79,373	0.35
2017	26,176	47,293	0.52
2018	22,199	10,058	0.39

Table A2. Total catch (metric tons) of black sea bass from Maine through North Carolina. Includes the 'New' MRIP estimates of recreational catch. Recreational discards assume 15% mortality.

	Commercial Landings	Commercial Discards	Recreational Landings	Recreational Discards	Total
1989	1,105	109	1,881	99	3,194
1990	1,402	53	1,354	231	3,040
1991	1,190	10	1,766	175	3,142
1992	1,264	141	1,344	165	2,914
1993	1,353	78	2,022	120	3,573
1994	848	37	1,347	210	2,443
1995	889	24	1,860	397	3,171
1996	1,448	285	2,755	236	4,724
1997	1,197	55	2,470	251	3,973
1998	1,152	121	681	310	2,263
1999	1,290	45	856	545	2,736
2000	1,186	44	1,836	873	3,939
2001	1,279	240	2,621	886	5,025
2002	1,564	46	2,528	1,381	5,518
2003	1,347	114	2,492	641	4,595
2004	1,405	380	1,362	374	3,521
2005	1,297	89	1,437	350	3,173
2006	1,285	33	1,243	371	2,933
2007	1,037	104	1,425	354	2,920
2008	875	66	1,606	585	3,132
2009	523	167	2,525	623	3,838
2010	751	134	3,502	733	5,121
2011	765	227	1,421	358	2,771
2012	782	116	3,162	1,048	5,108
2013	1,027	278	2,685	749	4,739
2014	1,088	459	3,510	839	5,896
2015	1,113	423	4,448	985	6,969
2016	1,133	757	6,131	1,391	9,412
2017	1,808	1,027	5,692	1,634	10,162
2018	1,514	722	4,008	1,033	7,277

Figures

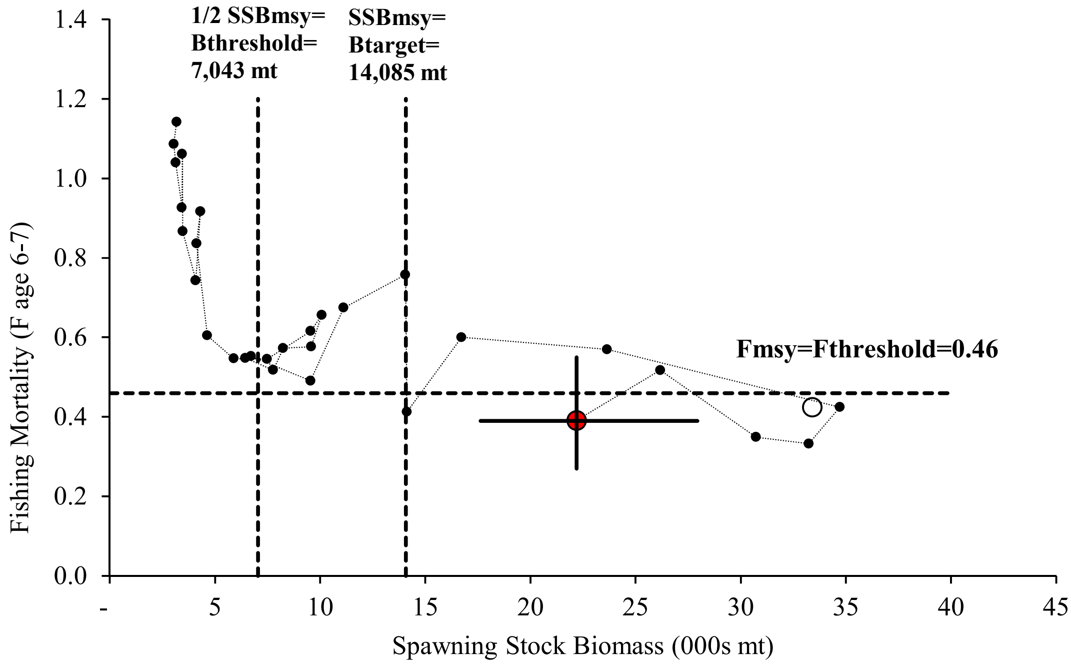


Figure A1. Estimates of black sea bass spawning stock biomass (SSB) and fully-recruited fishing mortality (F, peak at ages 6-7) relative to the updated 2019 biological reference points. Filled circle with 90% confidence intervals shows the assessment point estimates. The open circle shows the retrospectively adjusted estimates.

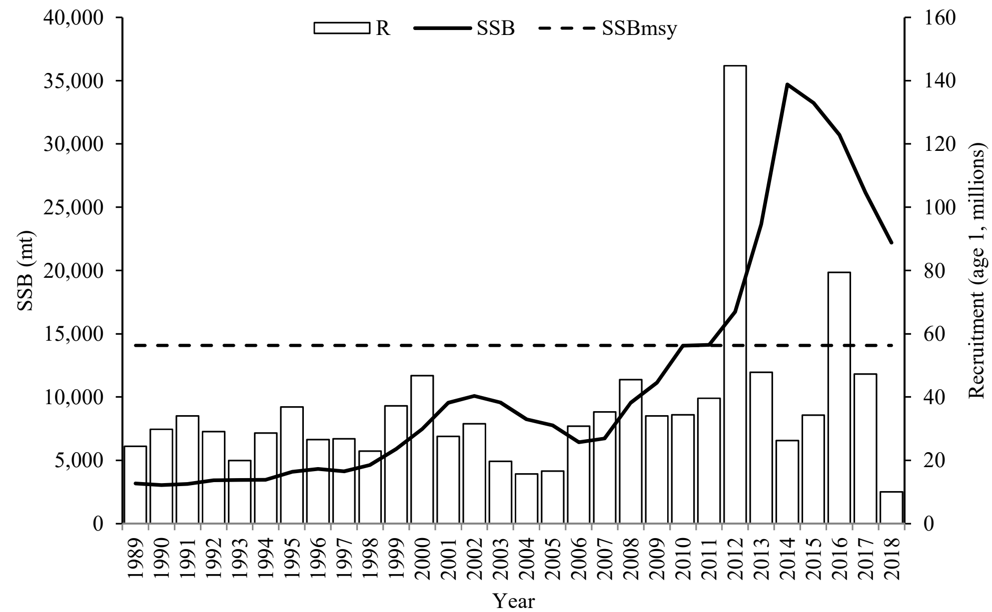


Figure A2. Black sea bass spawning stock biomass (SSB; solid line) and recruitment at age 0 (R; vertical bars) by calendar year. The horizontal dashed line is the updated SSB_{MSY} proxy = $SSB_{40\%}$ = 14,092 mt.

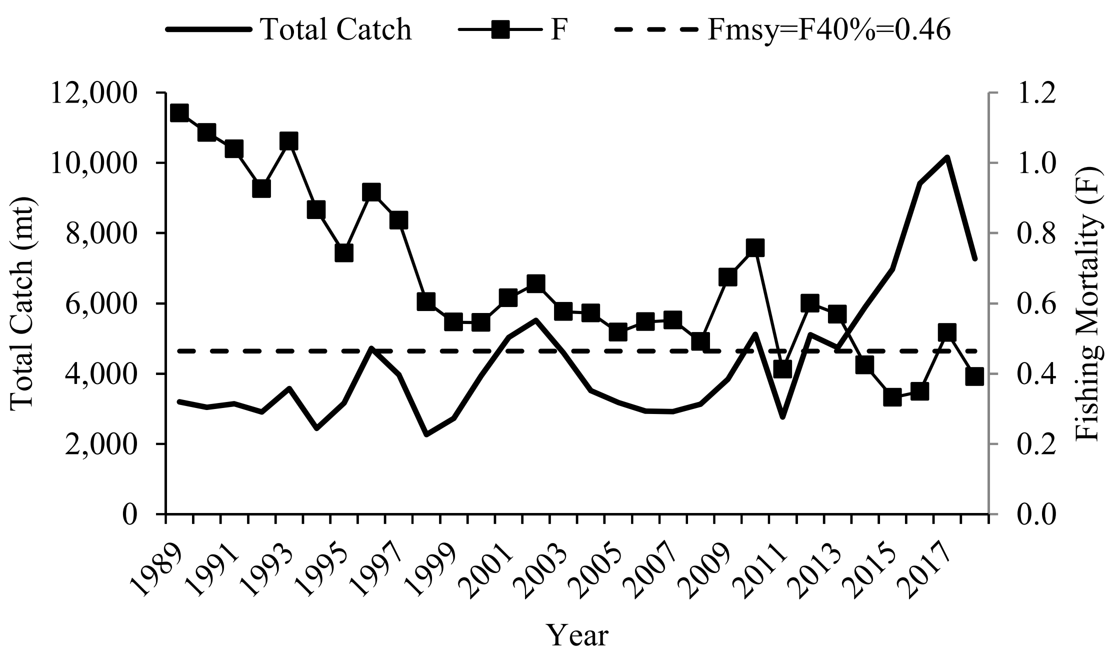


Figure A3. Total fishery catch (metric tons; mt; solid line) and fishing mortality (F, peak at age 6-7; squares) for black sea bass. The horizontal dashed line is the updated F_{MSY} proxy = $F_{40\%}$ = 0.46.

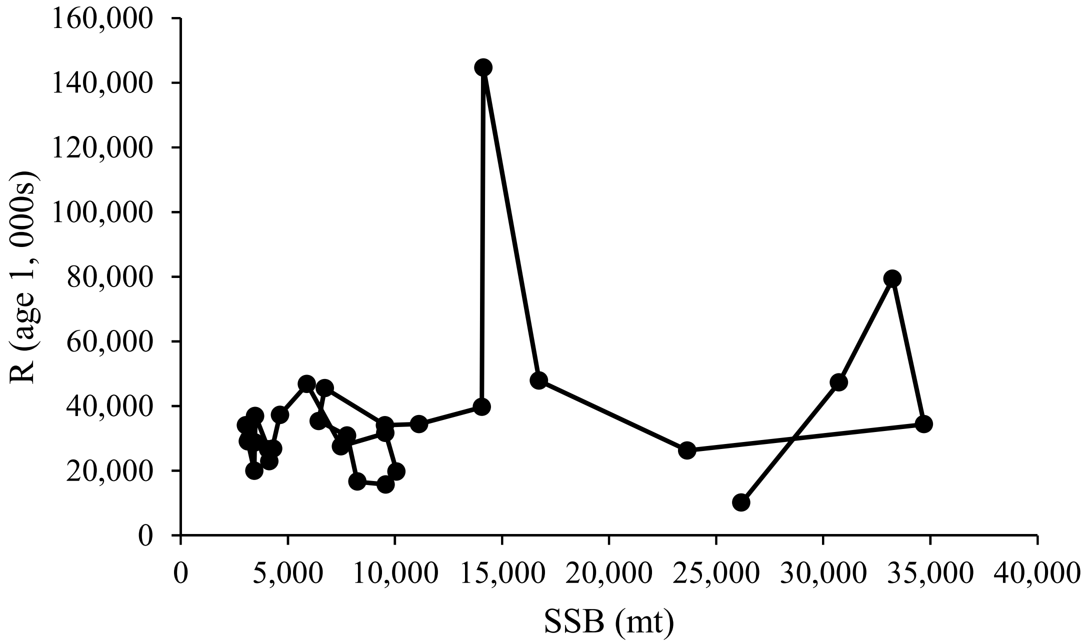


Figure A4. Spawning Stock Biomass (SSB) and Recruitment (R) scatter plot for black sea bass.

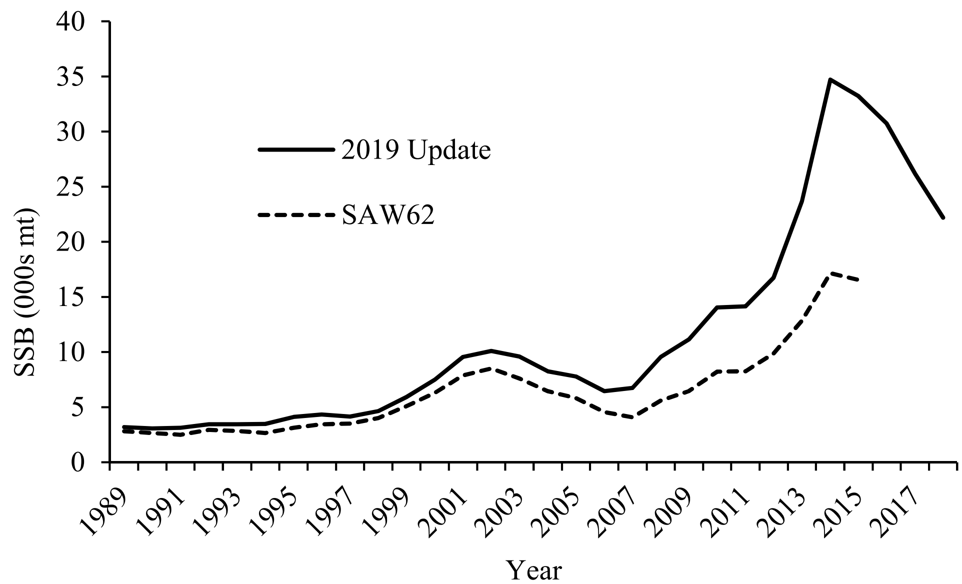


Figure A5. Historical retrospective of the 2016 (SAW 62; NEFSC 2017) and 2019 (Operational Assessment) stock assessments of black sea bass. The heavy solid lines are the 2019 Operational Assessment estimates that include the New MRIP recreational catch.

B: Scup Operational Assessment for 2019
(Lead: Mark Terceiro)

State of Stock
This assessment of scup (*Stenotomus chrysops*) is an update through 2018 of commercial and recreational fishery catch data, research survey indices of abundance, and analyses of those data. The scup stock was not overfished and overfishing was not occurring in 2018 relative to the updated biological reference points (Figure B1). Spawning stock biomass (SSB) was estimated to be 186,578 mt in 2018, about 2 times the updated biomass target reference point SSB_{MSY} proxy = $SSB_{40\%}$ = 94,020 mt (Table B1, Figure B2). There is a 90% chance that SSB in 2018 was between 159,746 and 221,281 mt. Fishing mortality on the fully selected age 3 fish was 0.158 in 2018, 73% of the updated fishing mortality threshold reference point F_{MSY} proxy = $F_{40\%}$ = 0.215 (Table B1, Figure B3). There is a 90% probability that the fishing mortality rate in 2018 was between 0.123 and 0.195. The average recruitment from 1984 to 2018 is 134 million fish at age 0. The 2015 year class is estimated to be the largest in the time series at 326 million fish, while the 2016-2018 year classes are estimated to be below average. (Table B1, Figures B2, B4). The 2018 model estimates of F and SSB adjusted for internal retrospective error are within the model estimate 90% confidence intervals and so no adjustment of the terminal year estimates has been made for stock status determination or projections (Figure B1). The stock has sustained catches above MSY since 2013. However, stock biomass is projected to further decrease toward the target unless more above average year classes recruit to the stock in the short term.

OFL Projections
Projections using the 2019 Operational Assessment ASAP model (data through 2018) were made to estimate the OFL catches for 2020-2021. The projections assume the 2019 ABC of 16,525 mt with recreational catch in 'New' MRIP equivalents will be taken in 2019, providing an estimated catch of 20,711 mt in 2019. The projections sample from the estimated recruitment for 1984-2018. The OFL projection uses F2020-F2021 = updated F_{MSY} proxy = $F_{40\%}$ = 0.215. The OFL catches are 18,674 mt in 2020 (CV = 17%) and 15,696 mt in 2021 (CV = 16%).

OFL for 2020-2021
Catches and SSB in metric tons

Year	Total Catch	Landings	Discards	F	SSB
2019	20,711	16,642	4,070	0.208	183,137
2020	18,674	15,472	3,664	0.215	163,495
2021	15,696	12,530	3,714	0.215	149,089

Catch
Reported 2018 commercial landings were 6,064 mt = 13.369 million lb. Estimated 2018 recreational landings were 5,887 mt = 12.979 million lb. Total commercial and recreational landings in 2018 were 11,951 mt = 26.347 million lb. Estimated 2018 commercial discards were 3,293 mt = 7.260 million lb. Estimated 2018 recreational discards were 644 mt = 1.420 million

lb. The estimated total catch in 2018 was 15,888 mt = 35.027 million lb (Catch and Status Table below; Table B2).

In July 2018, the Marine Recreational Information Program (MRIP) replaced the existing estimates of recreational catch ('Old' MRIP) with a calibrated 1981-2017 time series ('New' MRIP) that corresponds to new survey methods that were fully implemented in 2018. For comparison with the existing estimates noted above, the 'New' MRIP estimate of 2017 recreational landings is 6,143 mt = 13.543 million lb, 2.5 times the 'Old' estimate. The 'New' MRIP estimate of 2017 recreational discards is 1,079 mt = 2.372 million lb, 2.7 times the 'Old' estimate. The 'New' MRIP recreational catch estimates increased the 1981-2017 total catch by an average of 18% (from 9,575 mt = 21.109 million lb to 11,310 mt = 24.934 million lb), ranging from +1% in 1986 to +51% in 2000. The increase in 2017 was +30%, from 14,608 mt = 32.205 million lb to 18,961 mt = 41.802 million lb. The 2019 updated assessment model includes the 'New' MRIP estimates of recreational landings and discards (Catch and Status Table below; Table B2).

Catch and Status Table: Scup

Catch weights in metric tons (mt); spawning stock biomass thousands of metric tons; recruitment in millions of age 0 fish; min, max and arithmetic mean values are for 1984-2018. Commercial catches are latest reported landings and estimated discards. Recreational catches are 'New' MRIP 2018 calibrated landings and discard estimates.

Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Commercial landings	3,721	4,866	6,819	6,751	8,105	7,239	7,725	7,147	7,006	6,064
Commercial discards	3,189	2,638	1,234	1,029	1,279	1,004	1,774	2,772	4,733	3,293
Recreational landings	2.851	5,660	4,682	3.751	5,739	4,659	5,527	4,536	6,143	5,887
Recreational discards	552	787	516	636	568	480	581	862	1,079	644
Catch used in assessment	10,313	13,951	13,252	12,166	15,692	13,382	15,606	15,317	18,961	15,888
Spawning stock biomass	194	234	237	237	237	224	191	200	193	187
Recruitment (age 0)	128	143	199	114	106	235	326	112	93	83
Fully selected F (age 4)	0.074	0.090	0.086	0.086	0.119	0.113	0.158	0.140	0.167	0.158

Year	**Min**	**Max**	**Mean**
Commercial landings	1,207	8,105	4,887
Commercial discards	436	4,733	1,819
Recreational landings	824	6,430	3,893
Recreational discards	30	1,079	336
Catch used in assessment	3,485	18,961	11,430
Spawning stock biomass	3.5	237.5	93.1
Recruitment (age 0)	37.5	325.9	133.5
Fully selected F (age 4)	0.066	1.593	0.521

Stock Distribution and Identification
The Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC) Joint Fishery Management Plan defines the management unit as all scup from Cape Hatteras, North Carolina northeast to the US-Canada border (MAFMC 1999).

Assessment Model
The assessment model for scup is a complex statistical catch-at-age model (ASAP SCAA; Legault and Restrepo 1998; NFT 2013) incorporating a broad range of fishery and survey data (NEFSC 2015). The model assumes an instantaneous natural mortality rate (M) = 0.2. The fishery catch is modeled as four fleets: commercial landings, recreational landings, commercial discards and recreational discards.

Indices of stock abundance from NEFSC winter, spring, and fall, Massachusetts DMF spring and fall, Rhode Island DFW spring and fall, University of Rhode Island Graduate School of Oceanography (URIGSO), RI Industry Cooperative trap, Connecticut DEEP spring and fall, New York DEC, New Jersey DFW, Virginia Institute of Marine Science (VIMS) Chesapeake Bay, VIMS juvenile fish trawl, and NEAMAP spring and fall trawl surveys were used in the 2015 SAW 60 benchmark assessment (NEFSC 2015) and the 2017 assessment update. All indices were updated for this 2019 Operational Assessment.

There is not a major retrospective pattern evident in the scup assessment model. The minor internal model retrospective error tends to overestimate F by +26% and underestimate SSB by -11% over the last 7 terminal years. The 2018 model estimates of F and SSB adjusted for internal retrospective error (F = 0.124; SSB = 213,721 mt) are within the model estimate 90% confidence intervals and so no adjustment of the terminal year estimates has been made for stock status determination or projections. The 'historical' retrospective analysis (comparison between assessments) indicates that the general trends in spawning stock biomass, recruitment, and fishing mortality have been consistent for the last decade (Figure B5).

Biological Reference Points (BRPs)
Reference points were calculated using the non-parametric yield and SSB per recruit long-term projection approach. The cumulative distribution function of the 1984-2018 recruitment (corresponding to the period of input fishery catches-at-age) was re-sampled to provide future recruitment estimates for the projections used to estimate the biomass reference point.

The existing biological reference points for scup are from the 2015 SAW 60 benchmark assessment (NEFSC 2015). The reference points are $F_{40\%}$ as the proxy for F_{MSY}, and the corresponding $SSB_{40\%}$ as the proxy for the SSB_{MSY} biomass target. The $F_{40\%}$ proxy for F_{MSY} = 0.220; the proxy estimate for SSB_{MSY} = $SSB_{40\%}$ = 87,302 mt = 192.468 million lbs; the proxy estimate for the ½ SSB_{MSY} biomass threshold = ½ $SSB_{40\%}$ = 43,651 mt = 96.234 million lbs; and the proxy estimate for MSY = $MSY_{40\%}$ = 11,752 mt = 25.909 million lbs.

The $F_{40\%}$ and corresponding $SSB_{40\%}$ proxy biological reference points for scup were updated for this 2019 Operational Assessment. The updated fishing mortality threshold $F_{40\%}$ proxy for F_{MSY} = 0.215. The updated biomass target proxy estimate for SSB_{MSY} = $SSB_{40\%}$ = 94,020 mt = 207.279 million lbs and the updated biomass threshold proxy estimate for ½ SSB_{MSY} = ½

$SSB_{40\%}$ = 47,010 mt = 103.639 million lbs. The updated proxy estimate for MSY = $MSY_{40\%}$ = 12,927 mt = 28.499 million lbs.

Qualitative status description

The age structure in current fishery and survey catches is greatly expanded compared to the truncated distribution observed in the early 1990s. Most survey aggregate biomass indices are near their time series high. Recent survey indices suggest the recruitment of several large year classes over the last 15 years. These simple metrics indicate that current mortality from all sources is lower than recent recruitment inputs to the stock, which has resulted in a spawning stock biomass that is well above the management target.

Research and Data Issues

The recent recruitment of the largest year class in the assessment time series (the 2015 year class) has contributed to recent high commercial fishery discards. The exploration of management actions to reduce discarding in the event of future high recruitment events might include modification of the commercial fishery Gear Restricted Areas and modified commercial mesh sizes.

There is evidence of a decreasing trend in mean weights at age and maturity, perhaps indicative of density dependent effects. Potential effects on reference points and projected fishery yield should continue to be closely monitored.

The stock has sustained catches above MSY since 2013. However, spawning stock biomass is projected to further decrease toward the target unless more above average year classes recruit to the stock in the short term.

References

Legault CM, Restrepo VR. 1998. A flexible forward age-structured assessment program. ICCAT. Col. Vol. Sci. Pap. 49:246-253.

Mid-Atlantic Fishery Management Council. (MAFMC). 1999. Amendment 12 to the summer flounder, scup, and black sea bass fishery management plan. Dover, DE. 398 p + appendix.

Northeast Fisheries Science Center (NEFSC). 2009. The Northeast Data Poor Stocks Working Group Report, December 8-12, 2009 Meeting. Part A: Skate species complex, deep sea red crab, Atlantic wolffish, scup, and black sea bass. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 09-02; 496 p.

Northeast Fisheries Science Center (NEFSC). 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 15-08; 870 p.

NOAA Fisheries Toolbox (NFT). 2013. Age Structured Assessment Program (ASAP) version 3.0.11. (Internet address: http://nft.nefsc.noaa.gov).

Tables

Table B1. Summary assessment results; Spawning Stock Biomass (SSB) in metric tons (mt); Recruitment (R) at age 0 in millions; Fishing Mortality (F) for age of peak fishery selection (S = 1) age 3.

Year	SSB	R	F
1984	11,091	147	0.944
1985	14,688	134	1.053
1986	13,928	93	0.966
1987	11,667	70	1.017
1988	9,353	130	1.041
1989	8,809	75	0.922
1990	11,291	112	0.799
1991	9,290	99	1.321
1992	7,518	40	1.378
1993	5,713	40	1.316
1994	4,229	73	1.593
1995	3,548	43	1.248
1996	6,209	37	0.989
1997	6,505	96	0.727
1998	7,932	110	0.437
1999	16,868	231	0.279
2000	33,108	154	0.227
2001	61,166	143	0.124
2002	85,072	91	0.091
2003	106,588	92	0.125
2004	118,173	142	0.111
2005	121,024	226	0.069
2006	132,421	264	0.097
2007	145,789	262	0.093
2008	172,480	231	0.066
2009	194,081	128	0.074
2010	234,435	143	0.090
2011	236,631	199	0.086
2012	236,703	114	0.086
2013	237,483	106	0.119
2014	224,139	235	0.113
2015	191,237	326	0.158
2016	199,856	112	0.140
2017	193,258	93	0.167
2018	186,578	83	0.158

Table B2. Total catch (metric tons) of scup from Maine through North Carolina. Commercial landings include revised Massachusetts landings for 1986-1997. Commercial discards for 1981-1988 calculated from the mean ratio of discards to landings for 1989-1991. Commercial discard estimate for 1998 is the mean of 1997 and 1999 estimates. Includes the 'New' MRIP estimates of recreational catch.

Year	Commercial Landings	Commercial Discards	Recreational Landings	Recreational Discards	Total Catch
1981	9,856	4,495	5,054	108	19,514
1982	8,704	3,970	3,908	169	16,751
1983	7,794	3,555	3,911	76	15,336
1984	7,769	3,543	1,489	34	12,836
1985	6,727	3,068	5,122	72	14,989
1986	7,176	3,273	6,430	86	16,965
1987	6,276	2,862	4,722	42	13,902
1988	5,943	2,710	3,191	38	11,882
1989	3,984	1,277	4,781	54	10,096
1990	4,571	2,466	3,254	59	10,350
1991	7,081	3,388	5,857	75	16,401
1992	6,259	1,885	4,288	63	12,496
1993	4,726	1,510	2,101	31	8,367
1994	4,392	962	1,964	30	7,348
1995	3,073	974	1,030	38	5,115
1996	2,945	870	2,004	55	5,874
1997	2,188	675	1,152	38	4,053
1998	1,896	705	824	60	3,485
1999	1,505	735	2,098	51	4,390
2000	1,207	592	5,167	249	7,216
2001	1,729	1,671	4,434	417	8,251
2002	3,173	1,284	2,826	427	7,710
2003	4,405	436	7,806	462	13,109
2004	4,209	1,324	5,819	620	11,972
2005	3,711	565	1,949	413	6,637
2006	4,081	896	2,688	639	8,304
2007	4,193	1,363	3,221	407	9,183
2008	2,370	1,693	2,613	608	7,284
2009	3,721	3,189	2,851	552	10,313
2010	4,866	2,638	5,660	787	13,951
2011	6,819	1,234	4,682	516	13,252
2012	6,751	1,029	3,751	636	12,166
2013	8,105	1,279	5,739	568	15,692
2014	7,239	1,004	4,659	480	13,382
2015	7,725	1,774	5,527	581	15,606

2016	7,147	2,772	4,536	862	15,317
2017	7,006	4,733	6,143	1,079	18,961
2018	6,064	3,293	5,887	644	15,888

Figures

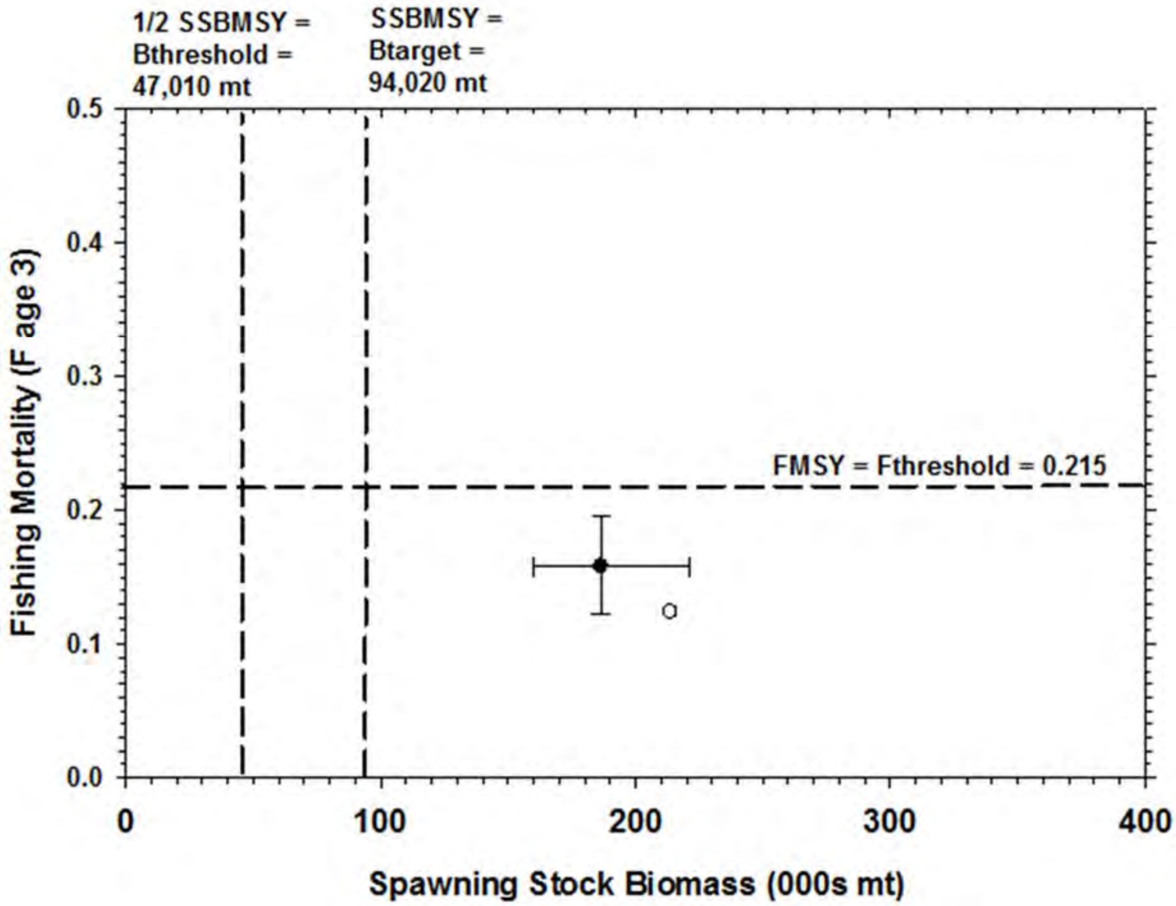


Figure B1. Estimates of scup spawning stock biomass (SSB) and fully-recruited fishing mortality (F, peak at age 3) relative to the updated 2019 biological reference points. Filled circle with 90% confidence intervals shows the assessment point estimates. The open circle shows the retrospectively adjusted estimates.

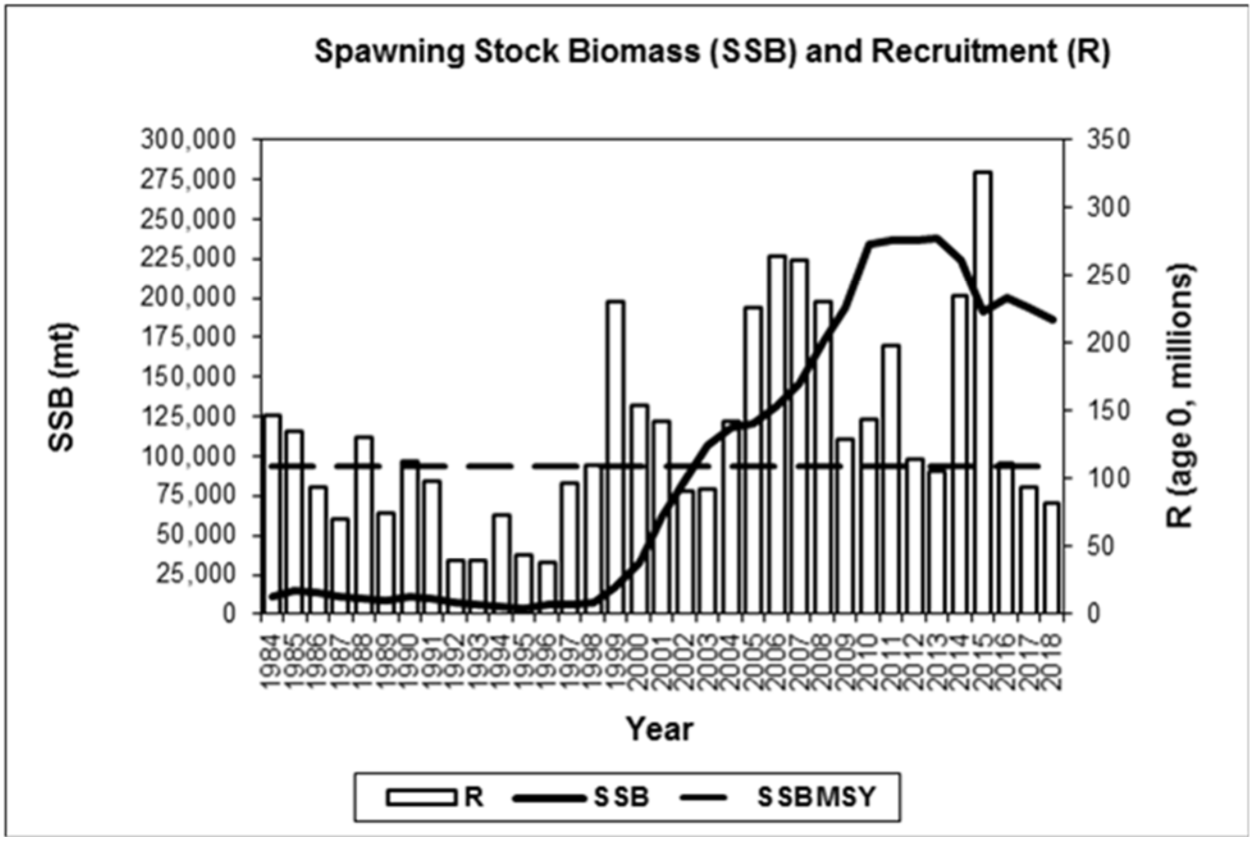


Figure B2. Scup spawning stock biomass (SSB; solid line) and recruitment at age 0 (R; vertical bars) by calendar year. The horizontal dashed line is the updated SSB_{MSY} proxy = $SSB_{40\%}$ = 94,020 mt. Note this figure only shows years when fishery age data are available in the model.

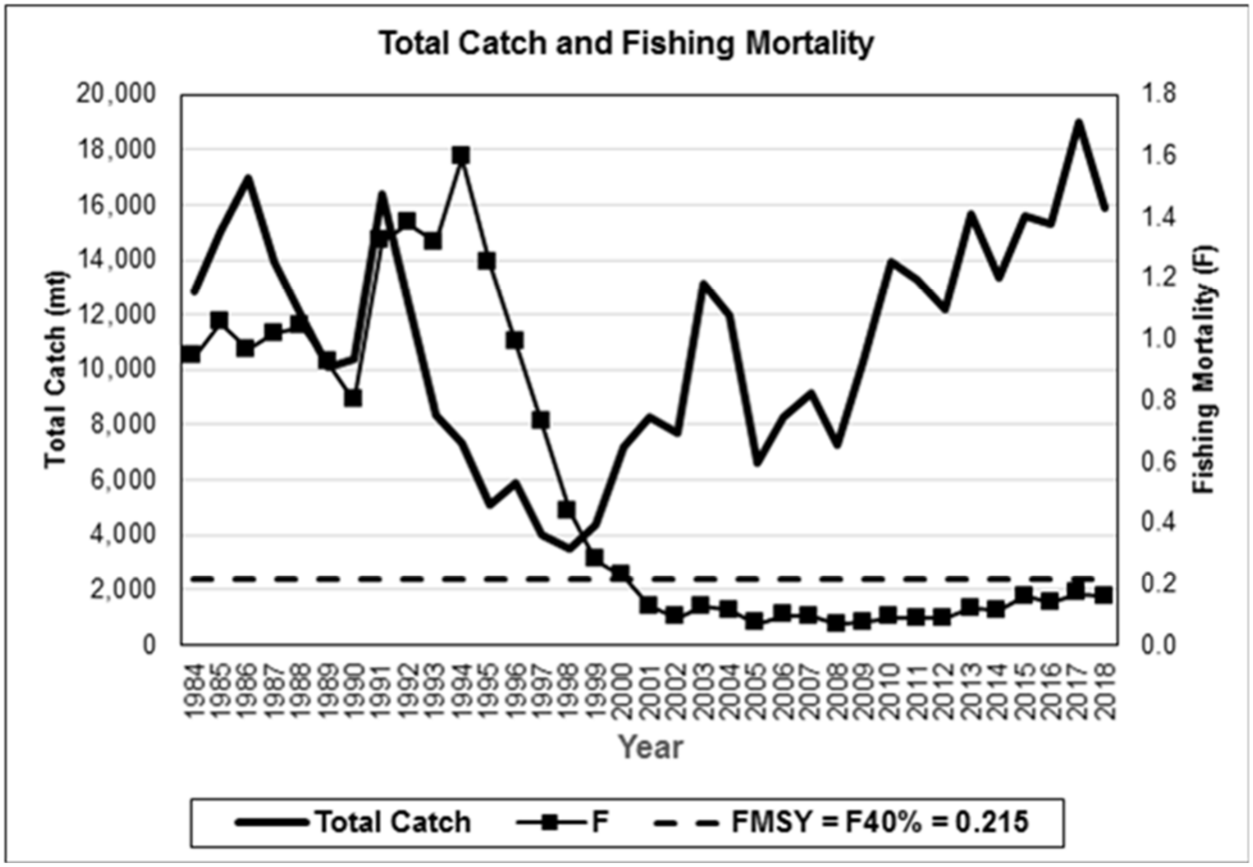


Figure B3. Total fishery catch (metric tons; mt; solid line) and fishing mortality (F, peak at age 3; squares) for scup. The horizontal dashed line is the updated F_{MSY} proxy = $F_{40\%}$ = 0.215. Note this figure only shows years when fishery age data are available in the model.

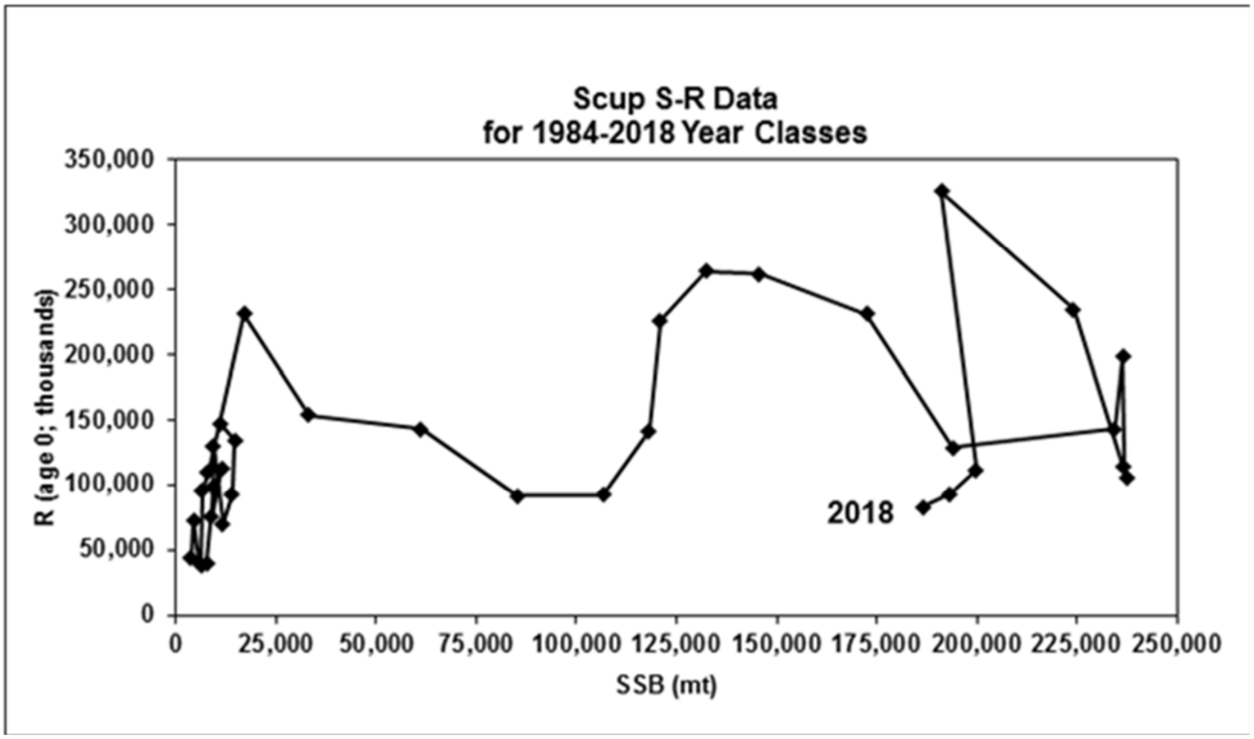


Figure B4. Spawning Stock Biomass (SSB) and Recruitment (R) scatter plot for scup. Note this figure only shows years when fishery age data are available in the model.

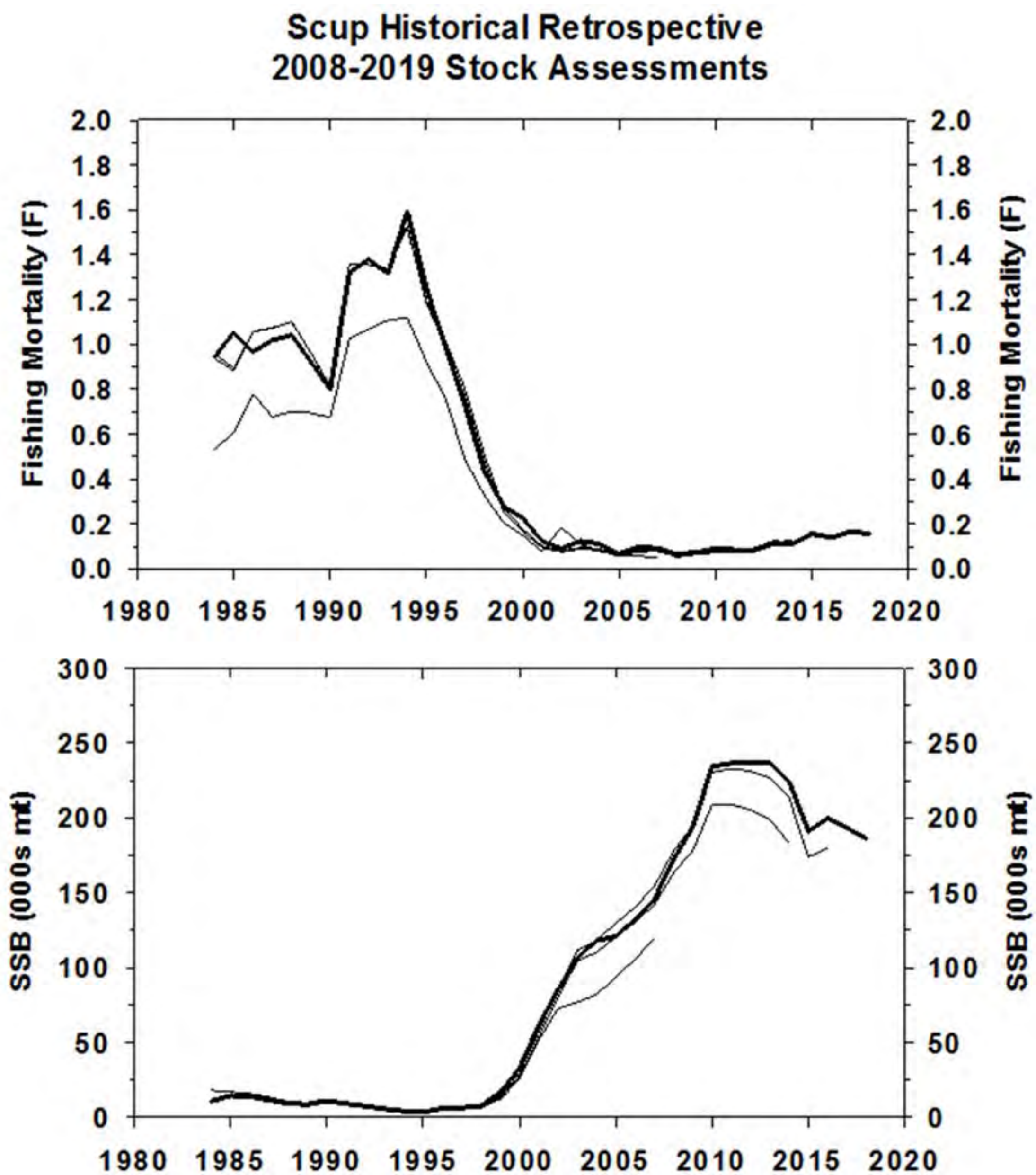


Figure B5. Historical retrospective of the 2008 (Data Poor Stocks; NEFSC 2009), 2015 (SAW 60; NEFSC 2015), 2017 (MAFMC SSC Update; unpublished) and 2019 (Operational Assessment) stock assessments of scup. The heavy solid lines are the 2019 Operational Assessment estimates that include the 'New' MRIP recreational catch.

C: Atlantic Bluefish Operational Assessment for 2019

(Lead: Anthony Wood)

State of Stock

This assessment of Atlantic bluefish (*Pomatomus saltatrix*) is an update through 2018 of commercial and recreational catch data, research survey indices of abundance, and the analyses of those data. The bluefish stock was overfished and overfishing was not occurring in 2018 relative to the updated biological reference points (Figure 1). Spawning stock biomass (SSB) was estimated to be 91,041 MT in 2018, about 46% of the updated biomass target reference point SSB_{MSY} proxy = $SSB_{35\%}$ = 198,717 MT, and 92% of the $SSB_{threshold}$ = 99,359 MT (Table 1, Figure 2). There is a 90% chance that SSB in 2018 was between 66,840 and 99,299 MT. Fishing mortality on the fully selected age 2 fish was 0.146 in 2018, 80% of the updated fishing mortality threshold reference point F_{MSY} proxy = $F_{35\%}$ = 0.183 (Table 1, Figure 3). There is a 90% probability that the fishing mortality rate in 2018 was between 0.119 and 0.205. The average recruitment from 1985 to 2018 was 46 million fish at age 0. The largest recruitment in the time series occurred in 1989 at 99 million fish, and the lowest recruitment was in 2016 at 29 million fish. Recruitment over the last decade has been below the time series average, except for 2013 where recruitment was 48 million fish (Table 1, Figures 2 & 4). Recruitment in 2018 was 42 million fish. The 2018 model estimates of F and SSB adjusted for internal retrospective error are within the model estimate 90% confidence intervals and so no adjustment of the terminal year estimates has been made for stock status determination of projections (Figure 1).

OFL Projections

Projections using the 2019 bluefish Operational Assessment ASAP model (data through 2018) were made to estimate the OFL catches for 2020-2021. Projections assumed that the 2019 ABC of 9,893 MT was harvested and sample from the estimated recruitment for 1985-2018. The 2019 ABC was converted into ‘new MRIP’ units using a 5-year average ratio of new to old recreational estimates. The OFL projection uses F_{2020}-F_{2021} = updated F_{MSY} proxy = F35% = 0.183. The OFL catches are 14,956 MT in 2020 (CV = 11%) and 16,016 MT in 2021 (CV = 10%).

Atlantic bluefish OFL for 2020-2021
Catches and SSB in metric tons

Year	Total Catch	F	SSB
2019	22,614	0.281	92,773
2020	14,956	0.183	98,353
2021	16,016	0.183	102,213

Catch

Reported 2018 commercial landings were 1,105 MT = 2.435 million lb. Estimated 2018 recreational landings were 5,695 MT = 12.556 million lb. Total commercial and recreational landings in 2018 were 6,800 MT = 14.991 million lb. Estimated 2018 recreational discards were 4,489 MT = 9.896 million lb. Commercial discards are not considered significant and not included in the assessment. The estimated total catch in 2018 was 11,288 MT = 24.887million lb.

In July 2018, the Marine Recreational Information Program (MRIP) replaced the existing estimates of recreational catch with a calibrated 1981-2017 time series ('New' MRIP) that corresponds to new survey methods that were fully implemented in 2018. For comparison with the existing estimates noted above, the 'New' MRIP estimate of 2017 recreational landings is 15,421 MT = 33.997 million lb, 3.3 times the 'Old' estimate. The 'New' MRIP estimate of 2017 recreational discards is 10,111 MT = 22.291 million lb, 5.4 times the 'Old' estimate. The 'New' MRIP recreational catch estimates increased the 1985-2017 total catch by an average of 116% (from 13,578 MT = 29.935 million lb to 29,291 MT = 64.576 million lb), ranging from +63% in 1986 to +291% in 2017. The increase in 2017 was 291%, from 6,532 MT = 14.400 million lb to 25,532 MT = 56.288 million lb. The 2019 updated assessment model includes the 'New' MRIP estimates of recreational landings and discards (Catch and Status Table; Table 2).

Catch and Status Table: Atlantic bluefish
(Weights in mt, recruitment in thousands, arithmetic means, includes New MRIP estimates)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Commercial landings	3,119	3,304	2,453	2,212	1,974	2,236	1,902	1,929	1,873	1,105
Recreational landings	18,040	21,013	15,430	15,051	15,526	12,050	13,524	10,433	15,421	5,695
Recreational discards[2]	10,071	11,965	14,606	11,039	9,537	9,848	6,953	8,008	10,111	4,489
Catch used in assessment	31,231	36,281	32,489	28,303	27,037	24,135	22,379	20,370	27,404	11,288
Spawning stock biomass	121,382	118,142	115,427	112,703	110,627	94,203	85,924	96,805	92,794	91,041
Recruitment (age 0, thousands)	36,453	40,079	35,654	31,643	48,315	41,454	44,071	28,904	45,171	41,890
F full[3]	0.27	0.32	0.32	0.32	0.35	0.38	0.37	0.26	0.40	0.15

	Min[1]	Max[1]	Avg[1]
Commercial landings	1,105	7,162	3,807
Recreational landings	5,695	74,988	21,012
Recreational discards[2]	1,440	14,850	7,717
Catch used in assessment	11,288	84,201	32,536
Spawning stock biomass	75,510	185,654	105,254
Recruitment (age 0, thousands)	28,461	98,997	46,159
F full[3]	0.15	0.58	0.35

[1] Years 1985-2018

[2] dead discards

[3] F on fully selected age 2. Note that table values are not retro adjusted.

Stock Distribution and Identification
The Atlantic States Marine Fisheries Commission (ASMFC) and Mid-Atlantic Fishery Management Council (MAFMC) jointly developed the Fishery Management Plan (FMP) for the bluefish fishery and adopted the plan in 1989 (ASMFC 1989, MAFMC 1990). The Secretary of Commerce approved the FMP in March 1990. The FMP defines the management unit as bluefish (*Pomatomus saltatrix*) in U.S. waters of the western Atlantic Ocean.

Assessment Model
The assessment model for Atlantic bluefish is a complex statistical catch-at-age model (ASAP SCAA; Legault and Restrepo 1998; NFT 2013) incorporating a broad range of fishery and survey data (NEFSC 2015). The model assumes an instantaneous natural mortality rate (M) = 0.2. The fishery catch is modeled as two fleets: 1. Commercial landings, and 2. Combined recreational landings and recreational discards.

Indices of stock abundance included a recreational catch-per-unit-effort index developed from the MRIP intercept data. In addition, eight fishery-independent indices were included in the model. Age-0+ fishery-independent indices included the NEFSC fall Bigelow trawl survey, the New Jersey ocean trawl survey, the Connecticut Long Island Sound trawl survey, the NEAMAP fall inshore trawl survey, and the North Carolina Pamlico Sound independent gillnet survey. Young-of-year indices included the SEAMAP fall trawl survey and a composite index developed from state seine indices from New Hampshire to Virginia. In 2018, all indices except the composite seine juvenile survey showed a decrease from 2017 values.

There is not a major retrospective pattern evident in the bluefish assessment model. The minor internal model retrospective error tends to underestimate F by 18% and overestimate SSB by 19% over the last 7 terminal years. The 2018 model estimates of F and SSB adjusted for internal retrospective error (F = 0.179; SSB = 76,312 MT) are within the model estimate 90% confidence intervals and so no adjustment of the terminal year estimates has been made for stock status determination or projections. The 'historical' retrospective comparison between the SARC60 benchmark, a 2017 continuity run using old MRIP data, and this update, indicates similar trends for SSB, F, and recruitment for most of the time-series (Figure 5). The addition of the new calibrated MRIP data in 2019 resulted in the model scaling estimates of SSB, F, and recruitment higher compared to the using the old data. Near the end of the time-series low catch in 2016 and 2018 leads to large drops in F.

Biological Reference Points (BRPs)
Reference points were calculated using the non-parametric yield and SSB per recruit long-term projection approach. The cumulative distribution function of the 1985-2018 recruitments (corresponding to the period of input fishery catches-at-age) was re-sampled to provide future recruitment estimates for the projections used to estimate the biomass reference point.

The existing biological reference points for bluefish are from the SSC review of the SAW 60 benchmark assessment (NEFSC 2015). The reference points are $F_{35\%}$ as the proxy for F_{MSY}, and the corresponding $SSB_{35\%}$ as the proxy for the SSB_{MSY} biomass target. The $F_{35\%}$ proxy for F_{MSY} = 0.19; the proxy estimate for SSB_{MSY} = $SSB_{35\%}$ = 101,343 MT = 223 million lbs; the proxy estimate for the ½ SSB_{MSY} biomass threshold = ½ $SSB_{35\%}$ = 50,672 MT = 112 million lbs; and the proxy estimate for MSY = $MSY_{35\%}$ = 14,443 MT = 32 million lbs.

The $F_{35\%}$ and corresponding $SSB_{35\%}$ proxy biological reference points for bluefish were updated for this 2019 Operational Assessment. The updated fishing mortality threshold $F_{35\%}$ proxy for F_{MSY} = 0.183; the updated biomass target proxy estimate for SSB_{MSY} = $SSB_{35\%}$ = 198,717 MT = 438 million lbs; the updated biomass threshold proxy estimate for ½ SSB_{MSY} = ½ $SSB_{35\%}$ = 99,359 MT = 219 million lbs; and the updated proxy estimate for MSY = $MSY_{35\%}$ = 29,571 MT = 65 million lbs.

Qualitative status description

The bluefish stock has experienced a decline in SSB over the past decade, coinciding with an increasing trend in F. Recruitment has remained fairly steady, fluctuating just below the time-series mean of 46 million fish. Both commercial and recreational fisheries had poor catch in 2016 (20,370 MT), and 2018 (11,288 MT), resulting in the second lowest and lowest catches on record, respectively. As a result of the very low catch in 2018, fishing mortality was estimated below the reference point for the first time in the time-series. These lower catches are possibly a result of availability. Anecdotal evidence suggests larger bluefish stayed offshore and inaccessible to most of the recreational fishery during these two years.

Research and Data Issues

The large increase in recreational landings and discards from the new MRIP calibration has further increased the importance of the recreational data to this assessment. Accurately characterizing the recreational discard lengths is an important component of the assessment and research that improves the methodology used to collect these data is recommended.

References

Atlantic States Marine Fisheries Commission (ASMFC).1989. Fishery Management Plan for Bluefish. 81 pp. + append.

Legault CM, Restrepo VR. 1998. A flexible forward age-structured assessment program. ICCAT. Col. Vol. Sci. Pap. 49:246-253.

Mid-Atlantic Fishery Management Council. 1990. Fishery management plan for the bluefish fishery. Dover, DE. 81 p. + append.

Northeast Fisheries Science Center (NEFSC). 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 15-08; 870 p.

NOAA Fisheries Toolbox (NFT). 2013. Age Structured Assessment Program (ASAP) version 3.0.11. (Internet address: http://nft.nefsc.noaa.gov).

Tables

Table C1. Summary assessment results for Atlantic Bluefish; Spawning Stock Biomass (SSB) in metric tons (MT); Recruitment (R) at age 0 in thousands; Fishing Mortality (F) for age of peak fishery selection (S = 1) age 2.

Year	SSB	R	F
1985	185,654	66,750	0.322
1986	165,351	52,276	0.491
1987	138,473	38,531	0.581
1988	102,815	47,993	0.547
1989	96,055	98,997	0.493
1990	85,487	48,818	0.534
1991	78,506	55,975	0.506
1992	75,510	28,461	0.447
1993	75,901	30,001	0.417
1994	77,018	42,217	0.350
1995	77,789	32,381	0.302
1996	76,446	42,664	0.304
1997	80,924	42,066	0.328
1998	94,032	40,385	0.299
1999	97,647	63,230	0.295
2000	107,896	35,554	0.297
2001	118,111	55,720	0.351
2002	101,029	44,238	0.288
2003	105,989	59,680	0.268
2004	117,967	31,811	0.267
2005	132,223	59,630	0.260
2006	107,584	67,106	0.303
2007	109,312	46,148	0.297
2008	131,873	44,782	0.229
2009	121,382	36,453	0.267
2010	118,142	40,079	0.324
2011	115,427	35,654	0.318
2012	112,703	31,643	0.324
2013	110,627	48,315	0.351
2014	94,204	41,454	0.381
2015	85,924	44,071	0.374
2016	96,805	28,904	0.257
2017	92,794	45,171	0.404
2018	91,041	41,890	0.146

Table C2. Total catch (metric tons) of Atlantic bluefish from Maine through Florida from 1985-2018. Does not include commercial discards as they are not considered significant for this stock. Includes the 'New' MRIP estimates of recreational catch.

Year	Commercial Landings	Recreational Landings	Recreational Discards	Total Catch
1985	6,124	47,376	1,655	55,154
1986	6,657	74,988	2,556	84,201
1987	6,579	63,834	3,198	73,610
1988	7,162	36,337	1,440	44,938
1989	4,740	36,250	2,029	43,019
1990	6,250	31,268	4,999	42,516
1991	6,138	26,485	6,137	38,760
1992	5,208	22,262	4,351	31,820
1993	4,819	16,170	5,955	26,943
1994	4,306	14,085	6,126	24,517
1995	3,629	13,228	4,400	21,257
1996	4,213	10,623	6,477	21,313
1997	4,109	12,516	7,829	24,455
1998	3,741	15,243	5,693	24,676
1999	3,325	10,501	11,809	25,634
2000	3,660	10,950	12,431	27,041
2001	3,953	14,888	14,850	33,691
2002	3,116	13,612	8,241	24,970
2003	3,359	14,758	7,281	25,398
2004	3,661	17,264	9,050	29,975
2005	3,211	17,661	9,571	30,443
2006	3,252	16,653	10,379	30,284
2007	3,390	18,077	10,136	31,603
2008	2,730	17,185	9,173	29,088
2009	3,119	18,040	10,071	31,231
2010	3,304	21,013	11,965	36,281
2011	2,453	15,430	14,606	32,489
2012	2,212	15,051	11,039	28,303
2013	1,974	15,526	9,537	27,037
2014	2,236	12,050	9,848	24,135
2015	1,902	13,524	6,953	22,379
2016	1,929	10,433	8,008	20,370
2017	1,873	15,421	10,111	27,404
2018	1,105	5,695	4,489	11,288

Figures

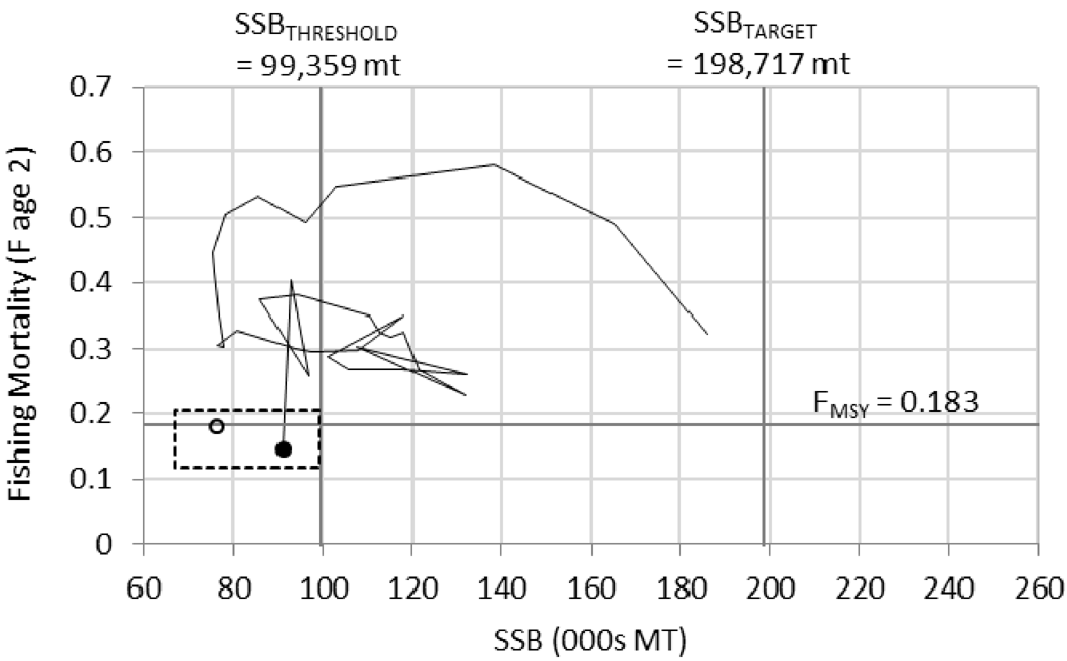


Figure C1. Estimates of Atlantic bluefish spawning stock biomass (SSB) and fully-recruited fishing mortality (F, peak at age 2) relative to the updated 2019 biological reference points. Filled circle with 90% confidence intervals (dotted box) shows the assessment point estimates. The open circle shows the retrospectively adjusted estimates.

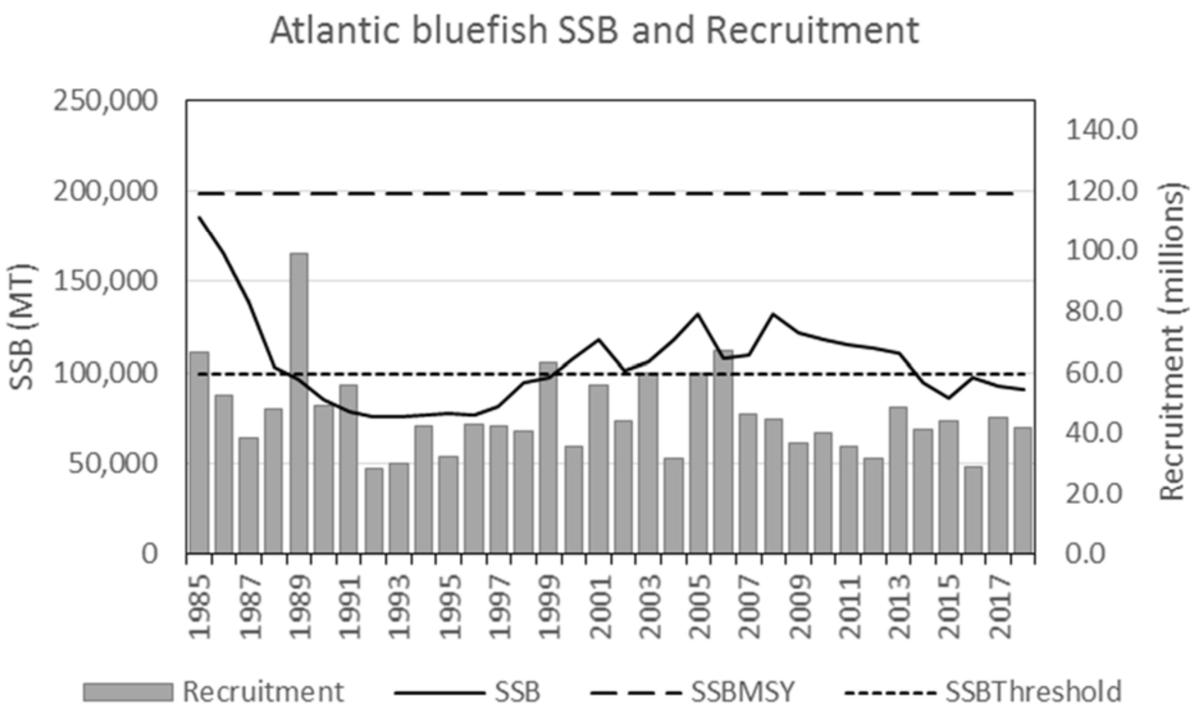


Figure C2. Atlantic bluefish spawning stock biomass (SSB; solid black line) and recruitment at age 0 (R; gray vertical bars) by calendar year. The horizontal dashed line is the updated SSB_{MSY} proxy = $SSB_{40\%}$ = 198,717 MT, and the dotted black line is the $SSB_{Threshold}$ = 99,359 MT.

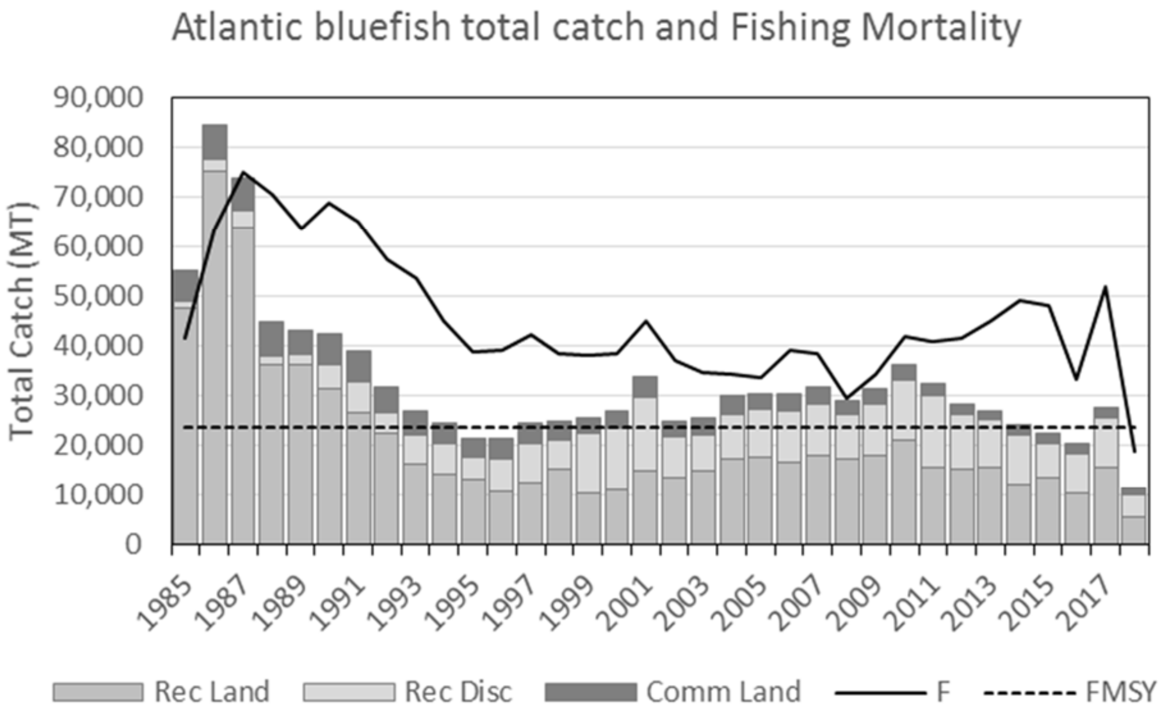


Figure C3. Total fishery catch (metric tons; MT; solid line) and fishing mortality (F, peak at age 3; squares) for Atlantic bluefish. The horizontal dashed line is the updated F_{MSY} proxy = $F_{35\%}$ = 0.183.

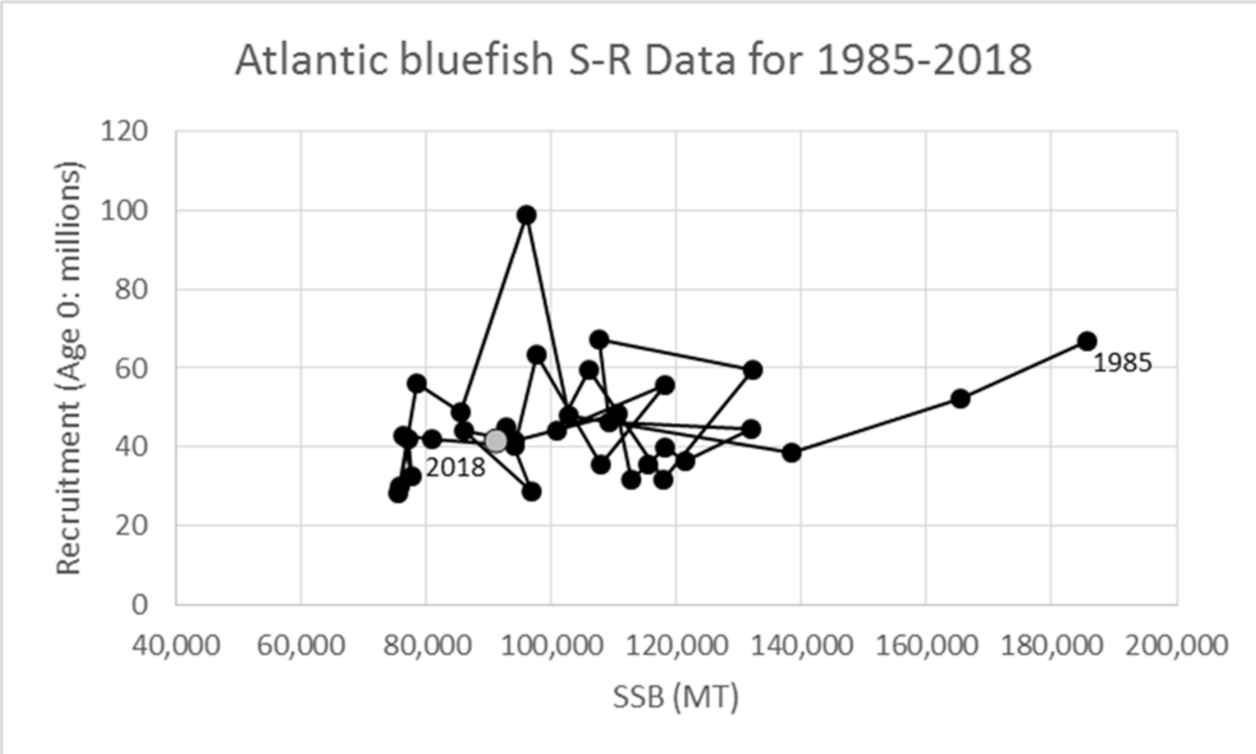


Figure C4. Spawning Stock Biomass (SSB) and Recruitment (R) scatter plot for Atlantic bluefish.

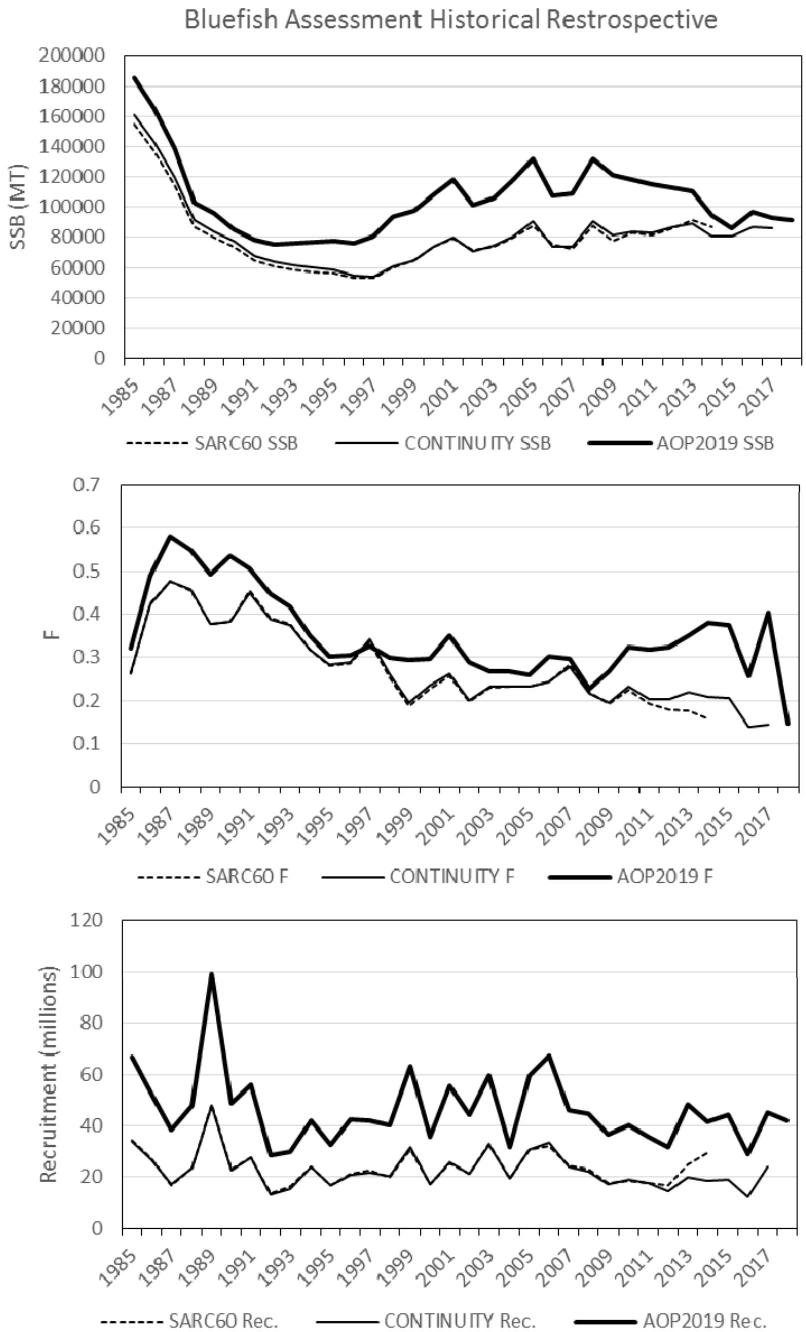


Figure C5. Historical retrospective analysis of the 2015 (dotted), 2017 (continuity run: slim black line), and 2019 (bold black line) stock assessments of Atlantic bluefish.

D. Monkfish Operational Assessment for 2019
(Lead: Anne Richards)

Executive Summary

Assessment data for northern and southern management units of monkfish were updated with minimal changes to the approaches of the previous index-based assessment (NEFSC 2016). No age data are available for monkfish, and the assessment does not include analytic models.

TOR 1. Update fishery-dependent and fishery-independent data from previous assessment.

Commercial fishery statistics for monkfish were updated for 2015-2018. In the north, landings and catch have fluctuated around a steady level since 2009, but increased after 2015. In the south, landings and catch had been declining since around 2000, but catch increased after 2015 due to discarding of a strong 2015 year class.

Survey data updated through 2018 indicate an increasing trend in biomass in both management areas since 2014; exploitable biomass (43+cm total length) indices have more than doubled in both areas since 2015, reflecting growth of the strong 2015 year class. Abundance also increased, and remains relatively high but has been decreasing in most series since 2016. Recruitment indices were high in the north in 2015 and 2016, and in the south in 2015.

New estimates of area-swept minimum biomass and abundance were developed using results from a study of relative efficiency of chain and rock-hopper sweeps on the net used for NEFSC bottom trawl surveys.The area-swept estimates are approximately 3 times (total biomass) or 5 times (total abundance) higher than the un-adjusted estimates, but follow the same trends.

TOR 2. Prepare an approach to providing scientific advice to management in the absence of an analytical model.

The monkfish assessment does not include an analytical model because the aging method has been invalidated, thus invalidating the growth model that is the foundation for the previously-approved model.

A simple model-free method previously used to derive Georges Bank cod catch limits was applied to current monkfish data. The method calculates the proportional rate of change in smoothed survey indices over the most recent 3 years for potential application to revising catch limits. In the NMA, the estimated rate of change was 1.2-1.3 depending on which surveys were included, and in the SMA, the estimated rate of change was 0.96-1.04.

TOR 3. Update the values of biological reference points (BRPs) for this stock.

BRPs defined in the management plan are dependent on output from the now-invalidated population model, therefore they have not been updated.

TOR 4. Include qualitative descriptions of stock status based on simple indicators/metrics.

Strong recruitment in 2015 fueled an increase in stock biomass in 2016-2018, though abundance has since declined as recruitment returned to average levels. Biomass increases were greater in the northern area than in the southern area, and biomass has declined somewhat in the south.

TOR 5. Perform short-term (2-year) population projections.

Not relevant to this assessment.

6. Comment on research areas or data issues that might lead to improvements in future stock assessments.

Development of a growth curve and/or an accurate aging method would allow application of age-based models. A better understanding of stock structure and movement patterns, especially mxing between management areas, would be helpful.

Introduction

Life History

The monkfish (*Lophius americanus*), also called goosefish, is distributed in the Northwest Atlantic from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina (Collette and Klein-Macphee 2002). Monkfish may be found from inshore areas to depths of at least 900 m (500 fathoms). Seasonal onshore-offshore migrations occur and appear to be related to spawning and possibly food availability (Collette and Klein-MacPhee 2002).

Monkfish rest partially buried on soft bottom substrates and attract prey using a modified first dorsal fin ray that resembles a fishing pole and lure. Monkfish are piscivorous and can eat prey as large as themselves. Despite the behavior of monkfish as a demersal ‘sit-and-wait’ predator, recent information from electronic tagging suggests seasonal off-bottom movements which may be related to migration (Rountree et al. 2006).

Growth rates of monkfish are not well understood and recent studies call into question the growth curves used in prior assessments (2007, 2010, 2013). One recent study has shown that the method currently used to age monkfish in the U.S. (counting rings on vertebrae) does not consistently identify the correct number of presumed-annual rings at the margin of the vertebra (Bank 2016). Further work conducted at the NEFSC has confirmed this using samples from the strong 2015 yearclass at presumed ages 1, 2 and 3 (Sandy Sutherland, NEFSC, personal communication). In addition, it appears that growth of immature monkfish may be much faster than previously understood. Growth estimated by modal progression of the 2015 yearclass suggests that monkfish may grow to ~25 cm by age 1 and reach the size at maturity (approximately 40 cm) by age two (Figure D1).

The estimated size at 50% maturity of monkfish is 41 cm for females and 37 cm for males (Richards et al. 2008). Few males are found larger than 70 cm, but females can reach sizes greater than 130 cm. Spawning takes place from spring through early autumn, progressing from south to north, with most spawning occurring during the spring and early summer (Richards et al. 2008). Females lay a buoyant mucoid egg raft or veil which can be as large as 12 m long and 1.5 m wide and only a few mm thick. The eggs are arranged in a single layer in the veil, and the larvae hatch after about 1-3 weeks, depending on water temperature. Females likely produce more than one egg veil per year (McBride et al. 2017). The larvae and juveniles spend several months in a pelagic phase before settling to a benthic existence at a size of about 8 cm (Collette and Klein-MacPhee 2002).

Stock Structure

The Fishery Management Plan (FMP) defines two management areas for monkfish (northern management area (NMA) and southern management area (SMA)), divided roughly by a line bisecting Georges Bank (Figure D2). The two assessment and management areas for monkfish were defined in the 1999 FMP based on differences in temporal patterns of recruitment (estimated from NEFSC surveys), perceived differences in growth patterns, and differences in the contribution of fishing gear types (mainly trawl, gill net, and dredge) to the landings. Since then, genetic studies using mitochondrial DNA have suggested a homogeneous population of monkfish off the U.S. east coast (Chikarmane et al. 2000; Johnson et al. in prep.); however research in progress using microsatellite DNA suggests a possible delination off Delaware Bay in the Mid-Atlantic Bight (Housbrouck et al. 2015).

Monkfish larvae are distributed over deep (< 300 m) offshore waters of the Mid-Atlantic Bight in March-April, and across the continental shelf (30 to 90 m) later in the year, but relatively few larvae have been sampled in the northern management area (Steimle et al. 1999). NEFSC surveys continue to indicate different recruitment patterns in the two management units in recent years.

The perceived differences in growth in the two management areas were based on studies about 10 years apart and under different stock conditions (Armstrong et al. 1992: Georges Bank to Mid-Atlantic Bight, 1982-1985; Hartley 1995: Gulf of Maine, 1992-1993). Age, growth, and maturity information from the NEFSC surveys and the 2001, 2004 and 2009 cooperative monkfish surveys indicated only minor differences in age, growth, and maturity between the areas (Richards et al., 2008; Johnson et al., 2008). However these growth studies used the vertebral aging method which is now called into question.

The southern deepwater extent of the range of American monkfish (*L. americanus*) overlaps with the northern extent of the range of blackfin monkfish (*L. gastrophysus*; Caruso 1983). These two species are morphologically similar, which may create a problem in identification of survey catches and landings from the southern extent of the range of monkfish. The potential for a problem however is believed to be small. The NEFSC closely examined winter and spring 2000 survey catches for the presence of blackfin monkfish and found none. The cooperative monkfish survey conducted in 2001 caught only eight blackfin monkfish of a total of 6,364 monkfish captured in the southern management area.

Fisheries Management

Commercial fisheries for monkfish occur year-round using gillnets, trawls and scallop dredges. No significant recreational fishery exists. The primary monkfish products are tails, livers and whole gutted fish. Peak fishing activity occurs during November through June, and value of the catch is highest in the fall due to the high quality of livers during this season.

U.S. fisheries for monkfish are managed in the Exclusive Economic Zone (EEZ) through a joint New England Fishery Management Council - Mid-Atlantic Fishery Management Council Monkfish Fishery Management Plan (FMP). The primary goals of the Monkfish FMP are to end and prevent overfishing and to optimize yield and economic benefits to various fishing sectors involved with the monkfish fisheries (NEFMC and MAFMC 1998; Haring and Maguire 2008). Current regulatory measures vary with type of permit but include limited access, limitations on days at sea, mesh size restrictions, trip limits, minimum size limits and annual catch limits (Tables 1 and 2).

Biological reference points for monkfish were established in the original Fishery Management Plan (FMP), but were revised after SAW 34 (NEFSC 2002), after the Data Poor Stocks Working Group (DPSWG) in 2007 (NEFSC 2007a), and after SAW 50 in 2010. The overfishing definition on record is F_{max}. Prior to 2007, $B_{threshold}$ was defined as one-half of the median of the 1965-1981 3-year average NEFSC autumn trawl survey catch (kg) per tow). After acceptance of an analytical assessment in 2007 (NEFSC 2007a), B_{target} was redefined as the average of total biomass for the model time period (1980-2006) and $B_{threshold}$ as the lowest observed value in the total biomass time series from which the stock had then increased (termed "B_{Loss}"). According to the earlier (survey index-based) reference points, monkfish were overfished and overfishing status could not be determined (NEFSC 2005); however, with adoption of the analytical assessment in 2007, monkfish status was changed to no longer overfished and overfishing was not occurring. Assessments in 2010 and 2013 (NEFSC 2010; 2013) also concluded that both stocks were not overfished and overfishing was not occurring, while recognizing the continuing significant uncertainty in the determination. With the invalidation of the growth curve and analytic assessment model, the estimated BRPs are no longer relevant.

TOR 1. Update data: fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment.

Fishery-Dependent Data

Landings

Landings of monkfish tails are converted from landed weight to live weight, because a substantial fraction of the landings occur as tails only (or other parts). The conversion of landed weight of tails to live weight of monkfish in the NEFSC weigh-out database is made by multiplying landed tail weight by a factor of 3.32.

Early catch statistics (before ~1980) are uncertain, because much of the monkfish catch was sold outside of the dealer system or used for personal consumption until the mid-1970s. For 1964 through 1989, there are two potential sources of landings information for monkfish; the NEFSC 'weigh-out' database, which consists of fish dealer reports of landings, and the 'general canvass' database, which contains landings data collected by NMFS port agents (for ports not included in the weigh-out system) or reported by states not included in the weigh-out system (Table D3). All landings of monkfish are reported in the general canvass data as 'unclassified tails.' Consequently, some landed weight attributable to livers or whole fish in the canvass data may be inappropriately converted to live weight. This is not an issue for 1964-1981 when only tails were recorded in both databases. For 1982-1989, the weigh-out database contains market category information that allows for improved conversions from landed to live weight. The two data sources produce the same trends in landings, with general canvass landings slightly greater than weigh-out landings. It is not known which of the two measures more accurately reflects landings, but the additional data sources suggest that the general canvass is most reliable for 1964-1981 landings, whereas the availability of market category details suggests that the weigh-out database is most reliable for 1982-1989.

Beginning in 1990, most of the extra sources of landings in the general canvass database were incorporated into the NEFSC weigh-out database. However, North Carolina reported landings of monkfish to the Southeast Fisheries Science Center and until 1997 these landings were not added to the NEFSC general canvass database. Since these landings most likely come from the southern management area, they have been added to the weigh-out data for the southern management area for 1977-1997 for the landings statistics used for stock assessment.

Beginning in July 1994, the NEFSC commercial landings data collection system was redesigned to consist of vessel trip reports (VTR) and dealer weigh-out records. The VTRs include area fished for each trip which is used to apportion dealer-reported landings to statistical areas. The northern management area includes statistical areas 511-515, 521-523 and 561; and the southern management area includes areas 525-526, 562, 537-543 and 611-636 (Figure D2).

Total U.S. landings (live weight) remained at low levels until the mid-1970s, increasing from less than 1,000 mt to around 6,000 mt in 1978 (Table D3, Figure D3). Annual landings remained stable at between 8,000 and 10,000 mt until the late 1980s. Landings increased from the late 1980s to over 20,000 mt per year during 1992-2004, peaking at 28,500 mt in 1997. Landings declined steadily after 2003, and stabilized around an average of 8,600 mt during 2009-2015. During 2008-2015, fishing year landings in the NMA remained well below the TAL, but during 2016-2018 were close to or higher than the TAL (Table D2). In the SMA, fishing year landings have been below the TAL since 2009. The most recent TALs are ~50% higher in the SMA than in the NMA.

Monkfish landings began to increase in the northern management region in the mid-1970s and in the late 1970s in the southern area. Most of the increase in landings during the late 1980s through mid-1990s was from the southern area. Historical under-reporting of landings should be considered in the interpretation of this series.

Trawls, scallop dredges and gill nets are the primary gear types that land monkfish (Table D4, Figure D4). Trawls have been the predominant gear in the north, accounting for approximately 75% of the landings on average. In the south, trawls and dredges dominated the landings before about 2002, but were subsequently replaced by gillnets as regulations changed. Gillnets accounted for about 75% of the landings from the southern management area during 2016-2018.

Until the late 1990s, total U.S. landings were dominated by landings of monkfish tails. From 1964 to 1980 landings of tails rose from 19mt to 2,302mt, and peaked at 7,191mt in 1997 (Tables 5, 6). Landings of tails declined after 1997, but are still an important component of the landings. Landings of gutted whole fish have increased steadily since the early 1990s and are now the largest market category on a landed-weight basis. On a regional basis, more tails were landed from the northern area than the southern area prior to the late 1970s (Tables 5 and 6). From 1979 to 1989, landings of tails were about equal from both areas. In the 1990's, landings of tails from the south predominated, but since 2000, landings of tails have been greater in the north.

Beginning in 1982, several market categories were added to the system (Tables 5, 6). Tails were broken down into large (> 2.0 lbs), small (0.5 to 2.0 lbs), and unclassified categories and the liver market category was added. In 1989, unclassified round fish were added, in 1991 peewee tails (<0.5 lbs) and cheeks, in 1992 belly flaps, and in 1993 whole gutted fish were added. Landings of unclassified round (whole) or gutted whole fish jumped in 1994 to 2,045 mt and 1,454 mt, respectively; landings of gutted fish continued to increase through 2003. The tonnage of peewee tails landed increased through 1995 to 364 mt and then declined to 153 mt in 1999 and 4 mt in 2000 when the category was essentially eliminated by regulations.

Foreign Landings

Landings (live wt) from NAFO areas 5 and 6 by countries other than the US are shown in Table D3 and Figure D3. Reported landings were high but variable in the 1960s and 1970s with a peak in 1973 of 6,818 mt. Landings were low but variable in the 1980s, declined in the early 1990s, and have generally been below 300 mt since 1996. NAFO data for monkfish were not updated for this assessment update.

Discard Estimates

Catch data from the fishery observer, dealer and VTR databases were used to investigate discarding frequencies and rates using standardized bycatch reporting methodology (SBRM, Rago et al. 2005; Wigley et al. 2007). The number of trips with monkfish discards available for analysis varied widely among management areas and gear types (Tables 7, 8). As in previous monkfish assessments (NEFSC 2007a, NEFSC 2010, NEFSC 2013, NEFSC 2016), monkfish discards were estimated on a gear, half-year and management area basis using observed discard-per-kept-monkfish expanded to total discards for otter trawls and gillnets, and observed discard-per-all-kept-catch to expand for scallop dredges and shrimp trawls. Discards for 1980-1988 (before observer sampling) were estimated by applying average discard ratios by management area and gear type (trawl, shrimp trawl, gillnet, dredge) from 1989-1991 to landings for 1980-1988 as follows:

Area	**Shrimp Trawls**	**Trawls**	**Gillnets**	**Dredges**
North				
Years included	1989-1991	1989-1991	1989-1991	1992-1997
Number of trips	124	253	1191	54
South				
Years included	n/a	1989-1991	1991-1992	1991-1993
Number of trips		334	177	32

The proportion of discards in the northern area catch was about 13% in the 1980s, 7% during 2002-2006, became slightly higher on average (12%) during 2007-2009, was 14% for 2010-2015 and 18% during 2016-2018 (Table D9, Figures 5, 6). The proportion of discards in the southern area catch has generally increased since the 1980s (average 16% 1980-1989), with an annual average of 29% during 2002-2006, 24% during 2007-2009, and 27% in 2010-2015 (Table D9, Figures 5 and 6). During 2016-2018, the proportion of discards in the catch was 51%, and estimated discards (mt) exceeded landings in 2017 and 2018. These high discard rates are due primarily to regulatory discards in the scallop dredge fishery (Table D8). Gill nets consistently have had the lowest discard ratios in both areas.

Overall, discarding has increased steadily in both management areas since 2015 (Table D9). In 2015, a large increase in discarding of small fish was observed in southern area dredge and trawl fisheries (Figure D8), reflecting the strong 2015 recruitment event. This yearclass now appears to have grown into the exploitable size range (43+cm) (Figure D1).

Size Composition of U.S. Catch

Tail lengths were converted to total lengths using relations developed by Almeida et al. (1995). As in previous assessments, (NEFSC 2007a and later), length composition of landings and discard were estimated from fishery observer samples by management area, gear-type (trawls, dredges and gillnets), catch disposition (kept or discarded) and variable time periods (Table D11). Landings in unknown gear categories were allocated proportionately to the 3 major gear types before assigning lengths. The estimated length composition of landings and discard is shown in Figures 7-10. Age composition of the catch was not estimated.

Effort and CPUE

Evaluating trends in effort or catch rates in the monkfish fishery is difficult for several reasons. Much of the catch is taken in multi-species fisheries, and defining targeted monkfish trips is difficult. There have been programmatic changes in data collection from port interviews (1980-1993) to logbooks (1994-2009), and comparison of effort statistics among programs is difficult. Catch rates may not reflect patterns of abundance, because they have been affected by regulatory changes (e.g., 1994 closed areas, 2000 trip limits, 2006 reductions in trip limits).

CPUE data have not been used in the assessment model for monkfish, therefore they were not examined for this assessment update.

Fishery-Independent Data

Resource surveys used in the 2016 assessment were updated, including NEFSC spring and autumn offshore surveys, ASMFC northern shrimp surveys (NFMA only), ME/NH spring and fall inshore surveys, and scallop dredge surveys conducted by NEFSC and Viginia Institute of Marine Science (VIMS) (SMA only). Very few strata in the SMA were sampled during the 2017 fall survey, so indices were not calculated for the 2017 fall survey in the SMA.

The NEFSC survey strata used to define the northern and southern management areas are:

Survey	Northern Area	Southern Area
NEFSC offshore bottom trawl	20-30, 34-40	1-19, 61-76
ASMFC Shrimp	1,3,5-8	
Shellfish		6,7,10,11,14,15,18,19,22-31,33-35,46,47,55,58-61,621,631

NEFSC spring and autumn bottom trawl survey indices for 1963-2008 were standardized to adjust for statistically significant effects of trawl type (Sissenwine and Bowman 1977) on catch rates. The trawl conversion coefficients apply only to the spring survey during 1973-1981.

NEFSC indices derived from surveys on the FSV Henry Bigelow (starting spring 2009) were adjusted using calibration coefficients estimated during experimental work (Miller et al. 2009). The FSV *Henry B. Bigelow,* which became the main platform for NEFSC research surveys in spring 2009, has significantly different size, towing power, and fishing gear characteristics than the previous survey platform (*Albatross IV)*, resulting in different fishing power and catchability for most species. Calibration experiments to estimate these differences were conducted during 2008 (Brown 2009, NEFSC 2007b,). Following guidelines developed by a peer-review panel (Anonymous 2009), monkfish catches were converted using a simple ratio estimator without a seasonal (spring vs. fall) or length-specific correction. The low catch rates of monkfish in the Albatross series made development of more detailed coefficients infeasible. The overall coefficients for monkfish were 7.1295 for numbers and 8.0618 for biomass (kg) (Anonymous 2009; Miller et al. 2009). The Bigelow time series is also presented as an independent, uncalibrated series.

NEFSC spring and fall survey estimates of minimum biomass and abundance were derived using relative efficiency estimates for monkfish from a set of paired-tow experiments comparing chain sweep (industry standard on soft bottom) vs. rock hopper gear (used on all tows on the FSV Bigelow) (Miller et al. 2017a, 2017b, 2018).

Northern Management Area (NMA)

Biomass indices from NEFSC autumn and spring research trawl surveys fluctuated without trend between 1963 and 1975, increased briefly in the late 1970's, but declined thereafter to near historic lows during the 1990's (Tables 12-13, Figures 11 and 12). From 2000 to 2003, indices increased, reflecting recruitment of a relatively strong 1999 yearclass. Subsequently, biomass indices declined and remained relatively low until 2016, when both biomass and abundance began to increase. Abundance declined slightly in 2017 and 2018 but biomass indices continued to increase in the fall survey (Figure D12). Exploitable biomass (43+cm) has increased steadily since 2014 (fall survey) or 2016 (spring survey) (Figure D13). ME-NH survey data has shown similar trends in total biomass and abundance as the NEFSC surveys (Figure D14).

Length composition of NEFSC and ME/NH fall survey catches (Figures15 and 18) suggest production of relatively strong yearclasses in 2015 and 2016; however, strong recruitment was not apparent in the spring or summer shrimp surveys (Figures 16 and 17).

Recruitment indices (abundance) were estimated for monkfish of lengths corresponding to presumed young-of-year (YOY, age 0). The size ranges used were based on length frequencies observed for the strong 2015 yearclass, and were adopted in the 2016 assessment, as follows:

	2013 Putative		2016 Putative	
North	age	cm range	age	cm range
Fall NEFSC	1	11-19	0	6-18
Fall ME-NH	1	11-19	0	8-18
South				
Spring/summer scallop	1	11-19	0	7-18
Fall NEFSC	1	11-17	0	12-28

Based on the recruitment indices (Figure D20), the frequency of recruitment events in the northern area has increased since the late 1980s, with strong yearclasses produced in 1993, 1994, 2000, 2015 and 2016. There appears to be a negative relationship between recruitment and size of monkfish in the NMA (Figure D20). One possible interpretation is that that cannibalism plays a role in stock dyanmics. Armstrong et al (1996) and Johnson et al. (2008) both found higher rates of cannibalism in relatively large monkfish.

Additional surveys that catch monkfish in portions of the northern area include the ASMFC shrimp survey, the Massachusetts Division of Marine Fisheries fall and spring surveys, and ME/NH inshore surveys (Table D15, Figures 11, 14, 17-19). The shrimp survey samples the western Gulf of Maine during summer and caught more monkfish than the spring or fall surveys prior to 2009 (when the FSV Bigelow survey series began). Patterns of abundance and biomass have been relatively consistent among the NEFSC spring and fall, ME-NH, and shrimp surveys (Figure D21). The Massachusetts surveys catch few monkfish and were not considered to reflect patterns of abundance for the entire management area (NEFSC 2007a); therefore have not been included in recent assessments.

Figure D22 shows the distribution of monkfish in surveys in the northern management area.

Southern Management Area

Inconsistent geographic coverage should be considered in the interpretation of southern survey indices. The NEFSC fall survey did not sample south of Hudson Canyon until 1967. The NEFSC scallop dredge survey has been limited to the southern flank of Georges Bank since 2014, and NEFSC sampling intensity over the entire mid-Atlantic Bight declined starting in 2011. In addition, the timing of the scallop dredge survey shifted in 2009 from mid-summer to late spring. The Virginia Institute of Marine Science VIMS is now conducting the scallop dredge survey in the areas south of Georges Bank (beginning in 2012), but the data are not incorporated into the NEFSC survey data base. This makes it laborious to fold the VIMS dredge survey data into the assessment calculations; however, the VIMS data have been included for most of the series presented in this assessment. NEAMAP inshore surveys in the Mid-Atlantic catch relatively few monkfish, so are not included here.

Biomass and abundance indices from NEFSC spring and autumn research surveys were high during the mid-1960s, fluctuated around an intermediate level during the 1970s-mid 1980s, and have been relatively low since the late 1980s (Tables 16-17, Figures 23 and 24). A sharp increase in abundance was observed in the 2015 scallop and fall surveys and in the 2016 spring survey (Tables 16-18 Figure D23), reflecting an apparent recruitment event in 2015. Exploitable biomass (43+cm) increased in the spring survey in 2017 and 2018, likely as a result of the growth of the 2015 yearclass (Figure D25). The fall survey also showed elevated exploitable biomass in 2018 (no survey in 2017).

Length distributions from the southern area show truncation over time but somewhat less dramatically than in the north (Figures 25-27). As in the northern area, fish greater than 60 cm have been rare since the 1980s, especially when compared to the 1960s. Recruitment indices (presumed YOY) (Figure D29) indicate two exceptional recruitment events in the south, occurring in 1972 and 2015. The negative relationship between median size in the population and recruitment seen in the north is not evident in the SMA (Figure D29); however, the median size has generally been lower in the south than in the north. Distribution plots suggest that the 2015 recruits were broadly distributed in the SMA (Figure D32).

TOR 2. Estimate F, R, B

TOR2a.) Estimate annual fishing mortality, recruitment, and stock size for the time series (“Plan A”). Include estimates of uncertainty, retrospective analyses (both historical and

within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

In the absence of an approved model, this TOR was not addressed through modeling efforts; however relative exploitation rates were calculated from landings or catch and survey estimates of minimum area-swept abundance or biomass estimated using adjustments for the rockhopper sweep (Miller et al. 2017a, 2017b, 2018) (Table D19, Figures 33-34). The area-swept estimates account for missed strata by applying average density from sampled strata in each management area to the un-sampled strata. The estimates assume that 100% of the monkfish encountered by the trawl are captured. Missing strata in monkfish assessment areas and total area of sampled strata during 2009-2018 were the following:

North	Missing strata	Area surveyed nmi2	South Missing strata	Area surveyed nmi2
2009		26,265	68	37,029
2010		26,265		37,081
2011	20, 25	24,654	17, 66	36,166
2012	25	25,875		37,081
2013	25	25,875	18	36,909
2014	20, 40	24,466	8	36,851
2015		26,265		37,081
2016		26,265		37,081
2017		26,265	1-12, 61-76	9,226
2018	30, 34, 351,39	22,617		37,081

b.) Prepare a "Plan B" assessment that would serve as an alternate approach to providing scientific advice to management. "Plan B" will be presented for peer review only if the "PlanA" assessment were to not pass review.

A model-free method used to derive Georges Bank cod catch limits in 2015 (NEFSC 2015) was applied to monkfish in the northern and southern management areas in the 2016 assessment (NEFSC 2016) and is updated here. The method calculates the rate and direction of change in survey indices using the slope of a log-linear regression of LOESS-smoothed survey indices during the most recent three years. In the case of cod, the proportional change in the indices (re-transformed slope, "catch multiplier") was applied to average cod catch in the three previous years to derive new cod catch limits.

The monkfish analysis calculated the multiplier using total biomass indices from either the NEFSC fall survey only or the average of the NEFSC spring and fall surveys. The missing 2017 fall survey index for the south was interpolated by averaging 2016 and 2018 biomass indices for the south. The spring survey may be affected more strongly than the fall survey by availability of monkfish to the gear due to timing of seasonal migrations. Biomass indices for 1986-2018 in each area were LOESS-smoothed (smoothing parameter=0.30, 9.9 year smoothing window) before being entered into a log-linear regression to estimate the proportional change during 2016-2018. The estimated proportional change (multiplier) for monkfish in the north was 1.26 (fall survey only, 26% increase) or 1.22 (spring and fall surveys combined, 22% increase). In the south, the proportional change was 0.96 (fall survey only, 4% decrease) or 1.04 (spring and fall surveys combined, 4% increase) (Figure D35).

TOR 3. Update BRPs

TOR 3. Update the values of biological reference points (BRPs) for this stock.
Biological reference points specified in the management plan are no longer relevant due to invalidation of the growth model, therefore they were not updated for this assessment update.

TOR 4. Stock Status

TOR4. a.) Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.
This TOR was not addressed because monkfish BRPs have been invalidated.

b.) Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

Based on trends in survey results, monkfish stock status has been improving (north) or remained steady (south) in both management regions in the past three years, likely due primarily to the 2015 recruitment event. Biomass continued to increase in the north in 2018 while abundance dropped, reflecting an increase in the proportion of large individuals in the population (likely of the 2015 year class). In the south, biomass increased after the 2015 recruitment event, but was lower in 2018 (fall 2017 data missing), as abundance of the 2015 year class declined. Recruitment has returned to average levels in the south, and in the north, to average levels observed since the late 1980s. Abundance and biomass patterns may be influenced by movement of monkfish between the management areas, which is poorly understood.

TOR 5. Population Projections

5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at FMSY or at an FMSY proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).
Not relevant to this assessment.

TOR 6. Research areas and data issues

TOR 6: Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

A benchmark assessment should consider the feasibility of using both observer and port samples in estimating length composition of commercial landings.

Ongoing research on age and growth of monkfish may lead to an acceptable growth curve, even if not an aging method that could be used for routine aging. If so, age structured models could be explored assuming static growth.

A better understanding of monkfish movements and stock structure would be helpful to interpretation of monkfish population data.

Future modeling efforts may want to consider the possible role of cannibalism in stock dynamics of monkfish in light of the strong negative relationship observed in the north between median size of monkfish in the population and recruitment indices.

References:

Almeida FP, Hartley DL, Burnett J. 1995. Length-weight relationships and sexual maturity of monkfish off the northeast coast of the United States. N Am J Fish Manage. 15:14-25.

Anonymous. 2009. Independent Panel review of the NMFS Vessel Calibration analyses for FSV/ Henry B. Bigelow/ and R/V/ Albatross IV/. August 11-14, 2009. Chair's Consensus report. 10 p.

Armstrong MP, Musick JA, Colvocoresses JA. 1992. Age, growth and reproduction of the monkfish *Lophius americanus* (Pisces:Lophiiformes). Fish Bull. 90: 217-230.

Armstrong, M. P., Musick, J. A., and Colvocoresses, J. A. 1996. Food and ontogenetic shifts in feeding of the goosefish, Lophius americanus. Journal of Northwest Atlantic Fishery Science, 18: 99–103.

Azarovitz TR. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. Pages 62-67 in W.G. Doubleday and D. Rivard, editors. Bottom trawl surveys. Can Spec Pub Fish Aquat Sci. 58.

Bank, C. 2016. Validation of age determination methods for monkfish (*Lophius americanus*). Master of Science Thesis, School of Marine Science and Technology, Univ. Mass.

Brown R. 2009. Design and field data collection to compare the relative catchabilities of multispecies bottom trawl surveys conducted on the NOAA ship *Albatross* IV and the FSV *Henry B. Bigelow*. NEFSC Bottom Trawl Survey Calibration Peer Review Working Paper. NEFSC, Woods Hole, MA. 19 p.

Caruso JH. 1983. The systematics and distribution of the lophiid angler fisher: II. Revision of the genera *Lophiomus* and *Lophius*. Copeia 1: 11-30.

Collette B, Klein-MacPhee G, (eds). 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, Third edition. Smithsonian Institution Press. 748 p.

Chikarmane HM, Kuzirian A, Kozlowski R, Kuzirian M, Lee T. 2000. Population genetic structure of the monkfish, *Lophius americanus*. Biol Bull. 199: 227-228.

Cook RM. 1997.Stock trends in six North Sea stocks as revealed by an analysis of research vessel surveys. ICES J Mar Sci. 54: 924-933.

Durbin EG, Durbin AG, Langton RW, Bowman RE. 1983. Stomach contents of silver hake, *Merluccius bilinearis*, and Atlantic cod, *Gadus morhua*, and estimation of their daily rations. Fish Bull. 81: 437-454.

Eggers DM. 1977. Factors in interpreting data obtained by diel sampling of fish stomachs. J Fish Res Board Can. 34: 290-294.

Elliot JM, Persson L. 1978. The estimation of daily rates of food consumption for fish. J Anim Ecol. 47: 977-991.

Haring P, Maguire JJ, 2008. The monkfish fishery and its management in the northeastern USA. ICES J Mar Sci. 65: 1370 – 1379.

Hartley D. 1995. The population biology of the monkfish, *Lophius americanus*, in the Gulf of Maine. M. Sc. Thesis, University of Massachusetts, Amherst. 142 p.

Hasbrouck, E., J. Scotti, T. Froehlich, K. Gerbino, J. Stent, J. Costanzo, I. Wirgin. 2015. Coastwide stock structure of monkfish using microsatellite DNA analysis. Completion report, Monkfish RSA Grant NA12NMF4540095.

Johnson AK, Richards RA, Cullen DW, Sutherland SJ, 2008. Growth, reproduction, and feeding of large monkfish, *Lophius americanus*. ICES J Mar Sci. 65: 1306 – 1315.

Johnson, A.K., Allen R. Place, Belita S. Nguluwe, R. Anne Richards, Ernest Williams. In prep.

Stock Discrimination of American Monkfish using a Mitochondrial DNA Marker.
Kleisner KM, Fogarty MJ, McGee S, Barnett A, Fratantoni P, Greene J, et al. (2016) The Effects of Sub-Regional Climate Velocity on the Distribution and Spatial Extent of Marine Species Assemblages. PLoS ONE 11(2): e0149220. doi:10.1371/journal.pone.0149220
Link JS, Col L, Guida V, Dow D, O'Reilly J, Green J, Overholtz W, Palka D, Legault C, Vitaliano J, Griswold C, Fogarty M, Friedland K. 2009. Response of Balanced Network Models to Large-Scale Perturbation: Implications for Evaluating the Role of Small Pelagics in the Gulf of Maine. Ecol Model. 220: 351-369.
Link J, Overholtz W, O'Reilly J, Green J, Dow D, Palka D, Legault C, Vitaliano J, Guida V, Fogarty M, Brodziak J, Methratta E, Stockhausen W, Col L, Waring G, Griswold C. 2008. An Overview of EMAX: The Northeast U.S. Continental Shelf Ecological Network. J Mar Sys. 74: 453-474.
Link JS, Griswold CA, Methratta EM, Gunnard, J. (eds). 2006. Documentation for the Energy Modeling and Analysis eXercise (EMAX). NEFSC Ref Doc. 06-15: 166 p.
Link JS, Sosebee K. 2008. Estimates and implications of Skate Consumption in the northeastern US continental shelf ecosystem. N Amer J Fish Manage. 28: 649-662.
Link JS, Idoine J. 2009. Predator Consumption Estimates of the northern shrimp *Pandalus borealis*, with Implications for Estimates of Population Biomass in the Gulf of Maine. N. Am J Fish Manage. 29:1567-1583.
Link JS, Garrison LP. 2002. Changes in piscivory associated with fishing induced changes to the finfish community on Georges Bank. Fish Res. 55: 71-86.
Link JS, Garrison LP, Almeida FP. 2002. Interactions between elasmobranchs and groundfish species (*Gadidae and Pleuronectidae)* on the Northeast U.S. Shelf. I: Evaluating Predation. N Am J Fish Manage. 22: 550-562.
Link JS, Almeida FP. 2000. An overview and history of the food web dynamics program of the Northeast Fisheries Science Center, Woods Hole, Massachusetts. NOAA Tech Memo. NMFS-NE-159. 60 p.
McBride, R., A. Johnson, E. Lindsay, H. Walsh, A. Richards. 2017. Goosefish Lophius americanus fecundity and spawning frequency, with implications for population reproductive potential. Journal of Fish Biology 90(5): 1861-1882. doi:10.1111/jfb.13272
Miller TJ, Das C, Politis P, Long A, Lucey S, Legault C, Brown R, Rago P. 2009. Estimation of */Henry B. Bigelow/* calibration factors. NEFSC Bottom Trawl Survey/ /Calibration Peer Review Working Paper. NEFSC, Woods Hole, MA. 376 p.
Miller, T. J., Richardson, D. E., Politis, P. Blaylock, J. 2017a. NEFSC bottom trawl catch efficiency and biomass estimates for 2009-2017 for 8 flatfish stocks included in the 2017 North-east Groundfish Operational Assessments. Working paper. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. September 11-15, 2017.
Miller, T. J., Martin, M. Politis, P., Legault, C. M., Blaylock, J. 2017b. Some statistical approaches to combine paired observations of chain sweep and rockhopper gear and catches from NEFSC and DFO trawl surveys in estimating Georges Bank yellowtail flounder biomass. TRAC Working Paper 2017/XX. 36. pp.
Miller, T. J., Politis, P., Blaylock, J., Richardson, D., Manderson, J., Roebuck, C. 2018. Relative efficiency of a chain sweep and the rockhopper sweep used for the NEFSC bottom trawl survey and chainsweep-based swept area biomass estimates for 11 flatfish stocks. SAW 66 summer flounder Data/Model/Biological Reference Point (BRP)

meeting. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. September 17-21, 2018.
Moustahfid H, Tyrrell MC, Link JS. 2009a. Accounting explicitly for predation mortality in surplus production models: an application to longfin inshore squid. N Am J Fish Manage. 29: 1555-1566.
Moustahfid H, Link JS, Overholtz WJ, Tyrell MC. 2009b. The advantage of explicitly incorporating predation mortality into age-structured stock assessment models: an application for Northwest Atlantic mackerel. ICES J Mar Sci. 66: 445-454.
NEFC (Northeast Fisheries Center). 1988. An evaluation of the bottom trawl survey program of the Northeast Fisheries Center.NOAA Technical Memorandum NMFS-F/NEC52.83 pp.
NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 1998. Monkfish Fishery Management Plan. http://www.nefmc.org/monk/index.html
NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 2003. Framework Adjustment 2 to the Monkfish Fishery Management Plan. http://www.nefmc.org/monk/index.html
NEFSC [Northeast Fisheries Science Center]. 2002. [Report of the] 34th Northeast Regional Stock Assessment Workshop (34th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. NEFSC Ref Doc. 02-06: 346p
NEFSC [Northeast Fisheries Science Center]. 2005. 40th Northeast Regional Stock Assessment Workshop (40th SAW) Assessment Report. NEFSC Ref Doc. 05-04:146 p
NEFSC [Northeast Fisheries Science Center]. 2006. 42nd Northeast Regional Stock Assessment Workshop. (42nd SAW) stock assessment report, part B: Expanded Multispecies Virtual Population Analysis (MSVPA-X) stock assessment model. NEFSC Ref Doc. 06-09b: 308 p.
NEFSC [Northeast Fisheries Science Center]. 2007a. Northeast Data Poor Stocks Working Group Monkfish assessment report for 2007. NEFSC Ref Doc. 07-21: 232 p.
NEFSC [Northeast Fisheries Science Center]. 2007b. Proposed vessel calibration studies for NOAA Ship *Henry B. Bigelow*. NEFSC Ref. Doc. 07-12: 26 p.
NEFSC [Northeast Fisheries Science Center]. 2007c. Assessment Report (45th SARC/SAW). Section A.10. [TOR 6]. NEFSC Ref Doc. 07-16: 13-138.
NEFSC [Northeast Fisheries Science Center]. 2007d. Assessment Report (44th SARC/SAW). Section B.8. [TOR 6]. NEFSC Ref Doc. 07-10: 332-344, 504-547.
NEFSC [Northeast Fisheries Science Center]. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007 Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. Section 2.1. NEFSC Ref Doc. 08-15: 855-865.
NEFSC [Northeast Fisheries Science Center]. 2010. Assessment Report (50th SARC/SAW). NEFSC Ref Doc. 10-17: 15-392.
NEFSC [Northeast Fisheries Science Center]. 2013. 2013 Monkfish Operational Assessment. NEFSC Ref Doc. 13-23: 116 p.
NEFSC [Northeast Fisheries Science Center]. 2015. Operational Assessment of 20 Northeast Groundfish Stocks, Updated Through 2014. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-24; 251 p.
NEFSC [Northeast Fisheries Science Center]. 2016. 2016 Monkfish Operationsl Assessment. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-09; 109 p.

Overholtz WJ, Link JS. 2009. A simulation model to explore the response of the Gulf of Maine food web to large scale environmental and ecological changes. Ecol Model. 220: 2491-2502.

Overholtz WJ, Jacobson LD, Link JS. 2008. Developing an ecosystem approach for assessment advice and biological reference points for the Gulf of Maine-Georges Bank herring complex: adding the impact of predation mortality. N Am J Fish Manag. 28: 247-257.

Overholtz WJ, Link JS. 2007. Consumption impacts by marine mammals, fish, and seabirds on the Gulf of Maine-Georges Bank Atlantic Herring (*Clupea harengus*) complex during 1977-2002. ICES J Mar. Sci. 64: 83-96.

Overholtz W, Link JS, Suslowicz LE. 2000. The impact and implications of fish predation on pelagic fish and squid on the eastern USA shelf. ICES J Mar Sci. 57: 1147-1159.

Overholtz W, Link JS, Suslowicz LE. 1999. Consumption and harvest of pelagic fishes in the Gulf of Maine-Georges Bank ecosystem: Implications for fishery management. Proceedings of the 16th Lowell Wakefield Fisheries Symposium-Ecosystem Considerations in Fisheries Management. AK-SG-99-01:163-186.

Overholtz WJ, Murawski SA, Foster KL. 1991. Impact of predatory fish, marine mammals, and seabirds on the pelagic fish ecosystem of the northeastern USA. ICES Mar Sci Symposia 193: 198-208.

Pennington M. 1985. Estimating the average food consumption by fish in the field from stomach contents data. Dana 5: 81-86.

Pennington, M. 1986. Estimating the mean and variance from highly skewed marine data. Fishery Bulletin 47: 1623-1624.

Rago PJ, Wigley SE, Fogarty MJ. 2005. NEFSC bycatch estimation methodology: allocation, precision, and accuracy. NEFSC Ref Doc. 05-09: 44 p

Rago PJ, Weinberg JR, Weidman C. 2006. A spatial model to estimate gear efficiency and animal density from depletion experiments. Can J Fish Aquat Sci: 63: 2377–2388.

Raymond M, Glass C. 2006. A Project to define monkfish trawl gear and areas that reduce groundfish bycatch and to minimize the impacts of monkfish trawl gear on groundfish habitat. Final Report, NOAA NERO CRPP Contract EA-133-F-03-CN-0049.

Richards A. 2006. Goosefish (*Lophius americanus*). In Status of Fishery Resources off the Northeastern US (www.nefsc.noaa.gov/sos/spsyn/og/goose).

Richards RA, Nitschke P, Sosebee K. 2008. Population biology of monkfish *Lophius americanus*. ICES J Mar Sci. 65: 1291-1305.

Richards, RA, Grabowski, J and Sherwood, G. 2012. Archival Tagging Study of Monkfish, *Lophius americanus*. Final Report to Northeast Consortium, Project Award 09-042.

Rountree RA, Gröger JP, Martins D. 2006. Extraction of daily activity pattern and vertical migration behavior from the benthic fish, *Lophius americanus*, based on depth analysis from data storage tags. ICES CM 2006/Q:01.

Sissenwine MP, Bowman EW. 1977. Fishing power of two bottom trawls towed by research vessels off the northeast coast of the USA during day and night. ICES CM. 1977: B30.

Steimle FW, Morse WW, Johnson DL. 1999. Essential fish habitat source document: monkfish, *Lophius americanus*, life history and habitat characteristics. NOAA TechMemoNMFS-NE-127.

Syrjala, S. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. ICES J. Mar. Sci. 57:831-842.

Taylor MH, Bascuñán C, Manning JP. 2005. Description of the 2004 Oceanographic Conditions on the Northeast Continental Shelf. NEFSC Ref Doc. 05-03: 90 p.

Tsou TS, Collie JS. 2001a. Estimating predation mortality in the Georges Bank fish community. Can J Fish Aquat Sci. 58: 908-922.

Tsou TS, Collie JS. 2001b. Predation-mediated recruitment in the Georges Bank fish community. ICES J Mar Sci. 58: 994-1001.

Tyrrell MC, Link JS, Moustahfid H, Overholtz WJ. 2008. Evaluating the effect of predation mortality on forage species population dynamics in the Northwest Atlantic continental shelf ecosystem: an application using multispecies virtual population analysis. ICES J Mar Sci. 65: 1689-1700.

Tyrrell MC, Link JS, Moustahfid H, Smith BE. 2007. The dynamic role of goosefish (*Pollachius virens*) as a predator in the Northeast US Atlantic ecosystem: a multi-decadal perspective. J Northwest Atl Fish Sci. 38: 53-65.

Ursin E, Pennington M, Cohen EB, Grosslein MD. 1985. Stomach evacuation rates of Atlantic cod (*Gadus morhua*) estimated from stomach contents and growth rates. Dana 5: 63-80.

Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design, and Estimation of Precision and Accuracy. NEFSC Ref Doc. 07-09: 156 p

Weinberg KL, Kotwicki S. 2008. Factors influencing net width and sea floor contact of a survey bottom trawl. Fish Res. 93: 265-279.

Tables

Table D1. Timeline of fishery management actions for monkfish.

(http://www.greateratlantic.fisheries.noaa.gov/sustainable/species/monkfish/)

1999 – Monkfish FMP was implemented which included a limited access permit program, a DAS management system, trip limits, and minimum size limits.

1999 – Amendment 1 (FR Notice) approved to ensure compliance with essential fish habitat requirements of the Magnuson-Stevens Act.

2002 – Framework Adjustment 1 (FR Notice) was disapproved by NMFS. NMFS instead published an emergency rule that implemented measures based upon the best available science to temporarily suspend the restrictive Year 4 default management measures that would have become effective May 1, 2002.

2003 –Framework Adjustment 2 (FR Notice) modified the overfishing definition and implemented annual adjustments to the management measures.

2003 - Final rule implemented a series of seasonal closures that prohibited the use of large mesh gillnets in Federal waters off the coast of Virginia and North Carolina to reduce the impact of the monkfish fishery on endangered and threatened species of sea turtles.

2005 – Amendment 2 (FR Notice) addressed essential fish habitat, bycatch concerns, and issues raised by public comments.

2006 – Framework Adjustment 3 (FR Notice) implemented to prohibit targeting monkfish on Multispecies B-regular DAS.

2007 – Interim management measures Framework 4 (FR Notice) adopted in May to address overfishing while NMFS conducted a stock assessment. Framework 4 was implemented in October to establish 3-year target total allowable catches (TACs), a target TAC backstop provision, and adjustments to DAS allocations and trip limits.

2007 – Amendment 3 (FR Notice) was implemented as an Omnibus Amendment to standardize bycatch reporting methodology for monkfish and other fisheries.

2008 – NMFS implemented Framework 5 (FR Notice) to ensure the Monkfish FMP succeeds in keeping landings within the target total allowable catch levels. Measures include reduction in carryover DAS, reduction in bycatch or incidental catch limits, and revision in the biological reference points used to determine if the stock is overfished.

2008 – Framework 6 (FR Notice) eliminated the backstop provision adopted in Framework Adjustment 4 to the FMP, October 2007.

Table D1, continued.

2011 – Amendment 5 (FR Notice) implemented a suite of measures including annual catch limits and accountability measures, measures to promote efficiency and reduce waste, and bring the biological reference points into compliance.

2011 – Framework Adjustment 7 (FR Notice) implemented measures that were disapproved in Amendment 5 due to newly available science. Specifically, DAS allocations, trip limits, and an annual catch target for the Northern Area.

2012 – Amendment 6 is still being developed in considering a catch shares management system for the fishery. Information on Amendment 6 is located here.

2013 - NMFS implements an emergency action (FR Notice) to suspend the monkfish possession limits in the Northern Fishery Management Area for monkfish permit categories C and D under a monkfish DAS.

2014 - Framework Adjustment 8 (FR Notice) implemented measures to incorporate results of latest stock assessment, increase monkfish day-at-sea allocations and landing limits to better achieve optimum yield, and increase operational flexibility by allowing all limited access monkfish vessels to use an allocated monkfish-only day-at-sea at any time throughout the fishing year and Category H vessels to fish throughout the Southern Fishery Management Area.

2016 – Framework Adjustment 9 (FR Notice) implemented measures to increase landings in the NFMA by eliminating the possession limit while fishing under both a NE multispecies and monkfish day-at-sea and increasing flexibility in the SFMA by reducing the minimum mesh size for roundfish gillnets.

2017 – Framework Adjustment 10 (FR Notice) implemented measures to incorporate results of the 2016 operational assessment, increase monkfish day-at-sea allocations and possession limits.

Table D2. Management measures for monkfish, fishing years 2000-2018. Regulations pertain to fishing years (FY, May 1- April 30), thus landings do not correspond to calendar year landings in Table D3. Trip limits apply to vessels fishing on declared monkfish days at sea.

Northern Fishery Management Area

Fishing Year	Target TAC/TAL (mt)	Trip Limits* Cat. A & C	Trip Limits* Cat. B & D	DAS Restrictions**	FY Landings (mt)	Percent of TAC
2000	5,673	n/a	n/a	40	11,859	209%
2001	5,673	n/a	n/a	40	14,853	262%
2002	11,674	n/a	n/a	40	14,491	124%
2003	17,708	n/a	n/a	40	14,155	80%
2004	16,968	n/a	n/a	40	11,750	69%
2005	13,160	n/a	n/a	40	9,533	72%
2006	7,737	n/a	n/a	40	6,677	86%
2007	5,000	1,250	470	31	5,050	101%
2008	5,000	1,250	470	31	3,528	71%
2009	5,000	1,250	470	31	3,344	67%
2010	5,000	1,250	470	31	2,834	57%
2011	5,854	1,250	600	40	3,699	63%
2012	5,854	1,250	600	40	3,920	67%
2013	5,854	1,250	600	40	3,596	61%
2014	5,854	1,250	600	45	3,403	58%
2015	5,854	1,250	600	45	4,080	70%
2016	5,854	1,250	600	45	5,447	93%
2017	6,338	1,250	600	45	6,807	107%
2018	6,338	1,250	600	45	6,168	97%

* Trip limits in pounds tail weight per DAS

** Excluding up to 10 DAS carryover, became 4 DAS carryover in FY2007

In 2011, the target TAC became a target TAL

Table D2, continued.

Southern Fishery Management Area

Fishing Year	Target TAC/TAL (mt)	Trip Limits* Cat. A,C,G	Trip Limits* Cat. B, D, H	DAS Restrictions**	FY Landings (mt)	Percent of TAC
2000	6,024	1,500	1,000	40	7,960	132%
2001	6,024	1,500	1,000	40	11,069	184%
2002	7,921	550	450	40	7,478	94%
2003	10,211	1,250	1,000	40	12,198	119%
2004	6,772	550	450	28	6,223	92%
2005	9,673	700	600	39.3	9,656	100%
2006	3,667	550	450	12	5,909	161%
2007	5,100	550	450	23	7,180	141%
2008	5,100	550	450	23	6,751	132%
2009	5,100	550	450	23	4,800	94%
2010	5,100	550	450	23	4,484	88%
2011	8,925	550	450	28	5,801	65%
2012	8,925	550	450	28	5,184	58%
2013	8,925	550	450	28	5,088	57%
2014	8,925	610	500	32	5,415	61%
2015	8,925	610	500	32	4,733	53%
2016	8,925	700	575	37	4,345	49%
2017	9,011	700	575	37	3,802	42%
2018	9,011	700	575	37	4,600	51%

* Trip limits in pounds tail weight per DAS
** Excluding up to 10 DAS carryover, became 4 DAS carryover in FY2007
In 2011, the target TAC became a target TAL

Table D3. Landings (calculated live weight, mt) of monkfish as reported in NEFSC weigh-out data base (1964-1993) and vessel trip reports (1994-2014) (North = SA 511-523, 561; South = SA 524-639 excluding 551-561 plus landings from North Carolina for years 1977-1995); General Canvas database (1964-1989, North = ME, NH, northern weigh out proportion of MA; South = Southern weigh-out proportion of MA, RI-VA); Foreign landings from NAFO database areas 5 and 6. Shaded cells denote suggested source for landings which are used in the total column at the far right (see text for details).

	Weigh Out Plus NC			General Canvas				
Year	US North	US South	US Total	US North	US South	US Total	Foreign	Total
1964	45	19	64	45	61	106	0	106
1965	37	17	54	37	79	115	0	115
1966	299	13	312	299	69	368	2,397	2765
1967	539	8	547	540	59	598	11	609
1968	451	2	453	449	36	485	2,231	2716
1969	258	4	262	240	43	283	2,249	2532
1970	199	12	211	199	53	251	477	728
1971	213	10	223	213	53	266	3,659	3925
1972	437	24	461	437	65	502	4,102	4604
1973	710	139	848	708	240	948	6,818	7766
1974	1,197	101	1,297	1,200	183	1,383	727	2110
1975	1,853	282	2,134	1,877	417	2,294	2,548	4842
1976	2,236	428	2,663	2,256	608	2,865	341	3206
1977	3,137	830	3,967	3,167	1,314	4,481	275	4756
1978	3,889	1,384	5,273	3,976	2,073	6,049	38	6087
1979	4,014	3,534	7,548	4,068	4,697	8,765	70	8835
1980	3,695	4,232	7,927	3,623	6,035	9,658	132	9790
1981	3,217	2,380	5,597	3,171	4,142	7,313	381	7694
1982	3,860	3,722	7,582	3,757	4,492	8,249	310	7,892
1983	3,849	4,115	7,964	3,918	4,707	8,624	80	8,044
1984	4,202	3,699	7,901	4,220	4,171	8,391	395	8,296
1985	4,616	4,262	8,878	4,452	4,806	9,258	1,333	10,211
1986	4,327	4,037	8,364	4,322	4,264	8,586	341	8,705
1987	4,960	3,762	8,722	4,995	3,933	8,926	748	9,470
1988	5,066	4,595	9,661	5,033	4,775	9,809	909	10,570
1989	6,391	8,353	14,744	6,263	8,678	14,910	1,178	15,922
1990	5,802	7,204	13,006				1,557	14,563
1991	5,693	9,865	15,558				1,020	16,578
1992	6,923	13,942	20,865				473	21,338
1993	10,645	15,098	25,743				354	26,097
1994	10,950	12,126	23,076				543	23,619
1995	11,970	14,361	26,331				418	26,749
1996	10,791	15,715	26,507				184	26,691
1997	9,709	18,462	28,172				189	28,361
1998	7,281	19,337	26,618				190	26,808

Table D3, continued

	Weigh Out Plus NC			General Canvas				
Year	US North	US South	US Total	US North	US South	US Total	Foreign	Total
1999	9,128	16,085	25,213				151	25,364
2000	10,729	10,147	20,876				176	21,052
2001	13,341	9,959	23,301				142	23,443
2002	14,011	8,884	22,896				294	23,190
2003	14,991	11,095	26,086				309	26,395
2004	13,209	7,978	21,186				166	21,352
2005	10,140	9,177	19,317				206	19,523
2006	6,974	7,980	14,955				279	15,234
2007	4,953	7,388	12,341					12,341
2008	3,942	7,250	11,192					11,192
2009	3,210	5,532	8,742					8,742
2010	2,424	4,996	7,420					7,420
2011	3,227	5,371	8,599					8,599
2012	4,033	5,724	9,757					9,757
2013	3,332	5,253	8,586					8,586
2014	3,402	5,135	8,537					8,537
2015	4,027	4,609	8,636					8,636
2016	4,633	4,422	9,055					9,055
2017	7,008	3,893	10,901					10,901
2018	5,954	4,465	10,419					10,419

Table D4. U.S. landings of monkfish (calculated live weight, mt) by gear type. A. Northern management area, B. Southern management area, C. Regions combined.

A. North											
Year	Trawl	Gill Net	Dredge	Other	Total	Year	Trawl	Gill Net	Dredge	Othe r	Total
1964	45	0			45	2005	6,876	2,567	99	598	10,140
1965	36	0			37	2006	5,054	1,573	185	162	6,974
1966	299	0		0	299	2007	3,482	1,172	243	56	4,953
1967	532		8		539	2008	3,055	802	52	34	3,942
1968	447		4		451	2009	2,491	651	21	47	3,210
1969	253	1	4		258	2010	1,947	460	12	6	2,424
1970	198	0		0	199	2011	2,696	482	45	5	3,227
1971	213		0		213	2012	3,551	347	134	1	4,033
1972	426	8	1	2	437	2013	2,799	421	112	0	3,332
1973	661	29	12	8	710	2014	2,950	418	33	0	3,402
1974	1,060	105	7	25	1,197	2015	3,256	670	100	1	4,027
1975	1,712	123	10	9	1,853	2016	3,937	608	86	2	4,633
1976	2,031	143	47	15	2,236	2017	6,030	946	32	0	7,008
1977	2,737	230	142	28	3,137	2018	4,935	860	151	8	5,954
1978	3,255	368	212	54	3,889						
1979	2,967	393	584	71	4,014						
1980	2,526	518	596	56	3,696						
1981	2,266	461	443	47	3,217						
1982	3,040	421	367	32	3,860						
1983	3,233	314	266	37	3,849						
1984	3,648	315	196	43	4,202						
1985	3,982	315	264	55	4,616						
1986	3,412	326	553	36	4,327						
1987	3,853	374	695	38	4,960						
1988	3,554	304	1,172	36	5,066						
1989	3,429	349	2,584	30	6,391						
1990	3,298	338	2,141	25	5,802						
1991	3,299	338	2,033	24	5,694						
1992	4,330	359	2,211	24	6,923						
1993	5,890	695	4,034	26	10,645						
1994	7,574	1,571	1,808	86	11,039						
1995	9,119	1,531	1,266	54	11,970						
1996	8,445	1,389	913	45	10,791						
1997	7,363	988	1,318	40	9,709						
1998	5,421	885	948	27	7,281						
1999	7,037	1,470	598	24	9,128						
2000	8,234	2,102	316	76	10,729						
2001	9,990	2,959	381	11	13,341						
2002	10,839	2,978	181	13	14,011						
2003	12,028	2,488	222	254	14,991						
2004	9,918	2,866	14	411	13,209						

Table D4, continued.

B. South											
Year	**Trawl**	**Gill Net**	**Dredge**	**Other**	**Total**	**Year**	**Trawl**	**Gill Net**	**Dredge**	**Other**	**Total**
1964	19				19	2005	1,706	4,673	1,581	1,216	9,177
1965	17				17	2006	1,457	3,970	1,532	1,022	7,980
1966	13			0	13	2007	1,084	3,782	1,594	928	7,388
1967	8				8	2008	1,041	4,098	1,370	741	7,250
1968	2				2	2009	721	3,117	826	868	5,532
1969	4				4	2010	590	2,738	579	1,089	4,996
1970	12				12	2011	1,178	3,480	565	149	5,371
1971	10				10	2012	1,144	3,688	739	153	5,724
1972	24				24	2013	1,112	3,366	599	176	5,253
1973	132		5	1	137	2014	1,028	3,142	879	86	5,135
1974	98			0	98	2015	673	3,308	538	91	4,610
1975	265	0	2	2	269	2016	578	3,332	349	162	4,421
1976	333		7	0	340	2017	550	2,832	400	112	3,894
1977	508		57	26	591	2018	496	3,404	471	93	4,464
1978	605	0	507	26	1,138						
1979	944	6	1,015	16	1,981						
1980	1,139	10	1,274	7	2,429						
1981	1,100	16	782	105	2,003						
1982	1,806	12	1,507	27	3,352						
1983	1,819	11	2,119	17	3,966						
1984	1,714	15	1,704	18	3,452						
1985	1,739	17	2,347	3	4,106						
1986	1,841	32	2,068	12	3,954						
1987	1,680	26	1,997	3	3,707						
1988	1,828	58	2,594	3	4,483						
1989	3,240	17	5,036	3	8,297						
1990	2,361	32	4,744	5	7,142						
1991	5,515	363	3,907	16	9,800						
1992	6,528	977	6,409	11	13,925						
1993	5,987	1,722	7,158	192	15,059						
1994	5,233	2,342	3,995	556	12,126						
1995	5,785	3,800	4,030	746	14,361						
1996	7,141	4,211	4,330	33	15,715						
1997	8,161	5,203	4,890	208	18,462						
1998	7,815	6,198	5,190	134	19,337						
1999	6,364	6,187	3,481	54	16,085						
2000	4,018	4,005	1,975	150	10,147						
2001	3,091	5,119	1,719	30	9,959						
2002	1,584	5,410	1,847	43	8,884						
2003	2,034	7,262	1,717	83	11,095						
2004	1,228	4,605	671	1,474	7,978						

Table D4, continued.

C.	Regions combined										
Year	Trawl	Gill Net	Dredge	Other	Total	Year	Trawl	Gill Net	Dredge	Other	Total
1964	64	0			64	2005	8582.4	7240.61	1680.16	1813.63	19,317
1965	53	0			53	2006	6510.9	5542.37	1716.94	1184.43	14,955
1966	311	0		0	312	2007	4566.1	4953.89	1837.33	983.87	12,341
1967	540		8		547	2008	4095.4	4899.6	1421.79	775.09	11,192
1968	449		4		453	2009	3212	3767.96	846.58	914.98	8,742
1969	257	1	4		262	2010	2537.3	3197.79	590.48	1094.13	7,420
1970	210	0		0	211	2011	3874.2	3962.29	609.1	153.23	8,599
1971	223		0		223	2012	4695.4	4035.07	872.89	154	9,757
1972	451	8	1	2	461	2013	3910.6	3787.2	711.45	176.42	8,586
1973	794	29	17	9	848	2014	3977.9	3560.22	911.91	86.55	8,537
1974	1,160	105	7	25	1,297	2015	3929	3978	638	92	8,637
1975	1,990	123	12	10	2,135	2016	4515	3940	435	164	9,054
1976	2,459	143	54	15	2,670	2017	6580	3778	432	112	10,902
1977	3,487	230	202	53	3,973	2018	5431	4264	622	101	10,418
1978	4,016	368	774	80	5,238						
1979	3,989	399	2,070	87	6,545						
1980	3,723	528	2,276	62	6,589						
1981	3,483	477	1,399	152	5,512						
1982	4,998	433	2,061	60	7,551						
1983	5,166	325	2,431	56	7,977						
1984	5,513	330	1,968	61	7,871						
1985	5,757	332	2,611	58	8,758						
1986	5,318	358	2,621	48	8,345						
1987	5,561	400	2,692	41	8,694						
1988	5,399	363	3,765	39	9,567						
1989	6,679	366	7,620	33	14,698						
1990	5,697	372	6,885	30	12,984						
1991	8,847	700	5,941	39	15,528						
1992	10,860	1,336	8,619	35	20,850						
1993	11,879	2,417	11,192	218	25,707						
1994	12,707	3,884	5,759	638	22,988						
1995	14,905	5,331	5,296	800	26,331						
1996	15,586	5,599	5,243	78	26,507						
1997	15,524	6,192	6,208	249	28,172						
1998	13,236	7,083	6,138	161	26,618						
1999	13,401	7,656	4,079	78	25,213						
2000	12,252	6,107	2,291	226	20,876						
2001	13,081	8,078	2,100	41	23,301						
2002	12,423	8,389	2,028	56	22,896						
2003	14,062	9,750	1,939	336	26,086						
2004	11,145	7,471	685	1,885	21,186						

Table D5. Landed weight (mt) of monkfish by market category for the northern management area.

				Head on,				Tails	Tails	Tails	Tails	Tails
Year	Belly Flaps	Cheeks	Liver	Gutted	Round	Dressed	Heads	Unc.	Large	Small	Peewee	All
1964	0	0	0	0	0	0	0	14	0	0	0	14
1965	0	0	0	0	0	0	0	11	0	0	0	11
1966	0	0	0	0	0	0	0	90	0	0	0	90
1967	0	0	0	0	0	0	0	163	0	0	0	163
1968	0	0	0	0	0	0	0	136	0	0	0	136
1969	0	0	0	0	0	0	0	78	0	0	0	78
1970	0	0	0	0	0	0	0	60	0	0	0	60
1971	0	0	0	0	0	0	0	64	0	0	0	64
1972	0	0	0	0	0	0	0	132	0	0	0	132
1973	0	0	0	0	0	0	0	214	0	0	0	214
1974	0	0	0	0	0	0	0	360	0	0	0	360
1975	0	0	0	0	0	0	0	558	0	0	0	558
1976	0	0	0	0	0	0	0	673	0	0	0	673
1977	0	0	0	0	0	0	0	945	0	0	0	945
1978	0	0	0	0	0	0	0	1,171	0	0	0	1,171
1979	0	0	0	0	0	0	0	1,209	0	0	0	1,209
1980	0	0	0	0	0	0	0	1,113	0	0	0	1,113
1981	0	0	0	0	0	0	0	969	0	0	0	969
1982	0	0	10	0	0	0	0	1,146	15	2	0	1,163
1983	0	0	9	0	0	0	0	1,152	5	2	0	1,159
1984	0	0	15	0	0	0	0	1,262	4	0	0	1,266
1985	0	0	11	0	0	0	0	1,386	2	3	0	1,390
1986	0	0	14	0	0	0	0	1,303	0	0	0	1,303
1987	0	0	24	0	0	0	0	1,492	2	1	0	1,494
1988	0	0	47	0	0	0	0	1,517	6	3	0	1,526
1989	0	0	59	0	11	0	0	1,465	327	130	0	1,922
1990	0	0	78	0	30	0	0	1,174	411	154	0	1,738
1991	0	3	70	0	0	0	0	1,014	539	153	9	1,715
1992	0	1	83	0	0	0	0	911	590	505	79	2,085
1993	0	1	208	98	351	0	0	1,034	868	1,062	103	3,067
1994	0	1	208	533	981	0	0	403	1,206	1,075	136	2,820
1995	0	1	46	1,224	1,113	0	0	362	1,180	1,003	304	2,850
1996	0	0	65	1,116	745	0	0	90	930	1,399	224	2,643
1997	0	0	51	634	244	0	0	26	1,126	1,361	119	2,633
1998	0	0	24	551	144	0	0	16	1,055	810	79	1,960
1999	0	0	40	1,701	511	0	0	28	996	848	139	2,012
2000	0	0	94	3,213	912	0	0	17	783	1,050	3	1,853
2001	0	0	93	3,084	231	0	0	128	1,115	1,647	0	2,890
2002	0	0	75	3,789	24	0	0	80	1,055	1,777	0	2,912
2003	0	0	61	2,364	14	0	0	95	1,573	2,032	0	3,699
2004	0	0	56	647	960	0	0	3	1,883	1,580	1	3,467

Table D5, continued.

				Head on,				Tails	Tails	Tails	Tails	Tails
Year	**Belly Flaps**	**Cheeks**	**Liver**	**Gutted**	**Round**	**Dressed**	**Heads**	**Unc.**	**Large**	**Small**	**Peewee**	**All**
2005	0	0	42	1,706	22	0	0	3	1,440	1,017	2	2,462
2006	0	0	22	1,622	20	0	0	9	899	627	3	1,538
2007	0	0	13	682	0	0	1	9	870	378	1	1,258
2008	0	0	5	391	0	4	0	1	739	311	0	1,051
2009	0	0	2	290	0	11	0	2	560	299	0	861
2010	0	0	1	208	0	0	0	2	396	261	0	658
2011	0	17	72	187	44	0	8	1	527	367	1	896
2012	0	24	89	142	0	0	3	1	609	556	2	1,168
2013	0	0	76	137	0	0	4	1	549	407	3	960
2014	0	0	71	117	0	0	25	2	560	423	4	988
2015	0	0	73	179	0	0	31	2	594	556	0	1,151
2016	0	0	86	105	0	0	127	4	672	683	0	1,359
2017	0	0	114	151	0	0	140	13	1006	1041	0	2,060
2018	0	0	73	195	1		174	3	931	792	0	1,726

Table D6. Landed weight (mt) of monkfish by market category for the southern management area.

Year	Belly Flaps	Cheeks	Liver	Head on, Gutted	Round	Dressed	Heads	Tails Unc.	Tails Large	Tails Small	Tails Peewee	Tails All
1964	0	0	0	0	0	0	0	6	0	0	0	6
1965	0	0	0	0	0	0	0	5	0	0	0	5
1966	0	0	0	0	0	0	0	4	0	0	0	4
1967	0	0	0	0	0	0	0	2	0	0	0	2
1968	0	0	0	0	0	0	0	1	0	0	0	1
1969	0	0	0	0	0	0	0	1	0	0	0	1
1970	0	0	0	0	0	0	0	4	0	0	0	4
1971	0	0	0	0	0	0	0	3	0	0	0	3
1972	0	0	0	0	0	0	0	7	0	0	0	7
1973	0	0	0	0	0	0	0	42	0	0	0	42
1974	0	0	0	0	0	0	0	30	0	0	0	30
1975	0	0	0	0	0	0	0	85	0	0	0	85
1976	0	0	0	0	0	0	0	129	0	0	0	129
1977	0	0	0	0	0	0	0	250	0	0	0	250
1978	0	0	0	0	0	0	0	403	0	0	0	403
1979	0	0	0	0	0	0	0	1,016	0	0	0	1,016
1980	0	0	0	0	0	0	0	1,189	0	0	0	1,189
1981	0	0	0	0	0	0	0	685	0	0	0	685
1982	0	0	0	0	0	0	0	912	138	51	0	1,102
1983	0	0	2	0	0	0	0	858	237	136	0	1,231
1984	0	0	10	0	0	0	0	860	183	45	0	1,087
1985	0	0	17	0	0	0	0	1,081	85	71	0	1,237
1986	0	0	23	0	0	0	0	1,063	76	52	0	1,191
1987	0	0	330	0	0	0	0	972	138	6	0	1,116
1988	0	0	65	0	0	0	0	1,129	190	32	0	1,350
1989	0	0	88	0	5	0	0	2,037	230	230	0	2,498
1990	0	0	102	0	187	0	0	1,428	443	223	0	2,095
1991	0	5	200	0	415	0	0	1,215	1,123	461	28	2,827
1992	0	3	239	0	386	0	0	1,868	1,318	788	104	4,078
1993	0	1	252	0	178	0	0	2,469	1,065	789	159	4,483
1994	0	4	251	921	1,064	0	0	854	1,025	989	122	2,989
1995	2	0	451	1,529	1,539	0	0	518	1,341	1,419	59	3,337
1996	0	0	504	2,352	318	0	0	996	1,160	1,629	46	3,830
1997	0	0	577	2,559	551	0	0	647	1,924	1,913	32	4,516
1998	0	0	582	3,036	438	0	0	842	1,952	1,840	16	4,650
1999	0	0	558	4,047	621	0	0	509	1,393	1,352	14	3,268
2000	0	4	530	3,701	179	0	0	276	797	657	2	1,732
2001	0	0	466	3,944	300	0	0	217	844	494	0	1,555
2002	0	0	433	4,013	551	0	0	167	629	336	0	1,132
2003	0	1	426	4,959	667	0	0	242	790	405	1	1,438
2004	0	2	355	2,758	1,066	8	0	186	671	274	0	1,130

Table D6, continued.

Year	Belly Flaps	Cheeks	Liver	Head on, Gutted	Round	Dressed	Heads	Tails Unc.	Tails Large	Tails Small	Tails Peewee	Tails All
2005	0	55	330	3,695	187	18	0	105	771	550	2	1,428
2006	0	108	293	3,351	27	20	5	69	658	506	1	1,233
2007	0	44	258	3,030	107	12	0	88	727	329	1	1,145
2008	0	5	253	3,008	44	13	1	61	768	300	0	1,130
2009	1	0	199	2,540	4	9	11	47	505	235	0	788
2010	0	0	188	2,117	9	4	27	61	476	235	0	772
2011	0	0	154	2,195	491	6	31	47	422	243	0	713
2012	0	0	110	2,921	0	4	40	44	405	269	1	720
2013	1	0	130	2,247	5	4	106	58	462	286	2	809
2014	0	0	111	2,049	2	14	116	45	540	250	3	837
2015	0	0	99	2,339	2	18	96	43	358	174	0	574
2016	0	0	86	2,399	`1	10	104	56	295	151	0	502
2017	0	0	72	2020	6	10	83	45	246	180	0	471
2018	0	0	93	2022	10	10	105	84	406	152	0	642

Table D7. Estimated monkfish discards (live weight) in the northern management region. Dredge and shrimp trawl discards are based on SBRM monkfish discards relative to kept of all species; trawl and gillnet are based on monkfish discards relative to monkfish kept.

North		Trawl					Gillnet				
Year	Half	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)
1989	1	30	0.037	0.58	1,550	58	1	0.036		84	3
	2	63	0.141	0.44	1,830	257	103	0.027	0.32	265	7
1990	1	16	0.082	0.60	1,562	128	73	0.036	0.41	121	4
	2	36	0.039	0.45	1,690	66	65	0.029	0.37	219	6
1991	1	27	0.042	0.45	1,233	52	191	0.030	0.47	120	4
	2	81	0.167	0.25	1,999	334	758	0.036	0.10	213	8
1992	1	51	0.122	0.30	1,674	203	403	0.065	0.16	105	7
	2	35	0.224	0.43	2,624	587	618	0.040	0.24	248	10
1993	1	19	0.067	0.30	2,821	189	271	0.086	0.21	119	10
	2	19	0.084	0.26	3,032	254	338	0.032	0.24	560	18
1994	1	18	0.035	0.29	3,273	115	65	0.065	0.29	270	18
	2	6	0.024	0.59	4,385	107	44	0.055	0.19	779	43
1995	1	30	0.164	0.36	4,643	762	38	0.141	0.30	469	66
	2	48	0.090	0.31	4,478	403	69	0.088	0.23	1,023	90
1996	1	21	0.190	0.23	4,294	814	28	0.137	0.43	340	47
	2	49	0.132	0.57	4,057	534	34	0.132	0.19	934	123
1997	1	13	0.100	0.49	3,795	378	19	0.036	0.32	329	12
	2	7	0.076	0.23	3,225	244	26	0.194	0.84	742	144
1998	1	7	0.124	0.37	3,150	392	39	0.028	0.41	238	7
	2	3	0.093	0.10	2,398	223	72	0.043	0.28	606	26
1999	1	3	0.098	0.04	3,947	388	36	0.067	0.65	282	19
	2	42	0.069	0.21	3,011	207	66	0.036	0.51	1,051	38
2000	1	80	0.069	0.32	3,916	271	58	0.041	0.30	501	21
	2	61	0.088	0.31	3,798	333	65	0.077	0.24	2,033	157
2001	1	61	0.102	0.20	5,088	518	41	0.061	0.69	880	53
	2	113	0.066	0.10	4,588	303	33	0.108	0.93	2,208	238
2002	1	47	0.076	0.25	5,634	428	33	0.045	0.39	760	34
	2	274	0.100	0.10	4,532	455	67	0.053	0.27	2,230	118
2003	1	206	0.101	0.14	6,642	671	112	0.037	0.24	628	23
	2	218	0.055	0.12	4,721	261	273	0.058	0.13	1,570	91
2004	1	163	0.042	0.12	5,307	225	212	0.021	0.22	739	16
	2	377	0.036	0.10	4,039	147	728	0.059	0.09	1,788	105
2005	1	500	0.047	0.07	3,971	187	153	0.098	0.26	516	51
	2	601	0.057	0.10	3,038	174	660	0.074	0.12	1,450	108
2006	1	292	0.055	0.08	2,852	158	93	0.063	0.41	262	17
	2	201	0.071	0.11	2,285	162	80	0.080	0.17	1,025	82
2007	1	221	0.050	0.10	2,075	104	42	0.061	0.32	228	14
	2	303	0.072	0.10	1,448	104	190	0.062	0.16	693	43
2008	1	277	0.088	0.10	1,821	160	61	0.076	0.28	141	11
	2	383	0.082	0.10	1,045	86	156	0.051	0.22	541	28

Table D7, continued.

North		Trawl					Gillnet				
Year	Half	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)
2009	1	351	0.166	0.13	1,666	276	129	0.209	0.46	149	31
	2	408	0.079	0.11	832	66	195	0.119	0.27	467	55
2010	1	339	0.097	0.08	1,537	149	305	0.056	0.15	112	6
	2	671	0.090	0.07	857	77	1364	0.102	0.07	303	31
2011	1	671	0.120	0.07	1,461	175	554	0.050	0.10	120	6
	2	743	0.058	0.08	1,174	69	1244	0.080	0.10	361	29
2012	1	739	0.057	0.06	1901	108	548	0.047	0.17	93	4
	2	664	0.078	0.05	1446	112	900	0.060	0.07	184	11
2013	1	471	0.125	0.07	1669	208	172	0.044	0.14	98	4
	2	440	0.097	0.10	1073	104	567	0.083	0.11	323	27
2014	1	405	0.143	0.07	1908	272	278	0.090	0.30	82	7
	2	528	0.100	0.09	927	93	830	0.062	0.11	336	21
2015	1	298	0.155	0.10	1891	294	87	0.056	0.21	120	7
	2	381	0.117	0.11	1223	143	475	0.063	0.12	549	34
2016	1	253	0.121	0.09	2058	249	82	0.064	0.32	94	6
	2	237	0.141	0.10	1702	241	201	0.094	0.21	514	48
2017	1	186	0.156	0.13	3002	467	36	0.018	0.28	152	3
	2	340	0.052	0.12	2814	147	245	0.035	0.15	794	28
2018	1	255	0.088	0.11	2841	250	72	0.031	0.35	136	4
	2	263	0.072	0.14	1980	142	124	0.079	0.24	719	57

Table D7, continued.

North		Scallop Dredge					Shrimp Trawl				
Year	Half	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)
1989	1		0.001		18,213	17	31	0.002	0.33	3,412	5.5
	2		0.008		24,053	185	9	0.001	0.62	931	1.2
1990	1		0.001		9,864	9	27	0.002	0.34	4,494	8.1
	2		0.008		19,293	149	4	0.058	1.01	620	35.8
1991	1		0.001		16,608	16	46	0.004	0.19	3,536	12.8
	2	1	0.002		21,312	40	7	0.046	0.40	340	15.7
1992	1	3	0.000	0.98	14,179	1	76	0.003	0.23	3,285	9.6
	2	6	0.001	0.41	20,033	26	6	0.003	0.28	161	0.4
1993	1	7	0.002	0.26	13,702	25	78	0.001	0.26	1,890	2.5
	2	4	0.018	0.45	12,674	230	4	0.001	0.70	316	0.3
1994	1	2	0.001	1.21	5,486	5	71	0.002	0.38	2,443	5.9
	2	5	0.010	0.38	6,230	59	6	0.001	0.44	906	0.7
1995	1	1	0.014		2,318	32	64	0.000	0.23	4,452	1.8
	2	5	0.018	0.50	6,544	119	9	0.001	0.43	1,377	0.7
1996	1	8	0.003	0.94	5,338	14	30	0.000	0.34	7,580	0.8
	2	5	0.022	0.40	11,375	246	5	0.000	0.79	1,418	0.4
1997	1	4	0.004	0.48	10,567	42	17	0.000	0.61	5,416	0.9
	2	4	0.020	0.76	9,148	180		0.001		649	0.4
1998	1	2	0.004	0.32	7,482	28		0.001		3,095	2.7
	2	7	0.014	0.16	6,400	90		0.001		168	0.1
1999	1	2	0.004	0.65	8,347	29		0.001		1,407	1.2
	2	6	0.004	0.44	6,797	30		0.001		33	0.0
2000	1		0.004		6,993	31		0.001		2,068	1.8
	2	95	0.004	0.13	13,019	56		0.001		35	0.0
2001	1	17	0.003	0.42	14,926	41	3	0.000	0.14	813	0.1
	2		0.005		11,525	60		0.001			0.0
2002	1		0.005		8,712	45		0.001		308	0.3
	2	10	0.008	0.97	11,533	88		0.001			0.0
2003	1	5	0.001	0.89	16,053	9	15	0.000	1.01	855	0.0
	2	8	0.015	0.41	10,361	157		0.001			0.0
2004	1	3	0.000	0.69	5,633	0	12	0.000	0.25	1,069	0.1
	2	19	0.096	0.48	3,705	355		0.001		44	0.0
2005	1	20	0.001	0.57	5,745	6	17	0.000	0.52	836	0.1
	2	39	0.008	0.21	23,131	184		0.001		40	0.0
2006	1	5	0.001	0.42	20,833	14	17	0.000	0.56	847	0.0
	2	39	0.021	0.32	14,291	305	3	0.000	0.10	449	0.2
2007	1	28	0.002	0.22	11,600	26	14	0.001	0.72	1,899	1.0
	2	68	0.021	0.18	23,644	487		0.001		333	0.2
2008	1	25	0.001	0.22	7,065	11	16	0.000	0.77	1,834	0.9
	2	22	0.011	0.34	3,696	42	3	0.001	0.90	167	0.1

Table D7, continued.

North		Scallop Dredge					Shrimp Trawl				
Year	Half	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)
2009	1	7	0.001	0.47	1,960	3	7	0.001	0.61	998	0.8
	2	22	0.003	0.26	11,642	34	5	0.000	0.92	347	0.0
2010	1	16	0.001	0.80	3,350	4	11	0.000	1.00	2,911	0.1
	2	25	0.003	0.31	15,930	50	4	0.000	0.91	780	0.0
2011	1	23	0.002	0.80	6,660	16	1	0.000		3,745	0.0
	2	81	0.004	0.13	35,600	158		0.001		78	0.0
2012	1	54	0.003	0.31	21,717	67	19	0.000	0.49	1,761	0.2
	2	90	0.010	0.24	28,609	300				132	0.0
2013	1	131	0.003	0.22	43,664	118	24	0.001	0.79	195	0.1
	2	67	0.010	0.35	12,980	128					
2014	1	66	0.000	0.33	10,688	4					
	2	61	0.029	0.21	5,406	155					
2015	1	77	0.002	0.49	12,489	28					
	2	50	0.020	0.16	4,912	96					
2016	1	79	0.013	0.37	12,841	170					
	2	43	0.038	0.27	4,300	162					
2017	1	45	0.000	0.36	10,814	5					
	2	19	0.157	0.32	1,502	235					
2018	1	78	0.011	0.27	18,115	203					
	2	48	0.079	0.17	19,019	1,504					

Table D8. Estimated monkfish discards (live weight) in the southern management region. Dredge discards are based on SBRM monkfish discards relative to kept of all species; trawl and gillnet are based on monkfish discards relative to monkfish kept.

South		Trawl					Gillnet				
Year	Half	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)
1989	1	46	0.709	0.50	2,195	1,556		0.031		12	0
	2	53	0.169	0.59	733	124	3	0.054		5	0
1990	1	50	0.064	0.26	1,567	100	1	0.031		14	0
	2	35	0.118	0.32	759	90	13	0.054		18	0
1991	1	73	0.258	0.30	1,257	324	3	0.031		209	2
	2	77	0.020	0.39	3,831	78	8	0.000		154	0
1992	1	62	0.061	0.38	3,947	239	94	0.011	0.31	786	8
	2	41	0.028	0.83	2,135	60	72	0.020	0.20	176	3
1993	1	40	0.092	0.68	2,598	238	78	0.034	0.70	1,306	44
	2	34	0.028	0.49	1,301	36	87	0.061	0.20	341	21
1994	1	43	0.095	0.29	2,925	277	124	0.079	0.33	1,565	124
	2	30	0.323	0.56	2,027	655	173	0.056	0.18	967	55
1995	1	61	0.175	0.55	2,789	488	260	0.044	0.20	2,758	121
	2	103	0.115	0.57	2,946	340	170	0.050	0.34	1,172	59
1996	1	56	0.164	0.36	3,187	523	226	0.077	0.27	2,615	202
	2	85	0.095	0.18	4,021	380	134	0.052	0.28	1,434	75
1997	1	60	0.025	0.47	4,130	102	238	0.067	0.34	3,089	206
	2	29	0.089	0.15	4,215	374	106	0.015	0.34	1,313	20
1998	1	31	0.108	0.33	3,991	431	228	0.070	0.20	3,606	252
	2	28	0.027	0.52	3,946	108	64	0.062	0.44	2,053	128
1999	1	39	0.045	0.30	4,370	195	52	0.052	0.34	4,207	220
	2	34	0.214	0.57	2,306	494	35	0.046	0.57	1,917	88
2000	1	67	0.786	0.32	2,255	1,773	60	0.063	0.30	2,683	170
	2	47	0.107	0.62	1,709	182	44	0.051	0.81	1,157	59
2001	1	61	0.946	0.47	1,703	1,611	57	0.030	0.42	2,248	67
	2	96	0.404	0.73	1,348	545	35	0.033	0.38	2,788	92
2002	1	50	0.338	0.38	1,123	379	34	0.017	0.80	3,590	61
	2	94	0.327	0.39	566	185	40	0.063	0.44	1,967	124
2003	1	120	0.331	0.36	1,172	388	50	0.016	0.35	4,452	69
	2	99	0.406	0.45	1,177	478	56	0.070	0.31	2,849	199
2004	1	237	0.240	0.44	1,012	243	78	0.073	0.22	3,441	252
	2	436	0.300	0.31	733	220	74	0.089	0.22	1,043	93
2005	1	534	0.175	0.14	945	165	100	0.104	0.22	3,217	334
	2	654	0.064	0.11	1,588	102	82	0.081	0.20	1,372	111
2006	1	327	0.180	0.19	1,008	181	43	0.054	0.19	2,865	155
	2	277	0.055	0.15	1,010	56	35	0.082	0.32	967	79
2007	1	335	0.125	0.25	741	93	59	0.220	0.37	2,139	471
	2	420	0.159	0.40	657	104	45	0.054	0.33	1,569	84
2008	1	343	0.098	0.19	744	73	54	0.108	0.25	2,882	311
	2	316	0.017	0.31	594	10	39	0.104	0.29	993	104

Table D8, continued.

South		Trawl					Gillnet				
Year	Half	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)	No. trips	D/K ratio	CV	Dlr monk (mt)	Discard (mt)
2009	1	414	0.080	0.30	646	52	62	0.052	0.19	2,438	128
	2	529	0.088	0.31	280	25	32	0.074	0.24	610	45
2010	1	569	0.248	0.24	474	118	114	0.060	0.21	2,034	122
	2	545	0.190	0.51	369	70	95	0.077	0.18	695	54
2011	1	573	0.123	0.13	634	78	178	0.078	0.12	2,357	185
	2	601	0.088	0.11	598	53	84	0.122	0.19	1,066	130
2012	1	476	0.147	0.13	812	119	203	0.051	0.13	3,015	153
	2	337	0.180	0.18	366	66	32	0.058	0.18	576	33
2013	1	594	0.117	0.24	720	84	60	0.058	0.15	2,142	124
	2	500	0.053	0.28	447	24	34	0.101	0.37	1,168	118
2014	1	633	0.171	0.22	616	105	126	0.056	0.16	2,249	127
	2	700	0.107	0.15	518	56	131	0.030	0.28	861	26
2015	1	563	0.179	0.15	487	87	225	0.022	0.16	2,403	52
	2	527	0.521	0.12	318	165	273	0.027	0.20	823	22
2016	1	557	0.381	0.26	521	198	361	0.023	0.15	2,627	62
	2	854	0.838	0.24	227	191	343	0.041	0.27	564	23
2017	1	819	1.155	0.25	510	589	448	0.036	0.16	2,211	79
	2	1088	0.402	0.23	245	98	372	0.065	0.24	543	35
2018	1	591	0.594	0.21	395	235	302	0.041	0.16	2,494	102
	2	925	0.774	0.17	198	153	332	0.048	0.44	832	40

Table D8, continued.

South		Scallop Dredge				
Year	Half	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)
1989	1		0.010	0.010	59,696	577
	2		0.015	0.015	35,498	528
1990	1		0.010		64,314	622
	2		0.015		53,040	789
1991	1		0.010		67,829	656
	2	2	0.001	0.07	36,015	19
1992	1	7	0.001	0.69	48,686	29
	2	7	0.012	0.50	39,126	460
1993	1	12	0.008	0.30	23,971	197
	2	4	0.032	0.53	18,379	587
1994	1	10	0.020	0.26	26,657	538
	2	10	0.015	0.29	24,222	370
1995	1	14	0.030	0.17	34,108	1,011
	2	9	0.050	0.45	18,456	917
1996	1	19	0.020	0.23	27,505	547
	2	15	0.029	0.26	19,621	562
1997	1	16	0.028	0.18	19,067	543
	2	8	0.041	0.39	14,997	612
1998	1	8	0.008	0.24	17,094	136
	2	15	0.012	0.57	15,300	177
1999	1	13	0.010	0.26	30,059	291
	2	56	0.004	0.16	34,102	150
2000	1	38	0.014	0.16	47,847	666
	2	133	0.009	0.16	43,879	382
2001	1	42	0.015	0.11	64,029	972
	2	48	0.014	0.15	70,044	973
2002	1	34	0.019	0.09	83,888	1,571
	2	61	0.018	0.10	81,620	1,475
2003	1	46	0.014	0.15	82,660	1,192
	2	71	0.017	0.12	91,638	1,542
2004	1	82	0.014	0.08	107,728	1,543
	2	193	0.015	0.10	95,117	1,432
2005	1	108	0.014	0.18	99,628	1,419
	2	174	0.019	0.19	67,548	1,290
2006	1	43	0.009	0.31	87,842	767
	2	166	0.022	0.14	99,456	2,210
2007	1	138	0.010	0.14	103,992	1,083
	2	156	0.013	0.15	68,914	920
2008	1	374	0.006	0.11	106,134	686
	2	245	0.010	0.13	74,506	717

Table D8, continued.

South		Scallop Dredge				
Year	Half	No. trips	D/K ratio	CV	Dlr all spp (mt)	Discard (mt)
2009	1	370	0.006	0.08	122,576	725
	2	103	0.009	0.15	73,175	652
2010	1	132	0.010	0.11	108,617	1,098
	2	174	0.008	0.12	81,139	648
2011	1	156	0.010	0.13	107,870	1,132
	2	150	0.010	0.12	62,873	623
2012	1	205	0.016	0.0756	98,241	1,545
	2	130	0.017	0.1489	46,675	797
2013	1	154	0.017	0.1682	49,832	864
	2	177	0.016	0.1282	45,168	709
2014	1	174	0.014	0.0931	62,720	892
	2	188	0.012	0.1405	44,960	518
2015	1	227	0.008	0.1204	56,595	464
	2	202	0.008	0.1409	58,643	444
2016	1	306	0.018	0.1006	60,595	1,100
	2	237	0.017	0.1263	69,514	1,204
2017	1	337	0.025	0.1199	95,113	2,364
	2	253	0.025	0.1255	83,173	2,084
2018	1	211	0.030	0.1051	91,400	2,759
	2	241	0.021	0.0928	86,776	1,861

Table D9. Estimated annual catch (landings plus discards, mt) of monkfish by management region and combined.

	North			South			Areas Combined			Foreign	
Year	Landings	Discard	Total (mt)	Landings	Discard	Total (mt)	Landings	Discard	Total (mt)	Landings	Total (mt)
1980	3,623	635	4,258	6,035	563	6,598	9,658	1,197	10,855	132	10,987
1981	3,171	754	3,925	4,142	451	4,593	7,313	1,204	8,517	381	8,898
1982	3,860	699	4,559	3,722	586	4,308	7,582	1,285	8,867	310	9,177
1983	3,849	664	4,513	4,115	659	4,774	7,964	1,323	9,287	80	9,367
1984	4,202	616	4,818	3,699	684	4,383	7,901	1,301	9,202	395	9,597
1985	4,616	640	5,256	4,262	636	4,898	8,878	1,276	10,154	1,333	11,487
1986	4,327	548	4,875	4,037	618	4,655	8,364	1,166	9,530	341	9,871
1987	4,960	766	5,726	3,762	1,039	4,801	8,722	1,805	10,527	748	11,275
1988	5,066	784	5,850	4,595	1,030	5,625	9,661	1,814	11,475	909	12,384
1989	6,391	534	6,925	8,353	2,786	11,139	14,744	3,320	18,064	1,178	19,242
1990	5,802	406	6,208	7,204	1,602	8,806	13,006	2,008	15,014	1,557	16,571
1991	5,693	481	6,174	9,865	1,080	10,945	15,558	1,561	17,119	1,020	18,139
1992	6,923	844	7,767	13,942	801	14,743	20,865	1,644	22,509	473	22,982
1993	10,645	730	11,375	15,098	1,123	16,221	25,743	1,853	27,596	354	27,950
1994	10,950	353	11,303	12,126	2,019	14,145	23,076	2,372	25,448	543	25,991
1995	11,970	1,475	13,445	14,361	2,935	17,297	26,331	4,410	30,741	418	31,159
1996	10,791	1,780	12,572	15,715	2,289	18,004	26,507	4,069	30,576	184	30,760
1997	9,709	1,002	10,712	18,462	1,856	20,318	28,172	2,858	31,030	189	31,219
1998	7,281	769	8,050	19,337	1,231	20,568	26,618	2,000	28,618	190	28,808
1999	9,128	713	9,841	16,085	1,438	17,523	25,213	2,151	27,364	151	27,515
2000	10,729	871	11,599	10,147	3,232	13,379	20,876	4,103	24,979	176	25,155
2001	13,341	1,213	14,554	9,959	4,260	14,219	23,301	5,473	28,773	142	28,915
2002	14,011	1,169	15,180	8,884	3,796	12,680	22,896	4,964	27,860	294	28,154
2003	14,991	1,212	16,203	11,095	3,869	14,964	26,086	5,080	31,167	309	31,476
2004	13,209	847	14,056	7,978	3,782	11,760	21,186	4,629	25,816	166	25,982
2005	10,140	711	10,851	9,177	3,421	12,597	19,317	4,132	23,449	206	23,655
2006	6,974	738	7,712	7,980	3,448	11,428	14,955	4,186	19,140	279	19,419
2007	4,953	778	5,732	7,388	2,755	10,143	12,341	3,533	15,875	8	15,883
2008	3,942	338	4,280	7,250	1,901	9,151	11,192	2,240	13,432	2	13,434
2009	3,210	465	3,675	5,532	1,626	7,158	8,742	2,092	10,833		10,833
2010	2,424	317	2,741	4,996	2,109	7,105	7,420	2,426	9,846		9,846
2011	2,362	452	2,814	6,344	2,200	8,545	8,707	2,652	11,359		11,359
2012	4,033	602	4,635	5,724	2,714	8,438	9,757	3,316	13,073		13,073
2013	3,332	589	3,922	5,253	1,922	7,176	8,586	2,512	11,097		11,097
2014	3,402	552	3,954	5,135	1,724	6,859	8,537	2,276	10,813		10,813
2015	4,027	603	4,630	4,609	1,235	5,844	8,636	1,838	10,474		10,474
2016	4,633	875	5,508	4,422	2,777	7,199	9,055	3,652	12,707		12,707
2017	7,008	886	7,894	3,893	5,250	9,143	10,901	6,136	17,037		17,037
2018	5,954	2161	8,115	4,465	5,150	9,615	10,419	7,311	17,730		17,730

Table D10. Number of length samples available for kept and discarded monkfish from observer database.

North							
Trawl		Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1	16	54	751	24	65	1393
	2	19	57	548	19	46	1046
2001	1	14	41	578	11	40	487
	2	26	74	659	28	45	1621
2002	1	7	28	391	12	32	342
	2	77	274	3452	153	388	7038
2003	1	74	333	4648	100	361	6340
	2	72	308	4193	81	363	4387
2004	1	67	226	3156	81	294	4278
	2	141	505	6122	179	657	5059
2005	1	177	751	8255	238	1426	14806
	2	214	841	7698	228	827	8134
2006	1	100	403	4960	126	672	7238
	2	71	333	2828	100	529	5615
2007	1	60	257	2580	98	555	4507
	2	118	554	3432	140	714	4992
2008	1	75	320	2973	121	657	6748
	2	98	341	2244	154	664	5705
2009	1	70	194	1869	113	502	4978
	2	83	181	1474	99	257	1762
2010	1	55	224	2875	68	303	3736
	2	23	72	906	42	140	960
2011	1	35	83	1076	73	259	3389
	2	34	82	795	60	147	1311
2012	1	25	60	853	76	262	2460
	2	23	44	556	87	203	2270
2013	1	12	31	260	38	102	1253
	2	13	47	307	60	154	1552
2014	1	32	61	596	79	227	2993
	2	12	20	190	40	103	925
2015	1	8	13	116	73	198	3021
	2	9	30	185	64	173	1244
2016	1	5	6	42	19	46	853
	2	11	26	204	24	59	573
2017	1	8	15	96	39	167	1864
	2	13	35	435	54	163	1859
2018	1	14	29	429	67	198	3061
	2	10	21	90	32	92	720

Table D10, continued

North							
Gillnet		Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1	37	49	311	9	14	59
	2	66	110	2708	8	16	87
2001	1	27	45	362	4	8	12
	2	50	76	1940	4	12	27
2002	1	29	50	976	10	18	60
	2	60	115	2493	25	47	198
2003	1	51	163	2564	30	72	321
	2	131	341	5099	58	121	696
2004	1	70	220	2212	27	49	133
	2	434	1314	15334	138	243	672
2005	1	29	54	459	8	10	32
	2	399	1251	14565	81	129	413
2006	1	43	102	651	5	8	15
	2	57	152	1404	12	15	26
2007	1	14	27	262	4	10	16
	2	134	415	3442	22	28	45
2008	1	19	55	320	6	7	22
	2	75	174	909	13	17	35
2009	1	9	32	48	4	7	13
	2	67	128	899	11	12	30
2010	1	31	88	677	8	9	11
	2	63	120	773	22	32	78
2011	1	9	13	38	3	4	4
	2	65	123	583	14	22	37
2012	1	20	44	118	11	18	22
	2	52	87	331	25	33	58
2013	1	13	29	163	7	8	9
	2	64	125	469	27	41	64
2014	1	27	72	148	11	25	35
	2	64	113	542	32	47	72
2015	1	13	26	164	7	10	12
	2	69	149	1501	19	42	121
2016	1	10	20	142	5	6	8
	2	52	68	474	8	14	29
2017	1	6	9	82	2	3	6
	2	83	162	1306	8	10	14
2018	1	10	12	66	5	15	30
	2	50	76	396	6	10	17

Table D10, continued.

North							
Scallop Dredge		Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1						
	2	3	29	89	3	19	29
2001	1	1	2	8	1	3	4
	2						
2002	1						
	2	4	66	191	4	9	28
2003	1				1	5	9
	2	5	48	161	4	49	321
2004	1				1	2	2
	2	4	10	13	11	42	120
2005	1	1	18	27	5	29	109
	2	6	25	113	27	192	979
2006	1	2	4	4	2	18	26
	2	15	76	356	29	170	711
2007	1	4	20	25	16	58	106
	2	23	212	1094	50	368	2082
2008	1	1	3	3	9	48	70
	2	6	22	96	15	45	158
2009	1				3	7	12
	2	5	9	90	12	77	219
2010	1				3	7	10
	2	1	8	12	8	41	100
2011	1	2	2	3	3	6	27
	2	14	44	120	57	178	559
2012	1	1	1	1	24	134	481
	2	27	107	294	56	280	1340
2013	1	3	4	9	44	203	495
	2	7	24	53	28	73	213
2014	1	4	4	5	13	25	34
	2	4	8	23	35	79	349
2015	1	3	5	11	19	38	105
	2	9	29	70	34	102	409
2016	1	7	42	118	7	42	118
	2	10	41	87	10	41	87
2017	1	2	5	7	2	5	7
	2	4	7	26	4	7	26
2018	1	4	5	15	4	5	15
	2	6	14	46	6	14	46

Table D10, continued.

South							
Trawl		Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1	14	27	86	11	22	216
	2	16	32	306	14	40	181
2001	1	12	26	126	12	56	338
	2	9	13	42	2	4	103
2002	1	16	37	85	2	4	11
	2	22	54	367	10	32	255
2003	1	62	196	1397	36	123	975
	2	38	141	740	23	43	359
2004	1	98	304	2301	66	275	2051
	2	129	494	2983	124	444	3406
2005	1	234	794	5760	184	759	8029
	2	218	982	9097	203	656	4960
2006	1	154	574	5490	126	498	4184
	2	92	337	3501	87	299	2330
2007	1	121	467	3078	72	426	1648
	2	102	236	1658	76	207	1198
2008	1	97	291	3024	88	265	2018
	2	77	239	2567	36	87	529
2009	1	64	190	1286	36	118	694
	2	68	161	1036	49	105	629
2010	1	65	166	1265	72	187	1777
	2	40	113	585	50	160	694
2011	1	47	109	569	66	165	1145
	2	41	86	823	64	167	2160
2012	1	36	100	732	65	212	2250
	2	13	31	176	19	63	342
2013	1	19	34	411	32	99	823
	2	17	33	204	33	88	463
2014	1	28	54	235	69	158	1143
	2	27	60	314	46	144	949
2015	1	23	44	210	59	125	758
	2	22	45	200	52	171	1405
2016	1	24	61	224	87	226	1476
	2	23	51	115	82	283	2047
2017	1	50	104	334	120	284	1944
	2	46	104	304	82	225	838
2018	1	60	107	448	113	240	881
	2	45	94	289	115	412	2539

Table D10, continued.

South							
Gillnet		Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1	70	94	2854	7	18	95
	2	22	42	952	3	4	47
2001	1	216	253	8634	3	4	9
	2	20	38	1543			
2002	1	58	88	2981	2	6	65
	2	13	15	391	2	3	39
2003	1	45	112	3937	6	14	35
	2	60	192	6047	13	35	113
2004	1	130	335	11691	36	103	747
	2	68	195	4337	11	20	174
2005	1	113	253	8853	14	31	215
	2	90	253	6705	16	31	120
2006	1	153	216	7833	10	15	30
	2	25	36	1290	5	7	10
2007	1	115	189	4789	15	35	245
	2	52	96	1966	2	3	3
2008	1	94	179	3976	9	24	333
	2	40	90	1485	6	9	14
2009	1	89	189	3819	7	13	45
	2	23	62	938	4	11	58
2010	1	69	154	3398	4	4	20
	2	43	95	1883	5	7	9
2011	1	56	125	2775	5	11	29
	2	15	27	605	2	4	75
2012	1	42	78	1304	4	4	14
	2	13	39	425	4	5	7
2013	1	41	75	1480	3	3	5
	2	18	39	414	0	0	0
2014	1	101	205	2463	5	10	30
	2	48	98	819	2	2	6
2015	1	117	244	2903	15	31	84
	2	51	99	820	4	5	7
2016	1	153	287	3255	8	9	31
	2	75	152	1595	13	15	24
2017	1	180	383	4134	31	49	120
	2	72	122	1366	4	5	22
2018	1	119	252	2382	12	17	48
	2	44	85	641	3	7	16

Table D10, continued.

South							
Scallop Dredge		Kept Lengths			Discard Lengths		
Year	Half-year	No. trips	No. hauls	No. Lengths	No. trips	No. hauls	No. Lengths
2000	1	12	415	2481	9	340	2317
	2	7	49	186	10	90	464
2001	1	5	52	215	6	65	303
	2	3	14	33	3	14	250
2002	1						
	2	7	60	155	16	141	675
2003	1	16	171	395	24	250	1115
	2	18	100	268	34	270	1215
2004	1	33	449	1205	50	767	5615
	2	63	1010	2962	157	2500	15145
2005	1	51	697	1782	67	901	5268
	2	88	377	1300	111	929	6274
2006	1	12	49	341	26	125	794
	2	57	465	1607	92	741	4625
2007	1	46	318	746	98	804	3384
	2	48	308	1144	116	900	4386
2008	1	96	443	1137	272	1492	4593
	2	60	370	1053	175	1131	3702
2009	1	109	727	1796	219	1549	4461
	2	34	235	808	62	502	2364
2010	1	50	360	615	89	915	4094
	2	41	283	703	117	898	3612
2011	1	36	342	940	104	951	5053
	2	38	167	565	110	536	2622
2012	1	58	257	855	162	1160	7150
	2	28	106	634	75	328	2549
2013	1	41	139	438	91	483	2264
	2	75	286	948	108	531	2398
2014	1	72	255	630	119	704	3868
	2	63	238	746	123	720	3014
2015	1	56	189	463	127	659	2362
	2	46	226	557	134	831	3218
2016	1	59	208	405	59	208	405
	2	36	211	472	36	211	472
2017	1	59	173	441	59	173	441
	2	36	79	244	36	79	244
2018	1	38	105	428	38	105	428
	2	34	68	222	34	68	222

Table D11. Temporal stratification used in expanding landings and discards to length composition of the monkfish catch. Unless otherwise indicated, sampling was expanded within gear type and area.

	Trawl		Gillnet		Dredge	
North	Kept	Discarded	Kept	Discarded	Kept	Discarded
1994	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1995	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1996	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1997	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1998	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
1999	annual	annual	1994-1999	1994-1999	1994-1999	1994-1999
2000	annual	annual	annual	2000-2002 N+S	annual N+S	annual N+S
2001	annual	annual	annual	2000-2002 N+S	annual N+S	annual N+S
2002	annual	annual	annual	2000-2002 N+S	annual N+S	annual N+S
2003	half-year	half-year	annual	annual N+S	annual N+S	annual N+S
2004	half-year	half-year	annual	annual N+S	annual N+S	annual N+S
2005	half-year	half-year	annual	annual N+S	annual N+S	annual N+S
2006	half-year	half-year	annual	2006-2008 N+S	annual N+S	annual N+S
2007	half-year	half-year	annual	2006-2008 N+S	annual N+S	annual N+S
2008	half-year	half-year	annual	2006-2008 N+S	annual N+S	annual N+S
2009	half-year	half-year	annual	2009-2011 N+S	annual N+S	annual N+S
2010	half-year	half-year	annual	2009-2011 N+S	annual N+S	annual N+S
2011	half-year	half-year	annual	2009-2011 N+S	annual N+S	annual N+S
2012	half-year	half-year	annual	2012-2014 N+S	annual N+S	annual N+S
2013	half-year	half-year	annual	2012-2014 N+S	annual N+S	annual N+S
2014	half-year	half-year	annual	2012-2014 N+S	annual N+S	annual N+S
2015	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
2016	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
2017	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S
2018	annual N+S	half-year	annual	annual N+S	annual N+S	annual N+S

Table D11, continued.

	Trawl		Gillnet		Dredge	
South	**Kept**	**Discarded**	**Kept**	**Discarded**	**Kept**	**Discarded**
1994	annual		annual	annual	annual	annual
1995	annual		annual	annual	annual	annual
1996	annual		annual	annual	annual	annual
1997	annual		annual	annual	annual	annual
1998	annual		annual	annual	annual	annual
1999	annual		annual	annual	annual	annual
2000	annual N+S	annual N+S	annual	2000-2002 N+S	annual	annual
2001	annual N+S	annual N+S	annual	2000-2002 N+S	2000-2002	2000-2002
2002	annual N+S	annual N+S	annual	2000-2002 N+S	2000-2002	2000-2002
2003	annual	half-year	annual	annual N+S	annual	annual
2004	annual	half-year	annual	annual N+S	annual	annual
2005	annual	half-year	annual	annual N+S	annual	annual
2006	annual	half-year	annual	2006-2008 N+S	annual	annual
2007	annual	half-year	annual	2006-2008 N+S	annual	annual
2008	annual	half-year	annual	2006-2008 N+S	annual	annual
2009	annual	half-year	annual	2009-2011 N+S	annual	annual
2010	annual	half-year	annual	2009-2011 N+S	annual	annual
2011	annual	half-year	annual	2009-2011 N+S	annual	annual
2012	annual	half-year	annual	2012-2014 N+S	annual	annual
2013	annual	half-year	annual	2012-2014 N+S	annual	annual
2014	annual	half-year	annual	2012-2014 N+S	annual	annual
2015	annual	half-year	annual	annual N+S	annual	annual
2016	annual	half-year	annual	annual N+S	annual	annual
2017	annual	half-year	annual	annual N+S	annual	annual
2018	annual	half-year	annual	annual N+S	annual	annual

Table D12a. Survey results from NEFSC offshore autumn bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1963	3.79	0.17	2.79	4.87	0.81	0.15	0.62	1.02
1964	1.89	0.21	1.30	2.54	0.39	0.20	0.26	0.52
1965	2.52	0.20	1.73	3.41	0.35	0.15	0.26	0.44
1966	3.33	0.15	2.52	4.16	0.51	0.14	0.39	0.64
1967	1.24	0.33	0.65	1.96	0.19	0.26	0.11	0.27
1968	2.05	0.34	1.01	3.41	0.29	0.27	0.17	0.41
1969	3.69	0.23	2.36	5.15	0.42	0.15	0.31	0.53
1970	2.32	0.26	1.33	3.42	0.40	0.20	0.27	0.53
1971	2.90	0.21	1.93	3.93	0.49	0.17	0.36	0.63
1972	1.39	0.25	0.87	2.02	0.32	0.18	0.22	0.42
1973	3.19	0.20	2.16	4.36	0.53	0.19	0.38	0.72
1974	2.02	0.21	1.38	2.78	0.32	0.19	0.22	0.44
1975	1.71	0.19	1.20	2.25	0.30	0.18	0.21	0.39
1976	3.22	0.21	2.16	4.41	0.42	0.20	0.28	0.56
1977	5.43	0.17	3.94	6.99	0.76	0.12	0.50	0.75
1978	4.73	0.13	3.77	5.84	0.70	0.13	0.47	0.71
1979	4.91	0.14	3.83	6.04	0.55	0.11	0.39	0.57
1980	4.04	0.20	2.75	5.48	0.64	0.14	0.41	0.67
1981	1.98	0.18	1.39	2.59	0.45	0.13	0.32	0.49
1982	0.94	0.25	0.57	1.32	0.14	0.22	0.09	0.19
1983	1.61	0.19	1.11	2.13	0.47	0.18	0.34	0.61
1984	2.82	0.20	1.95	3.82	0.49	0.14	0.38	0.59
1985	1.48	0.33	0.75	2.40	0.37	0.22	0.24	0.52
1986	2.23	0.22	1.47	3.10	0.61	0.17	0.45	0.78
1987	0.88	0.33	0.42	1.38	0.26	0.26	0.16	0.38
1988	1.53	0.31	0.78	2.40	0.31	0.27	0.18	0.47
1989	1.32	0.30	0.77	2.03	0.51	0.18	0.31	0.55
1990	1.01	0.28	0.56	1.48	0.71	0.15	0.44	0.74
1991	1.20	0.24	0.75	1.67	0.70	0.17	0.42	0.74
1992	1.12	0.23	0.74	1.57	0.94	0.17	0.67	1.21
1993	1.10	0.34	0.58	1.80	1.23	0.16	0.75	1.31
1994	0.90	0.23	0.58	1.26	1.34	0.12	1.08	1.61
1995	1.60	0.23	1.00	2.20	0.93	0.12	0.74	1.11
1996	1.07	0.25	0.66	1.55	0.63	0.17	0.46	0.81
1997	0.67	0.23	0.43	0.92	0.50	0.18	0.36	0.66
1998	0.96	0.20	0.65	1.26	0.62	0.19	0.44	0.82
1999	0.78	0.22	0.51	1.06	1.08	0.15	0.82	1.36
2000	2.41	0.20	1.66	3.22	2.34	0.14	1.84	2.88
2001	1.84	0.16	1.38	2.33	1.61	0.11	1.31	1.91
2002	1.83	0.17	1.35	2.34	1.28	0.13	1.01	1.56
2003	1.81	0.18	1.30	2.33	1.07	0.12	0.86	1.28
2004	0.64	0.27	0.38	0.96	0.52	0.19	0.36	0.68
2005	1.01	0.23	0.64	1.38	0.60	0.18	0.42	0.79
2006	1.04	0.23	0.66	1.46	0.77	0.15	0.58	0.98

2007	1.08	0.28	0.62	1.62	0.64	0.15	0.48	0.80

Table D12a, continued.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2008	0.99	0.29	0.54	1.48	0.79	0.21	0.53	1.10
2009	0.44	0.17	0.32	0.57	0.39	0.10	0.32	0.45
2010	0.64	0.14	0.49	0.78	0.51	0.09	0.44	0.58
2011	0.88	0.15	0.68	1.10	0.67	0.07	0.60	0.74
2012	0.81	0.12	0.65	0.96	0.68	0.07	0.61	0.76
2013	0.62	0.11	0.50	0.73	0.73	0.07	0.65	0.81
2014	0.76	0.08	0.66	0.86	0.95	0.09	0.81	1.09
2015	1.14	0.11	0.92	1.34	1.22	0.09	1.03	1.39
2016	1.50	0.10	1.25	1.76	1.84	0.07	1.63	2.07
2017	1.78	0.09	1.52	2.04	1.47	0.09	1.25	1.68
2018	2.16	0.07	1.92	2.42	1.29	0.06	1.16	1.42

Table D12b. Survey results from NEFSC offshore autumn bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	3.55	0.18	2.51	4.58	2.78	0.10	2.33	3.22
2010	5.13	0.15	3.88	6.38	3.65	0.09	3.13	4.17
2011	7.09	0.15	5.32	8.86	4.77	0.06	4.26	5.28
2012	6.50	0.11	5.33	7.68	4.88	0.07	4.34	5.41
2013	4.97	0.11	4.05	5.90	5.21	0.07	4.64	5.79
2014	6.11	0.09	5.23	6.98	6.79	0.09	5.82	7.76
2015	9.20	0.11	7.47	10.93	8.71	0.09	7.41	10.02
2016	12.11	0.10	10.08	14.14	13.09	0.07	11.52	14.66
2017	14.38	0.09	12.30	16.46	10.45	0.08	9.01	11.88
2018	17.39	0.07	15.33	19.45	9.20	0.06	8.23	10.17

Table D13a. Survey results from NEFSC offshore spring bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1968	1.01	0.33	0.50	1.59	0.17	0.29	0.09	0.25
1969	1.34	0.42	0.54	2.37	0.18	0.36	0.09	0.30
1970	2.02	0.26	1.17	2.94	0.34	0.18	0.24	0.44
1971	1.05	0.29	0.61	1.58	0.16	0.29	0.09	0.25
1972	4.63	0.15	3.45	5.85	0.65	0.15	0.50	0.81
1973	1.89	0.21	1.23	2.53	0.44	0.23	0.27	0.60
1974	1.49	0.20	1.04	1.99	0.44	0.14	0.35	0.55
1975	0.94	0.17	0.69	1.21	0.34	0.15	0.26	0.43
1976	2.51	0.13	1.94	3.02	0.67	0.13	0.53	0.81
1977	0.93	0.18	0.66	1.19	0.26	0.19	0.18	0.34
1978	0.56	0.20	0.38	0.75	0.14	0.16	0.10	0.18
1979	0.67	0.21	0.45	0.92	0.14	0.14	0.11	0.17
1980	1.43	0.18	1.00	1.87	0.38	0.13	0.30	0.47
1981	1.67	0.20	1.16	2.25	0.38	0.12	0.30	0.44
1982	2.97	0.25	1.80	4.26	0.35	0.25	0.22	0.50
1983	1.53	0.31	0.85	2.38	0.42	0.24	0.27	0.60
1984	1.57	0.27	0.93	2.31	0.33	0.22	0.22	0.46
1985	2.12	0.22	1.39	2.94	0.35	0.20	0.24	0.46
1986	2.13	0.26	1.21	3.09	0.34	0.20	0.24	0.45
1987	1.73	0.27	0.95	2.48	0.24	0.20	0.17	0.33
1988	2.03	0.23	1.30	2.89	0.61	0.17	0.44	0.79
1989	1.60	0.30	0.90	2.46	0.62	0.21	0.41	0.81
1990	1.01	0.30	0.56	1.56	0.28	0.21	0.18	0.38
1991	1.61	0.24	0.99	2.23	0.59	0.18	0.42	0.77
1992	0.89	0.57	0.24	1.92	0.49	0.31	0.27	0.76
1993	1.16	0.19	0.82	1.55	0.68	0.13	0.53	0.82
1994	0.98	0.30	0.51	1.42	0.45	0.18	0.31	0.58
1995	1.84	0.28	1.04	2.72	1.01	0.16	0.75	1.29
1996	0.98	0.24	0.60	1.36	0.67	0.22	0.43	0.92
1997	0.55	0.36	0.25	0.91	0.34	0.25	0.21	0.50
1998	0.44	0.27	0.26	0.65	0.42	0.14	0.32	0.52
1999	1.15	0.19	0.80	1.53	0.83	0.16	0.62	1.04
2000	1.40	0.18	1.03	1.83	1.13	0.12	0.91	1.36
2001	1.85	0.28	1.07	2.83	1.67	0.12	1.36	2.01
2002	1.93	0.13	1.54	2.35	1.74	0.10	1.46	2.04
2003	1.87	0.20	1.30	2.51	0.81	0.20	0.56	1.09
2004	2.26	0.26	1.31	3.31	0.91	0.17	0.67	1.15
2005	1.47	0.21	0.99	2.02	0.72	0.16	0.53	0.92
2006	0.93	0.40	0.39	1.61	0.37	0.27	0.22	0.53
2007	1.05	0.41	0.39	1.82	0.55	0.23	0.35	0.77

Table D13a, continued.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2008	1.29	0.30	0.70	1.90	0.67	0.17	0.49	0.86
2009	0.47	0.15	0.36	0.58	0.33	0.10	0.27	0.39
2010	0.63	0.14	0.49	0.78	0.38	0.14	0.30	0.47
2011	0.89	0.15	0.69	1.13	0.46	0.13	0.37	0.57
2012	0.61	0.13	0.47	0.74	0.54	0.14	0.42	0.67
2013	0.58	0.11	0.48	0.69	0.55	0.07	0.49	0.61
2014	0.63	0.16	0.46	0.81	0.61	0.12	0.50	0.74
2015	0.73	0.16	0.56	0.93	0.54	0.09	0.46	0.62
2016	0.74	0.09	0.64	0.85	0.69	0.07	0.61	0.76
2017	1.13	0.13	0.89	1.39	0.68	0.10	0.57	0.79
2018	1.65	0.07	1.47	1.83	1.04	0.08	0.91	1.17
2019	1.32	0.08	1.16	1.51	0.87	0.08	0.76	1.00

Table D13b. Survey results from NEFSC offshore spring bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	3.80	0.14	2.91	4.70	2.36	0.10	1.96	2.76
2010	5.08	0.14	3.89	6.27	2.72	0.13	2.12	3.32
2011	7.20	0.16	5.31	9.08	3.31	0.14	2.55	4.07
2012	4.90	0.14	3.79	6.00	3.83	0.13	3.00	4.67
2013	4.70	0.11	3.82	5.57	3.93	0.07	3.48	4.38
2014	5.07	0.16	3.77	6.38	4.38	0.12	3.52	5.23
2015	5.90	0.16	4.33	7.47	3.83	0.09	3.24	4.41
2016	6.00	0.08	5.21	6.79	4.88	0.06	4.37	5.40
2017	9.14	0.14	7.03	11.25	4.86	0.10	4.08	5.64
2018	13.30	0.07	11.81	14.79	7.42	0.07	6.52	8.32
2019	10.66	0.08	9.26	12.07	6.23	0.08	5.41	7.05

Table D14. Survey results from ASMFC summer shrimp surveys in the northern management region (strata 1, 3, 5, 6-8). Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass				Abundance			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1991	1.88	0.17	1.40	2.45	2.88	0.10	2.45	3.36
1992	2.69	0.16	2.04	3.46	2.90	0.10	2.45	3.42
1993	3.07	0.25	1.85	4.39	3.70	0.13	2.93	4.52
1994	1.66	0.21	1.11	2.25	3.42	0.13	2.70	4.20
1995	1.55	0.23	0.95	2.15	2.08	0.18	1.44	2.71
1996	3.36	0.31	1.83	5.30	2.99	0.13	2.37	3.69
1997	2.08	0.21	1.36	2.84	1.57	0.14	1.21	1.94
1998	2.27	0.29	1.24	3.36	2.12	0.13	1.70	2.58
1999	6.26	0.09	5.56	7.57	6.75	0.08	6.00	7.89
2000	3.84	0.16	2.87	4.84	5.72	0.13	4.49	7.09
2001	7.27	0.11	6.02	8.58	10.89	0.09	9.29	12.54
2002	12.44	0.10	10.25	14.51	11.65	0.09	9.99	13.33
2003	7.36	0.16	5.68	9.74	5.80	0.12	4.82	7.23
2004	4.45	0.10	3.70	5.17	3.38	0.10	2.85	3.92
2005	7.25	0.13	5.73	8.87	5.25	0.10	4.45	6.08
2006	6.54	0.12	5.29	7.77	4.31	0.07	3.82	4.80
2007	4.10	0.21	2.69	5.52	4.46	0.13	3.53	5.37
2008	3.79	0.19	2.62	5.03	2.82	0.12	2.29	3.37
2009	3.21	0.19	2.23	4.25	3.12	0.11	2.57	3.72
2010	2.76	0.21	1.89	3.76	2.54	0.15	1.96	3.14
2011	2.66	0.15	2.04	3.37	2.25	0.09	1.93	2.62
2012	3.14	0.16	2.34	3.97	3.55	0.12	2.85	4.31
2013	4.07	0.16	3.05	5.20	4.13	0.13	3.30	5.12
2014	3.31	0.15	2.57	4.19	4.94	0.09	4.23	5.68
2015	1.45	0.23	0.91	2.00	2.76	0.21	1.79	3.69
2016	5.01	0.13	3.98	6.17	6.61	0.07	5.83	7.43
2017	4.78	0.16	3.56	5.99	4.63	0.10	3.90	5.39
2018	5.36	0.25	3.34	7.83	4.88	0.13	3.86	6.02

Table D15. Monkfish indices from Maine-New Hampshire inshore surveys, strata 1-4, regions 1-5.

Fall Year	Mean Wt (kg)	CV	L95%	U95%	Mean Number	CV	L95%	U95%
2000	1.6	0.39	1.1	2.2	4.8	0.29	3.6	6.0
2001	4.7	0.20	3.9	5.6	10.7	0.21	8.5	13.0
2002	3.4	0.66	1.2	5.7	4.1	0.56	1.8	6.3
2003	3.6	0.38	2.0	5.2	3.7	0.31	2.4	5.0
2004	3.6	0.41	1.9	5.3	2.9	0.31	1.9	4.0
2005	2.0	0.35	1.1	3.0	1.8	0.22	1.3	2.3
2006	1.8	0.23	1.4	2.2	2.9	0.22	2.3	3.5
2007	2.1	0.32	1.4	2.8	3.1	0.26	2.3	4.0
2008	2.9	0.27	2.1	3.8	4.1	0.33	2.7	5.5
2009	1.9	0.59	0.9	3.0	2.0	0.45	1.2	2.8
2010	0.7	0.35	0.5	0.9	1.0	0.32	0.7	1.4
2011	1.1	0.38	0.7	1.5	1.0	0.37	0.6	1.3
2012	0.5	0.51	0.2	0.8	0.8	0.35	0.5	1.1
2013	0.6	0.59	0.3	1.0	0.8	0.39	0.5	1.1
2014	0.3	0.43	0.2	0.4	1.0	0.32	0.8	1.3
2015	1.6	0.30	1.2	2.1	7.0	0.33	4.9	9.1
2016	1.3	0.33	0.9	1.7	6.8	0.21	5.4	8.1
2017	2.2	0.33	1.6	2.8	4.1	0.30	3.2	5.1
2018	2.3	0.31	1.6	3.1	2.9	0.24	2.2	3.5

Spring Year	Mean Wt (kg)	CV	L95%	U95%	Mean Number	CV	L95%	U95%
2000								
2001	1.0	0.35	0.7	1.3	6.0	0.35	4.2	7.9
2002	1.1	0.37	0.8	1.5	2.4	0.31	1.7	3.0
2003	0.6	0.52	0.3	1.0	1.0	0.26	0.7	1.2
2004	0.4	0.60	0.2	0.6	1.4	0.23	1.1	1.7
2005	0.8	0.35	0.5	1.1	1.1	0.22	0.8	1.4
2006	0.1	0.45	0.1	0.2	0.3	0.42	0.2	0.4
2007	0.4	0.49	0.2	0.6	1.1	0.30	0.8	1.5
2008	0.5	0.30	0.3	0.7	1.4	0.26	1.0	1.7
2009	0.2	0.44	0.1	0.3	0.8	0.31	0.6	1.0
2010	0.2	0.49	0.1	0.3	0.6	0.41	0.4	0.8
2011	0.2	0.69	0.1	0.3	0.3	0.35	0.2	0.4
2012	0.3	0.95	0.0	0.5	0.4	0.36	0.2	0.5
2013	0.2	1.01	0.0	0.3	0.4	0.45	0.2	0.5
2014	0.2	0.97	0.0	0.4	0.9	0.39	0.6	1.1
2015	0.2	0.32	0.1	0.2	1.1	0.28	0.8	1.3
2016	0.5	0.31	0.4	0.6	2.5	0.28	1.9	3.0
2017	0.4	0.64	0.2	0.6	1.2	0.28	0.9	1.4
2018	0.3	0.36	0.2	0.4	1.5	0.27	1.2	1.8

Table D16a. Survey results from NEFSC offshore autumn bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967; survey sampled only a small portion of the southern management area in 2017, therefore indices were not calculated for 2017. Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1963	3.60	0.24	2.30	5.09	1.20	0.18	0.87	1.58
1964	5.50	0.17	3.89	7.19	1.64	0.15	1.17	1.98
1965	4.90	0.17	3.60	6.41	1.15	0.15	0.90	1.44
1966	7.01	0.12	5.71	8.61	1.93	0.14	1.53	2.41
1967	1.14	0.22	0.74	1.56	0.52	0.17	0.37	0.66
1968	0.91	0.22	0.60	1.25	0.40	0.21	0.28	0.56
1969	1.34	0.30	0.75	2.06	0.54	0.21	0.37	0.76
1970	1.29	0.22	0.79	1.77	0.35	0.16	0.26	0.44
1971	0.79	0.36	0.38	1.30	0.28	0.21	0.18	0.37
1972	4.89	0.14	3.83	6.05	4.11	0.22	2.48	5.26
1973	1.83	0.16	1.33	2.27	1.18	0.11	0.95	1.35
1974	0.72	0.26	0.43	1.06	0.22	0.21	0.15	0.30
1975	2.00	0.16	1.50	2.54	0.75	0.16	0.50	0.84
1976	1.00	0.18	0.72	1.30	0.31	0.19	0.23	0.43
1977	1.88	0.18	1.37	2.45	0.45	0.14	0.29	0.46
1978	1.40	0.18	1.00	1.83	0.31	0.16	0.19	0.33
1979	1.93	0.16	.451	2.45	0.84	0.13	0.55	0.85
1980	1.85	0.17	1.35	2.38	0.87	0.16	0.51	0.87
1981	2.26	0.17	1.66	2.90	1.16	0.16	0.72	1.23
1982	0.65	0.21	0.43	0.88	0.61	0.18	0.44	0.79
1983	1.76	0.21	1.18	2.40	0.78	0.17	0.57	0.99
1984	0.77	0.40	0.34	1.36	0.31	0.31	0.17	0.49
1985	1.29	0.19	0.93	1.72	0.62	0.16	0.40	0.68
1986	0.55	0.27	0.33	0.81	0.36	0.23	0.22	0.46
1987	0.28	0.29	0.16	0.42	0.48	0.18	0.35	0.63
1988	0.55	0.28	0.32	0.83	0.23	0.26	0.14	0.33
1989	0.62	0.25	0.37	0.87	0.46	0.22	0.24	0.51
1990	0.37	0.32	0.20	0.58	0.35	0.27	0.17	0.43
1991	0.77	0.29	0.45	1.19	0.83	0.28	0.40	1.08
1992	0.32	0.22	0.22	0.44	0.34	0.16	0.25	0.43
1993	0.27	0.34	0.14	0.44	0.35	0.23	0.19	0.41
1994	0.55	0.23	0.35	0.75	0.60	0.19	0.42	0.79
1995	0.39	0.27	0.23	0.57	0.49	0.21	0.33	0.68
1996	0.39	0.21	0.26	0.53	0.23	0.21	0.16	0.32
1997	0.59	0.19	0.42	0.79	0.31	0.17	0.23	0.39
1998	0.50	0.24	0.32	0.72	0.33	0.24	0.21	0.46
1999	0.30	0.15	0.23	0.38	0.45	0.12	0.36	0.54
2000	0.47	0.20	0.32	0.63	0.42	0.17	0.31	0.54
2001	0.65	0.18	0.47	0.85	0.38	0.17	0.27	0.49
2002	1.25	0.18	0.88	1.61	0.83	0.14	0.64	1.02
2003	0.82	0.15	0.61	1.04	0.95	0.17	0.71	1.24
2004	0.74	0.18	0.53	0.97	0.47	0.20	0.32	0.62
2005	0.77	0.23	0.50	1.09	0.58	0.20	0.41	0.80

2006	0.76	0.24	0.49	1.07		0.45	0.19	0.33	0.60

Table D16a, continued.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2007	0.50	0.24	0.31	0.71	0.20	0.22	0.12	0.27
2008	0.41	0.35	0.19	0.68	0.20	0.25	0.12	0.29
2009	0.24	0.12	0.19	0.28	0.22	0.13	0.17	0.27
2010	0.36	0.17	0.27	0.47	0.40	0.19	0.29	0.54
2011	0.30	0.12	0.24	0.36	0.62	0.13	0.48	0.75
2012	0.43	0.14	0.33	0.54	0.28	0.14	0.22	0.34
2013	0.27	0.15	0.21	0.34	0.29	0.17	0.21	0.37
2014	0.15	0.18	0.11	0.19	0.16	0.12	0.13	0.19
2015	0.37	0.22	0.25	0.51	1.96	0.28	1.20	3.05
2016	0.42	0.23	0.27	0.59	0.63	0.20	0.44	0.84
2017								
2018	0.26	0.13	0.21	0.32	0.47	0.17	0.35	0.62

Table D16b. Survey results from NEFSC offshore autumn bottom trawl surveys in the southern management region (strata 1-19, 61-76). Values are indices calculated without adjustment for change in survey methods in 2009. Only a small portion of the southern management area was sampled in 2017, therefore indices were not calculated for 2017. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
Year	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	1.92	0.13	1.52	2.33	1.56	0.15	1.18	1.93
2010	2.92	0.18	2.04	3.79	2.87	0.21	1.89	3.85
2011	2.42	0.13	1.89	2.95	4.36	0.15	3.27	5.44
2012	3.50	0.18	2.46	4.53	1.96	0.16	1.45	2.47
2013	2.19	0.17	1.58	2.81	2.07	0.18	1.44	2.69
2014	1.20	0.23	0.75	1.65	1.14	0.15	0.86	1.42
2015	2.96	0.23	1.82	4.10	13.96	0.31	6.85	21.06
2016	3.37	0.22	2.14	4.61	4.46	0.19	3.06	5.85
2017								
2018	2.13	0.13	1.66	2.60	3.38	0.17	2.45	4.31

Table D17a. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967. Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
1968	1.16	0.23	0.77	1.61	0.21	0.19	0.15	0.28
1969	0.92	0.23	0.58	1.31	0.23	0.20	0.15	0.30
1970	1.00	0.25	0.58	1.40	0.18	0.19	0.12	0.23
1971	0.76	0.29	0.43	1.15	0.21	0.25	0.13	0.29
1972	1.88	0.18	1.36	2.47	0.36	0.12	0.29	0.44
1973	1.82	0.08	1.59	2.06	1.04	0.08	0.91	1.17
1974	1.16	0.16	0.87	1.47	0.49	0.11	0.40	0.57
1975	0.91	0.15	0.70	1.15	0.44	0.12	0.36	0.54
1976	1.13	0.11	0.91	1.33	0.41	0.12	0.33	0.48
1977	1.16	0.14	0.90	1.45	0.30	0.10	0.25	0.35
1978	0.73	0.13	0.58	0.89	0.34	0.09	0.28	0.39
1979	0.70	0.17	0.51	0.90	0.27	0.15	0.21	0.34
1980	0.74	0.15	0.56	0.92	0.45	0.10	0.38	0.53
1981	1.74	0.15	1.33	2.20	0.77	0.12	0.62	0.92
1982	2.60	0.17	1.92	3.33	0.93	0.12	0.75	1.11
1983	0.95	0.26	0.58	1.35	0.27	0.16	0.20	0.35
1984	0.74	0.31	0.36	1.12	0.18	0.23	0.11	0.25
1985	0.33	0.32	0.17	0.52	0.16	0.25	0.10	0.23
1986	0.83	0.28	0.48	1.23	0.28	0.27	0.18	0.43
1987	0.50	0.48	0.17	0.95	0.11	0.23	0.07	0.15
1988	0.43	0.13	0.34	0.52	0.44	0.16	0.33	0.55
1989	0.36	0.16	0.27	0.47	0.20	0.23	0.13	0.28
1990	1.00	0.20	0.67	1.34	0.21	0.11	0.17	0.24
1991	0.58	0.24	0.37	0.82	0.32	0.25	0.20	0.46
1992	0.22	0.33	0.11	0.34	0.18	0.25	0.11	0.25
1993	0.26	0.28	0.15	0.39	0.20	0.23	0.12	0.28
1994	0.33	0.28	0.19	0.50	0.11	0.23	0.07	0.16
1995	0.52	0.39	0.20	0.90	0.20	0.20	0.13	0.27
1996	0.28	0.20	0.19	0.38	0.14	0.20	0.09	0.18
1997	0.13	0.22	0.09	0.18	0.12	0.21	0.08	0.16
1998	0.28	0.15	0.22	0.35	0.25	0.14	0.20	0.31
1999	0.64	0.20	0.44	0.86	0.34	0.14	0.26	0.42
2000	0.30	0.18	0.21	0.39	0.24	0.17	0.18	0.31
2001	0.26	0.31	0.14	0.41	0.24	0.20	0.16	0.31
2002	0.38	0.30	0.21	0.60	0.32	0.33	0.18	0.52
2003	1.38	0.15	1.03	1.72	0.31	0.16	0.23	0.39
2004	0.18	0.27	0.11	0.27	0.12	0.25	0.07	0.17
2005	0.37	0.16	0.28	0.47	0.26	0.27	0.16	0.39
2006	0.54	0.27	0.32	0.78	0.17	0.20	0.12	0.23
2007	0.55	0.22	0.37	0.77	0.26	0.16	0.20	0.33
2008	0.39	0.31	0.22	0.60	0.19	0.31	0.11	0.29

Table D17a, continued.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2008	0.39	0.31	0.22	0.60	0.19	0.31	0.11	0.29
2009	0.30	0.15	0.23	0.38	0.16	0.14	0.12	0.19
2010	0.22	0.19	0.15	0.29	0.16	0.21	0.11	0.22
2011	0.42	0.11	0.34	0.50	0.28	0.14	0.22	0.34
2012	0.35	0.11	0.29	0.42	0.30	0.09	0.26	0.34
2013	0.34	0.14	0.27	0.44	0.20	0.17	0.15	0.26
2014	0.25	0.19	0.17	0.33	0.14	0.13	0.11	0.17
2015	0.20	0.18	0.14	0.26	0.11	0.16	0.08	0.14
2016	0.28	0.11	0.23	0.32	0.46	0.10	0.38	0.54
2017	0.49	0.16	0.37	0.62	0.46	0.18	0.33	0.59
2018	0.63	0.16	0.46	0.78	0.33	0.16	0.24	0.41
2019	0.36	0.10	0.30	0.42	0.29	0.11	0.24	0.34

Table D17b. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

	Biomass Index				Abundance Index			
	Mean	CV	L90%	U90%	Mean	CV	L90%	U90%
2009	2.45	0.16	1.81	3.09	1.11	0.15	0.85	1.38
2010	1.73	0.19	1.19	2.28	1.15	0.22	0.73	1.56
2011	3.41	0.11	2.80	4.01	1.99	0.14	1.54	2.44
2012	2.86	0.11	2.36	3.35	2.14	0.09	1.83	2.45
2013	2.76	0.14	2.10	3.42	1.43	0.17	1.03	1.82
2014	2.03	0.19	1.41	2.65	1.03	0.13	0.80	1.25
2015	1.58	0.17	1.14	2.02	0.77	0.15	0.58	0.97
2016	2.22	0.10	1.85	2.59	3.25	0.11	2.68	3.82
2017	3.93	0.16	2.92	4.94	3.25	0.18	2.26	4.24
2018	5.04	0.16	3.72	6.36	2.36	0.16	1.73	2.99
2019	2.89	0.10	2.42	3.36	2.07	0.11	1.70	2.43

Table D18. Survey results from NEFSC (1984-2011) and NEFSC and VIMS (2012-2018) offshore scallop dredge surveys in the southern management region (shellfish strata 6, 7, 10, 11, 14, 15, 18, 19, 22-31, 33-35, 46, 47, 55, 58-61, 621, 631). The survey vessel used by NEFSC and survey timing change in 2009. VIMS conducted an increasing portion of the survey starting in 2012. Indices are arithmetic stratified means with bootstrapped variance estimates (where available).

	Abundance Index Mean	CV	L90%	U90%
1984	1.34	0.1	1.17	1.51
1985	1.57	0.1	1.37	1.79
1986	1.29	0.1	1.12	1.46
1987	3.17	0.1	2.89	3.46
1988	1.69	0.1	1.49	1.89
1989	1.00	0.1	0.88	1.13
1990	1.53	0.1	1.40	1.69
1991	2.26	0.1	2.05	2.46
1992	1.95	0.1	1.75	2.18
1993	2.83	0.0	2.62	3.06
1994	3.33	0.1	3.06	3.62
1995	2.26	0.1	2.03	2.49
1996	2.01	0.1	1.80	2.23
1997	1.12	0.1	0.99	1.26
1998	1.06	0.1	0.95	1.18
1999	2.57	0.1	2.28	2.89
2000	2.29	0.1	2.04	2.58
2001	1.73	0.1	1.56	1.92
2002	1.70	0.1	1.54	1.86
2003	2.75	0.1	2.48	3.01
2004	2.89	0.1	2.59	3.23
2005	2.01	0.1	1.81	2.21
2006	1.44	0.1	1.31	1.57
2007	0.83	0.1	0.73	0.94
2008	1.03	0.1	0.89	1.17
2009	0.78	9.8	0.65	0.92
2010	0.74	9.9	0.61	0.87
2011	0.94	12.5	0.73	1.12
2012	1.00			
2013	0.81			
2014	0.55			
2015	2.29			
2016	2.17			
2017	1.62			
2018	0.99			

Table D19. Area-swept estimates of minimum abundance and biomass, and relative exploitation indices for monkfish from NEFSC fall surveys. Estimates are adjusted for sweep type (adjusted to chain sweep), assume that 100% of monkfish encountered by the trawl are captured and account for missed strata in some years.

North	Catch (millions of fish)	Landings (millions of fish)	Catch mt	adjusted AS total abund	adjusted AS 43 cm+ abund	adjusted AS Biomass mt	C/Total N Rel F	L/43+cm Rel F	C mt/ B mt Rel F
2009	1.559	1.066	3,675	36,717,874	8,662,877	32,406	0.04	0.12	0.11
2010	1.169	0.819	2,741	40,524,791	10,999,269	42,178	0.03	0.07	0.06
2011	1.445	0.970	2,814	51,328,487	14,797,117	49,936	0.03	0.07	0.06
2012	1.995	1.390	4,635	57,008,552	13,828,353	51,063	0.04	0.10	0.09
2013	1.724	1.109	3,922	60,967,483	8,414,414	40,838	0.03	0.13	0.10
2014	1.865	1.139	3,954	84,100,939	13,314,746	54,125	0.02	0.09	0.07
2015	2.137	1.395	4,630	105,281,189	17,990,848	77,578	0.02	0.08	0.06
2016	2.552	1.670	5,508	174,643,487	26,516,683	103,686	0.01	0.06	0.05
2017	3.222	2.478	7,894	115,927,590	39,300,789	113,147	0.03	0.06	0.07
2018	3.210	2.090	8,115	100,164,292	35,993,154	140,801	0.03	0.06	0.06

South	Catch (millions of fish)	Landings (millions of fish)	Catch mt	adjusted AS total abund	adjusted AS 43 cm+ abund	adjusted AS Biomass mt	C/Total N Rel F	L/43+cm Rel F	C mt/ B mt Rel F
2009	2.14	1.282	7,158	26,947,935	4,900,883	20,592	0.08	0.26	0.35
2010	2.64	1.095	7,105	47,905,108	8,873,105	32,509	0.06	0.12	0.22
2011	2.66	1.236	8,545	62,976,941	6,254,672	25,878	0.04	0.20	0.33
2012	3.35	1.439	8,438	24,635,364	7,309,501	31,016	0.14	0.20	0.27
2013	2.46	1.398	7,176	36,089,410	7,908,464	23,849	0.07	0.18	0.30
2014	2.49	1.243	6,859	25,860,088	4,769,114	20,359	0.10	0.26	0.34
2015	2.29	1.057	5,844	298,342,595	3,536,976	50,510	0.01	0.30	0.12
2016	4.51	0.971	7,199	77,586,702	5,136,276	52,014	0.06	0.19	0.14
2017	2.96	0.934	9,143						
2018	2.98	1.112	9,615	67,592,308	6,726,308	26,619	0.04	0.17	0.36

Figures

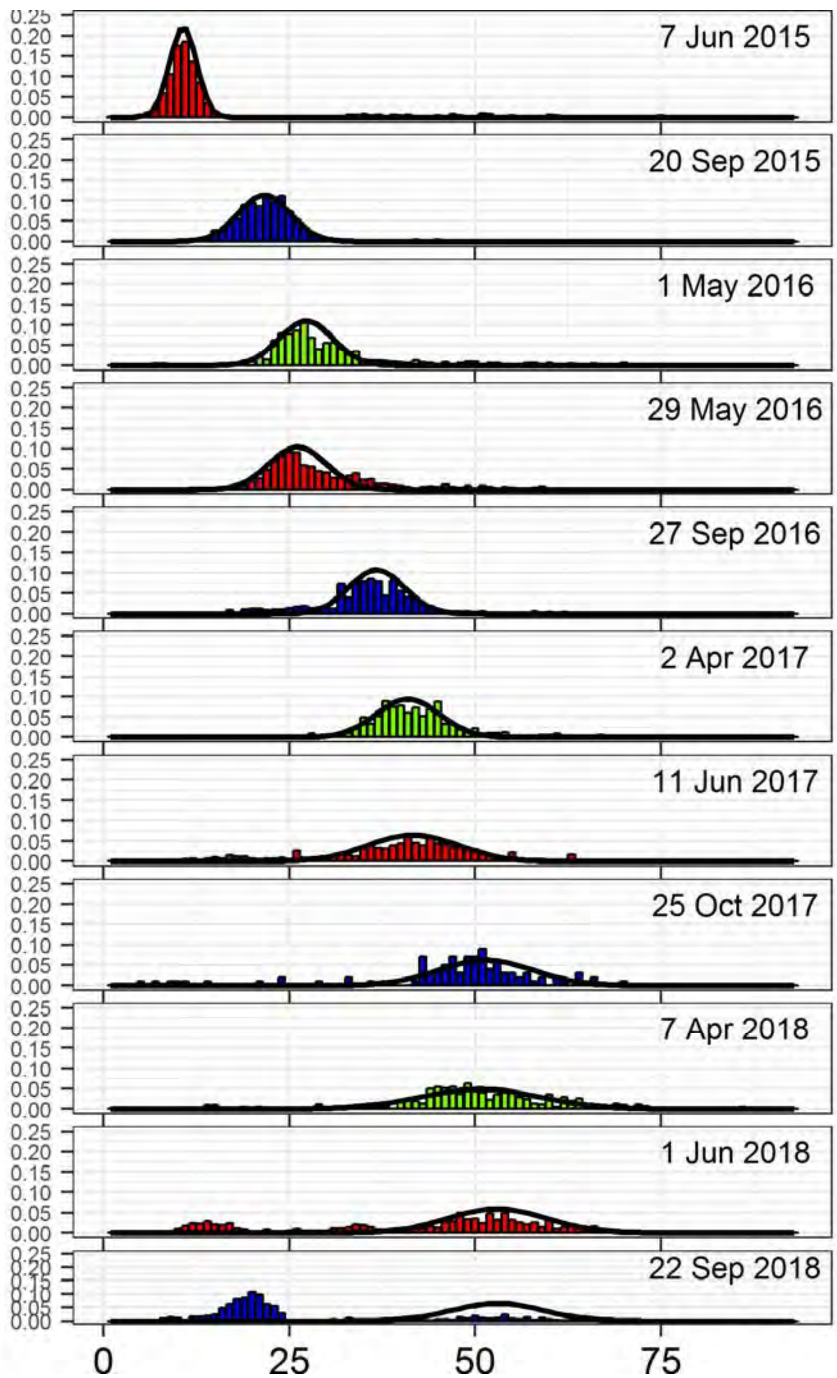


Figure D1. Length frequency distributions of monkfish in southern management area from NEFSC spring (green), scallop dredge (NEFSC and VIMS, red), and NEFSC fall surveys (blue) illustrating growth rates of presumed 2015 year class of monkfish. Normal curves were fit to dominant mode using NORMSEP. Monkfish settle to the benthos at about 8 cm. Geographic scope of sampling was limited to southern flank of Georges Bank in fall 2017.

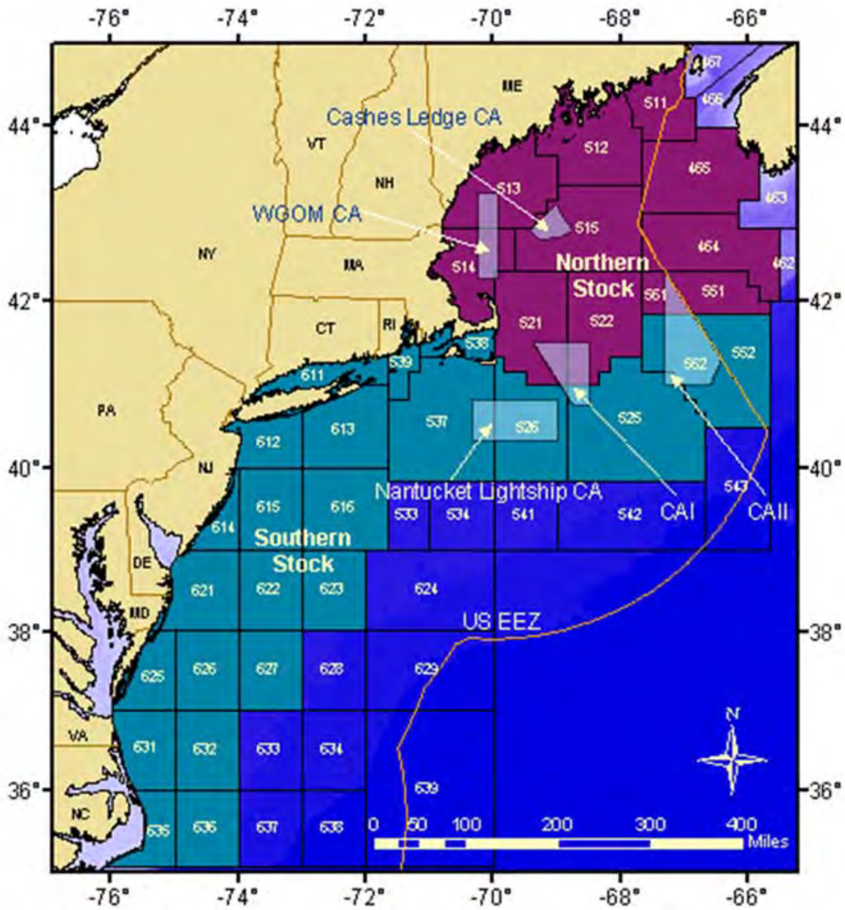


Figure D2. Fishery statistical areas used to define northern and southern monkfish management areas.

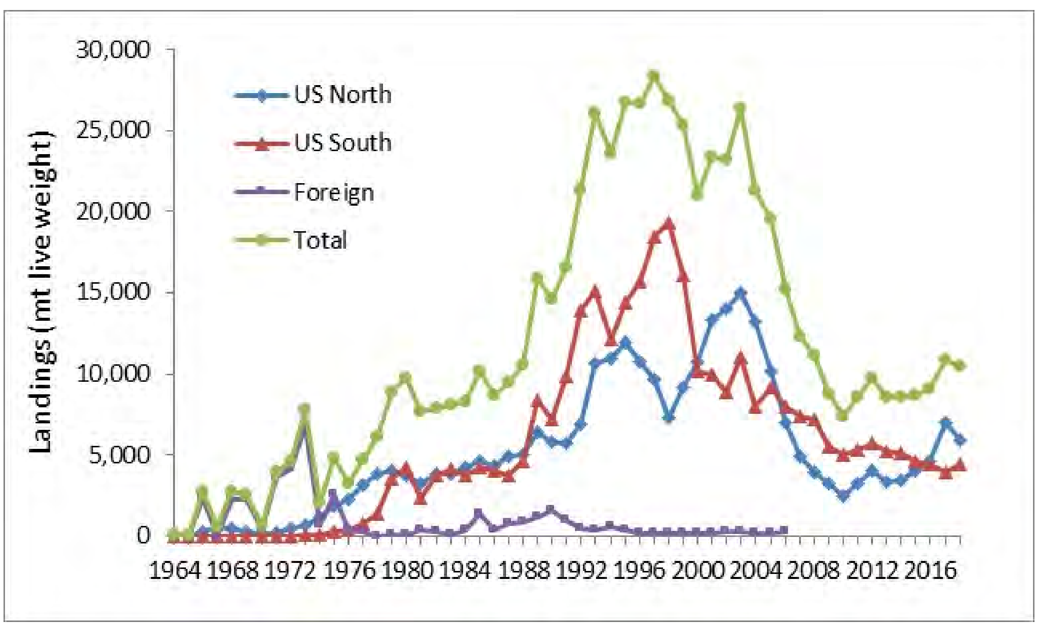


Figure D3. Monkfish landings by management area and combined areas, 1964-2018.

A.

B.

C.

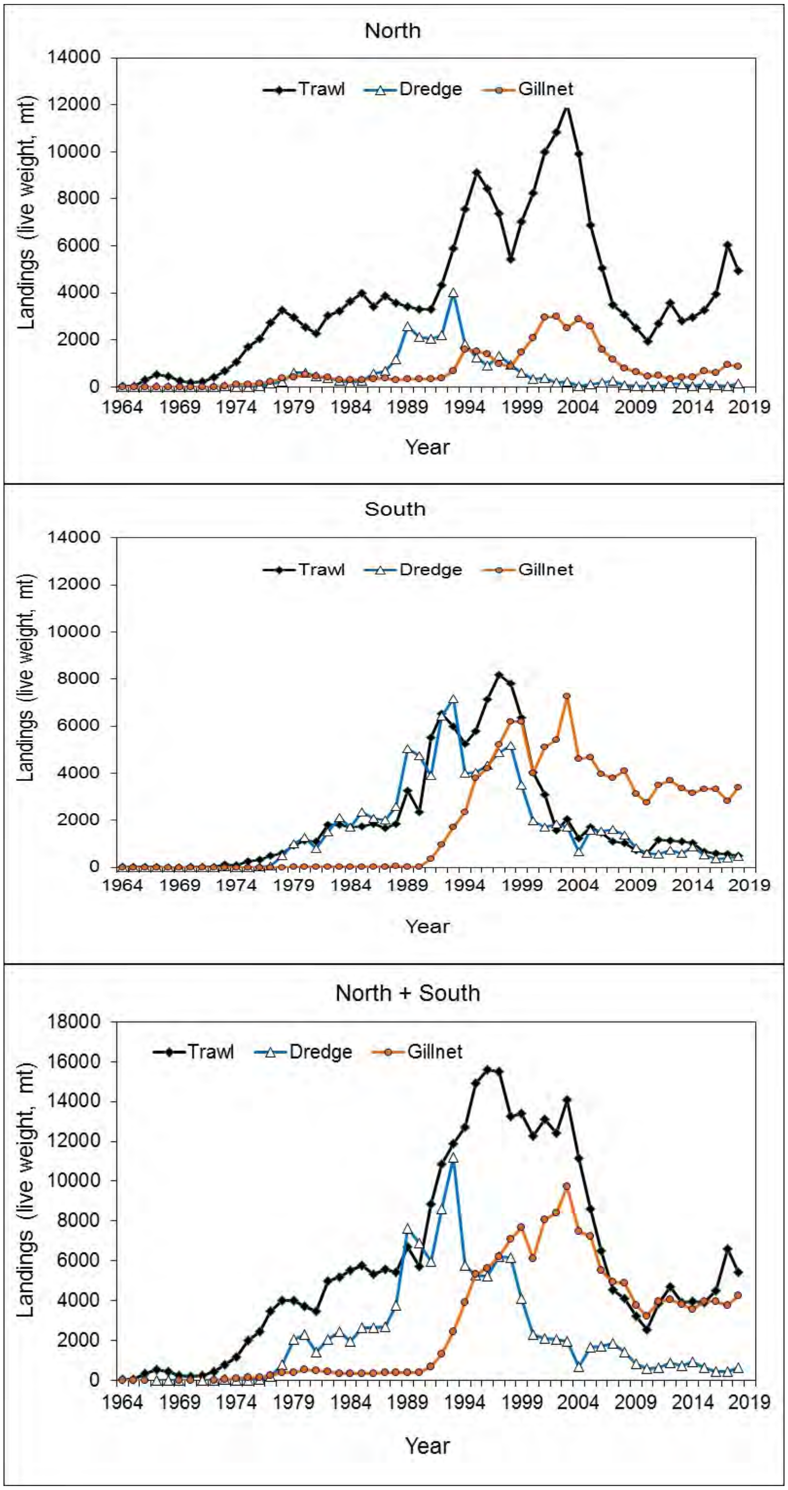


Figure D4. Commercial landings of monkfish by gear type and management area, 1964-2018. A. Northern management area, B. Southern management area, C. Management areas combined.

North South

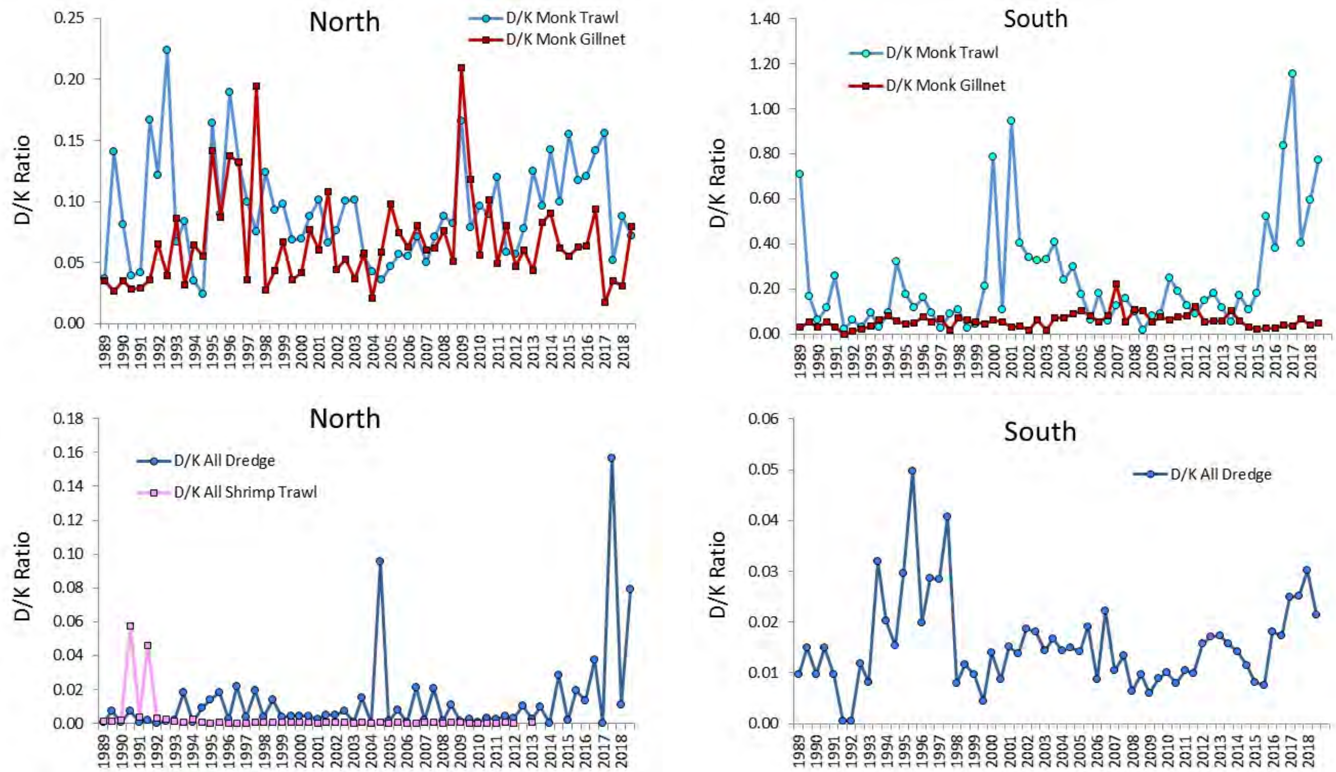


Figure D5. Discard ratios by half year for trawls and gillnets (top panels), and dredges and shrimp trawls (bottom panels) for North (left column) and South (right column). Trawls and gillnets ratios were based on kept monkfish; dredge and shrimp trawl were based on kept of all species.

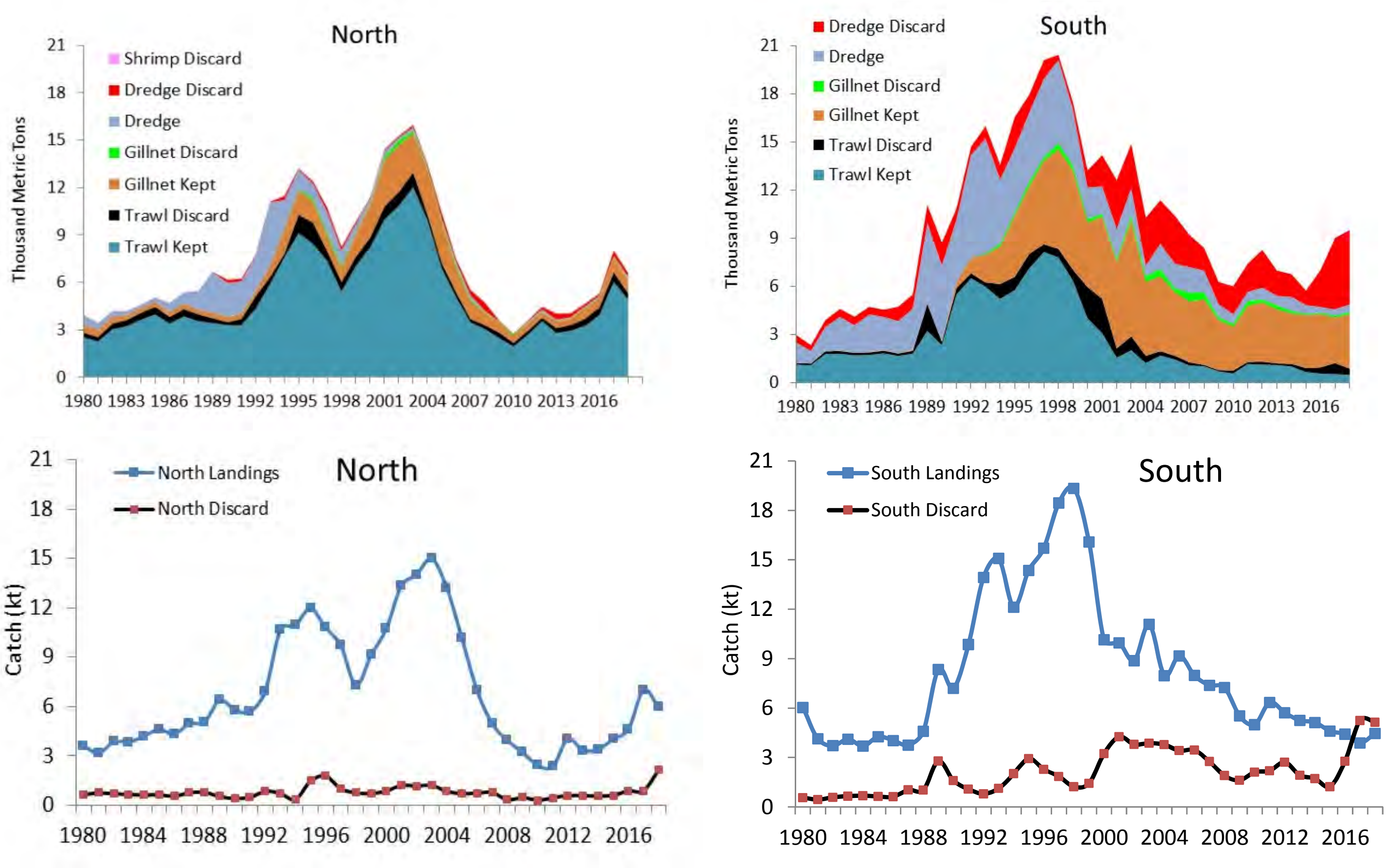


Figure D6. Monkfish landings and discard by gear type (top panels) and total (bottom panels) for North (left) and South (right).

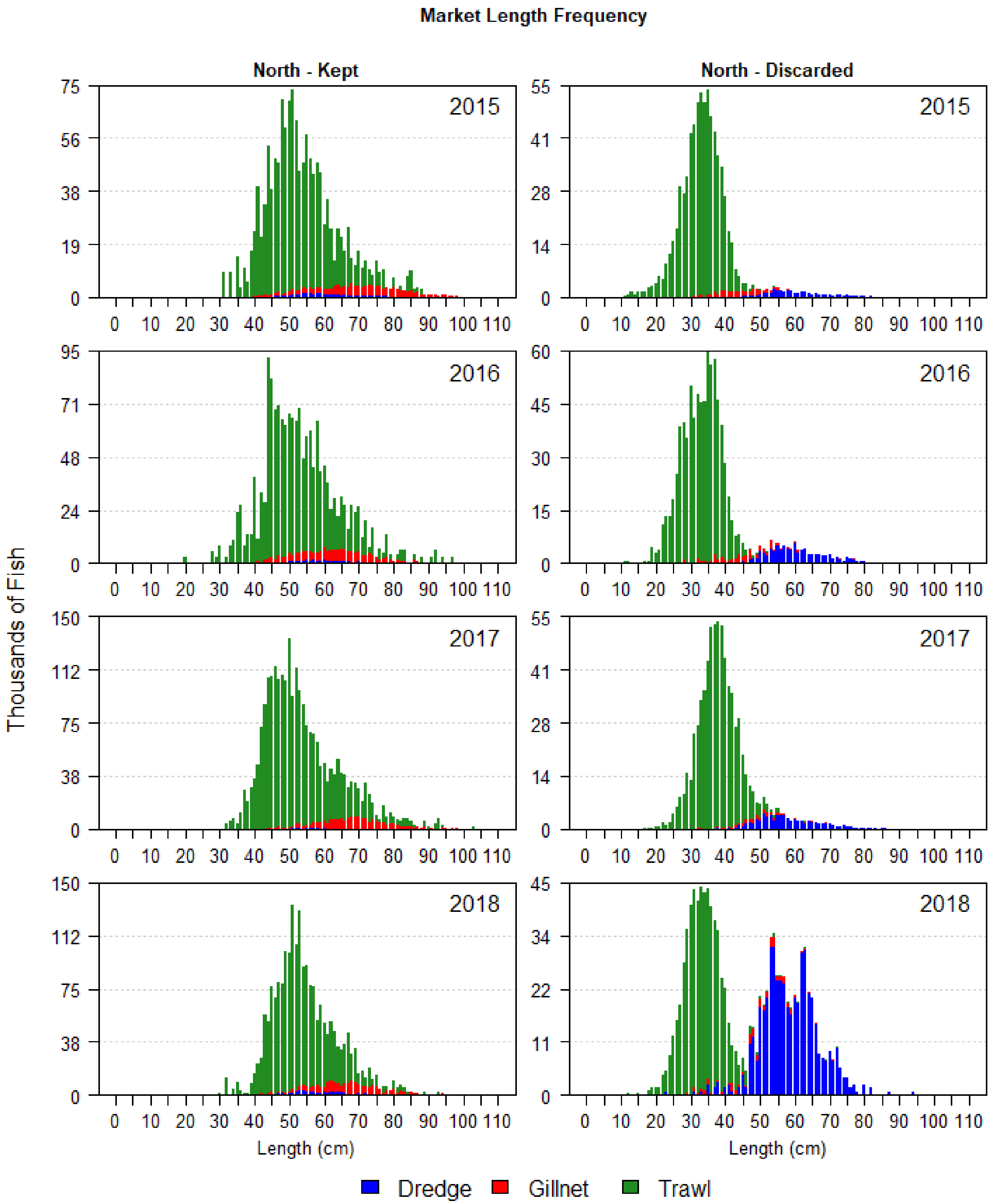


Figure D7. Estimated length composition of kept and discarded monkfish by gear type in the northern management area.

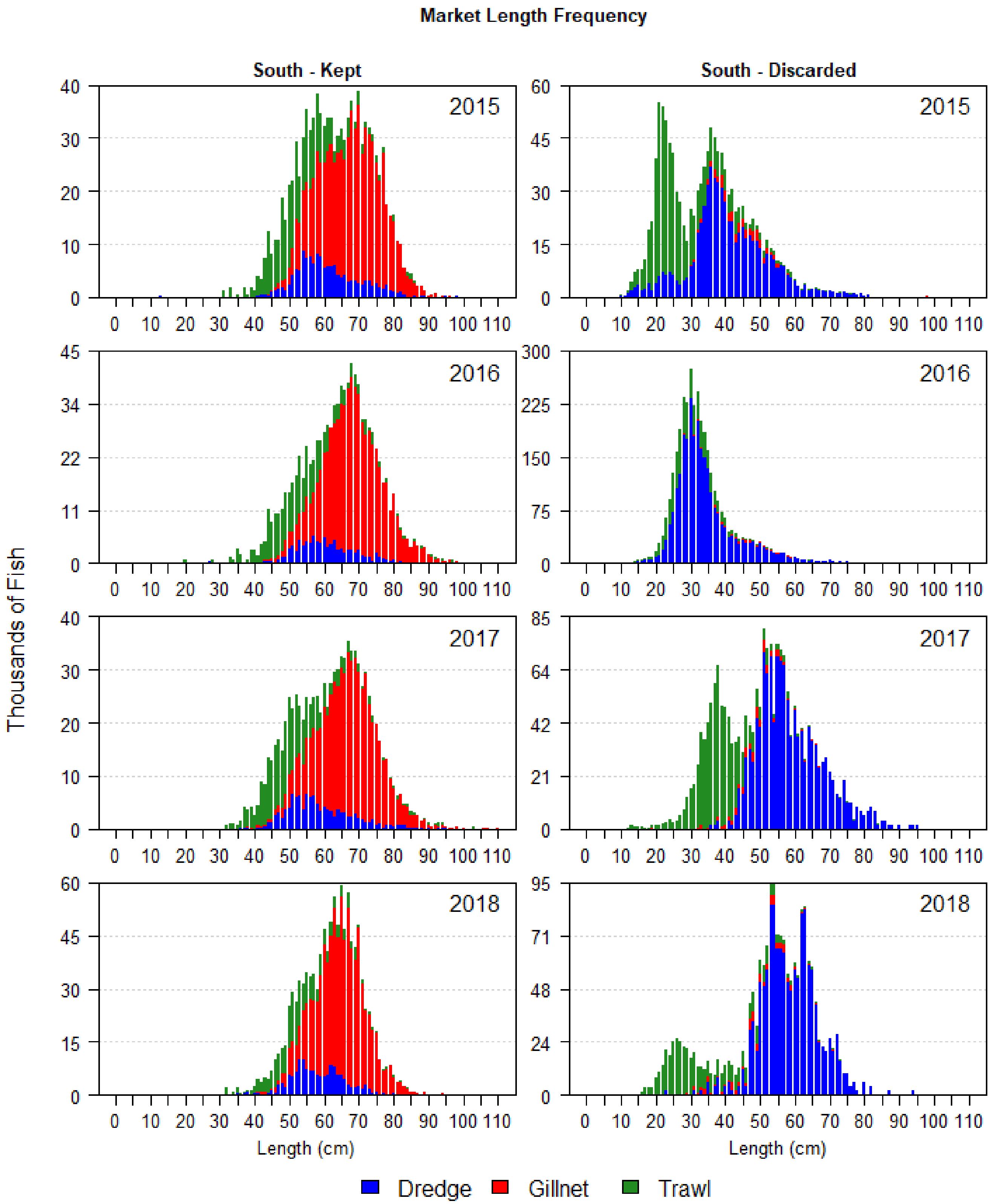


Figure D8. Estimated length composition of kept and discarded monkfish by gear type in the southern management area.

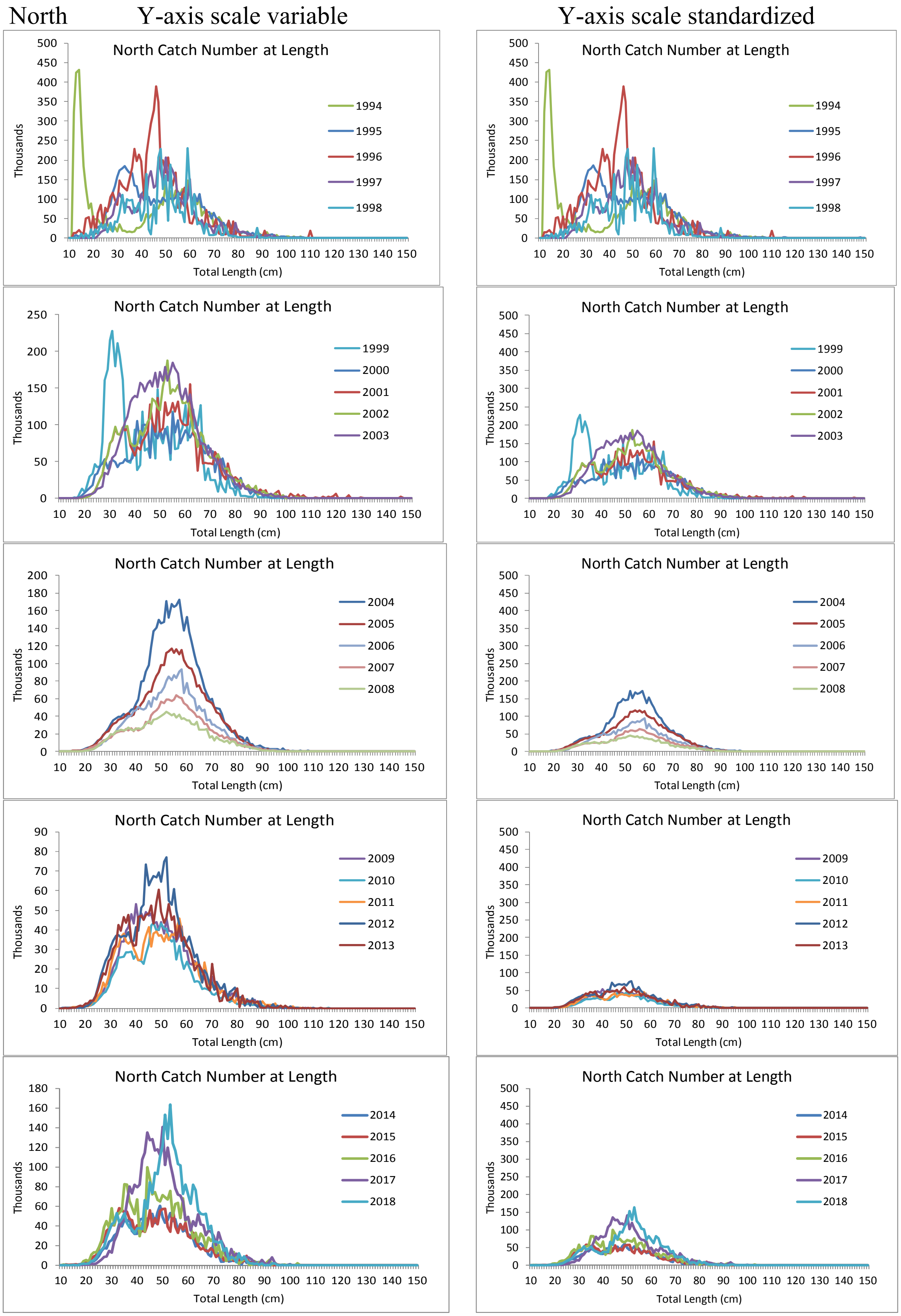


Figure D9. Estimated length composition of commercial monkfish catch, northern management area.

South Y-axis scale variable Y-axis scale standardized

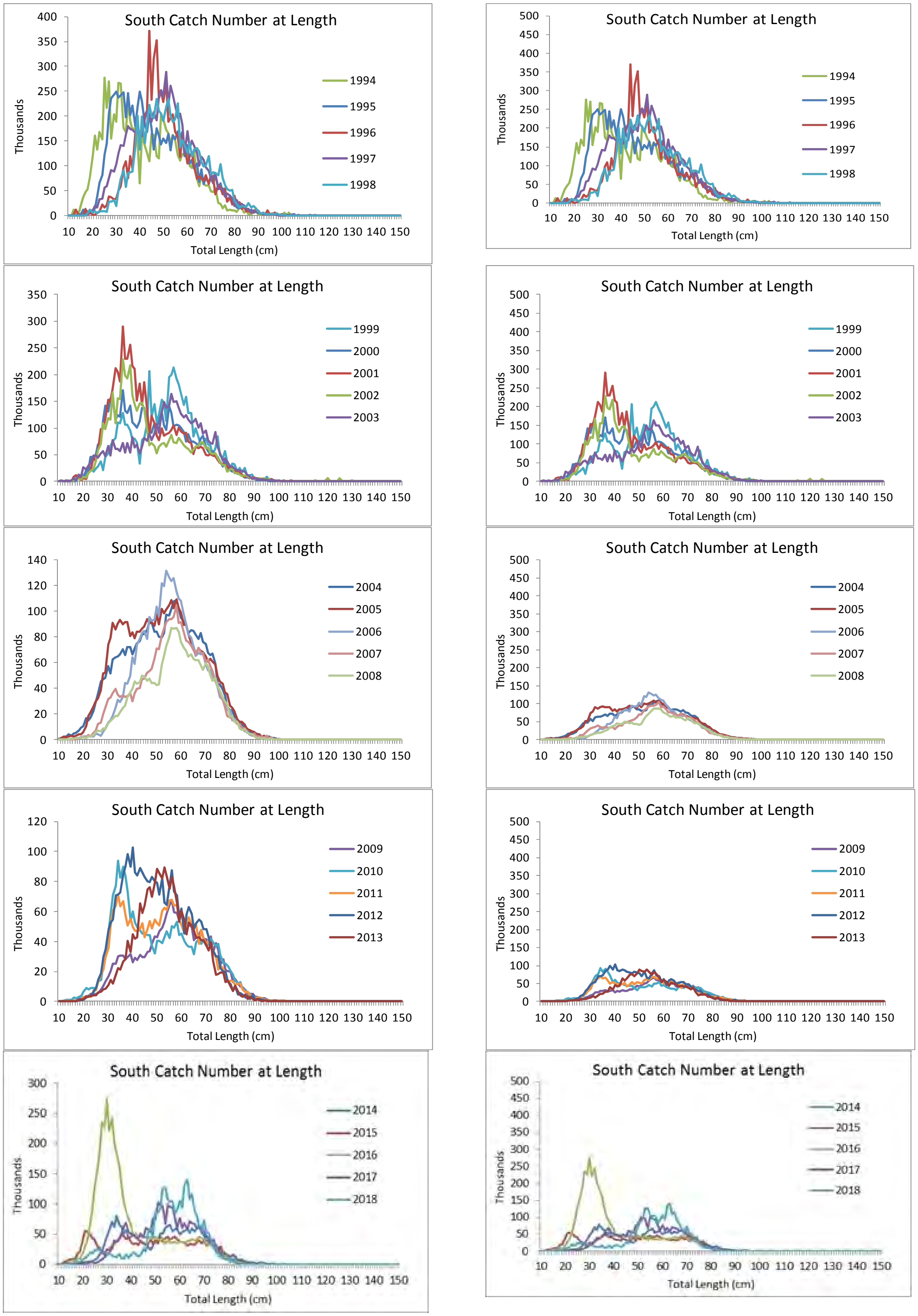


Figure D10. Length composition of monkfish commercial catch estimated using length frequency data collected by fishery observers in the southern management area.

North

Biomass | Abundance

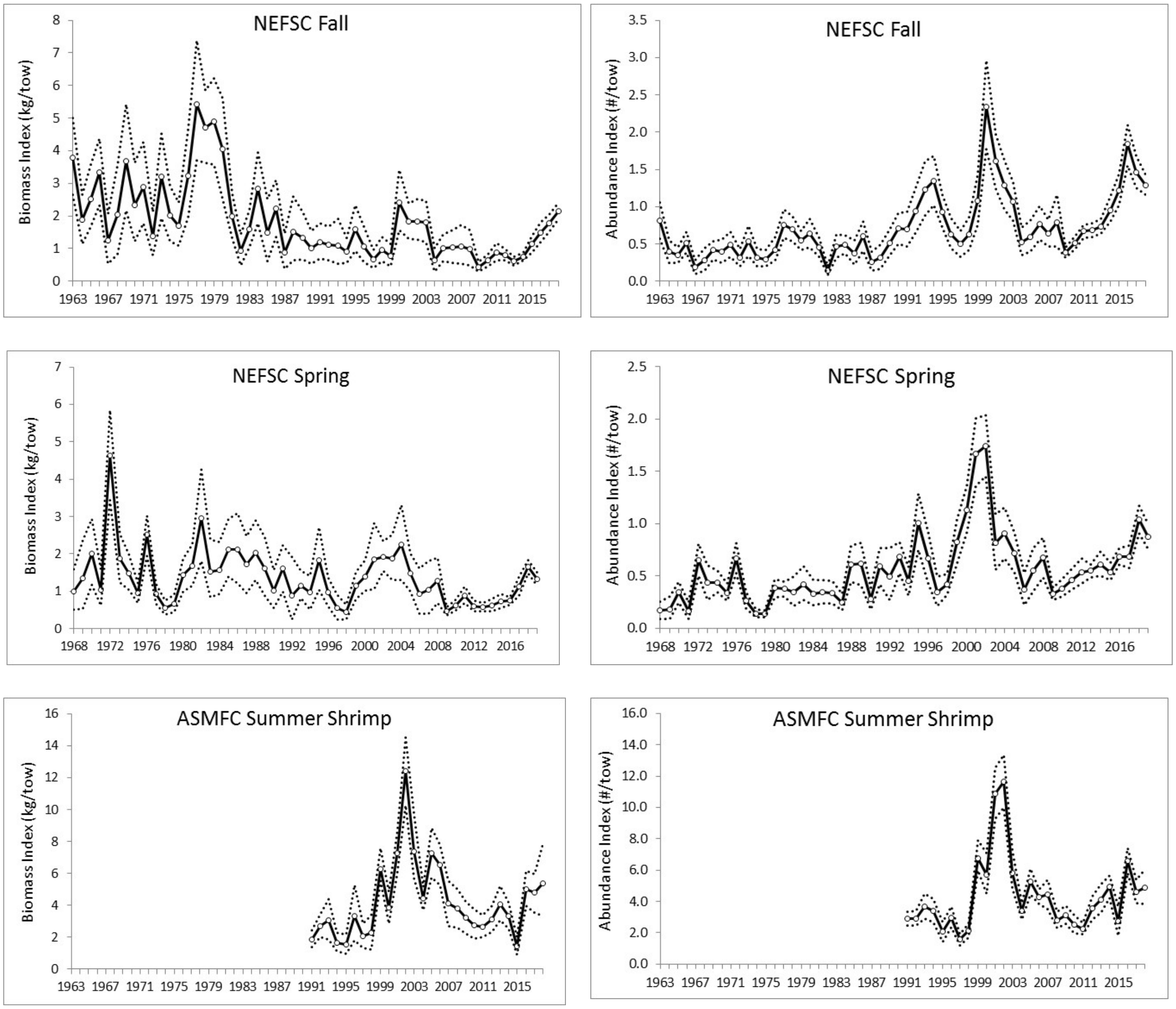


Figure D11. Survey indices for monkfish in the northern management area. Points after 2008 in spring and fall surveys are from surveys conducted on the FSV Bigelow, converted to Albatross units as described in the text.

North

Biomass | Abundance

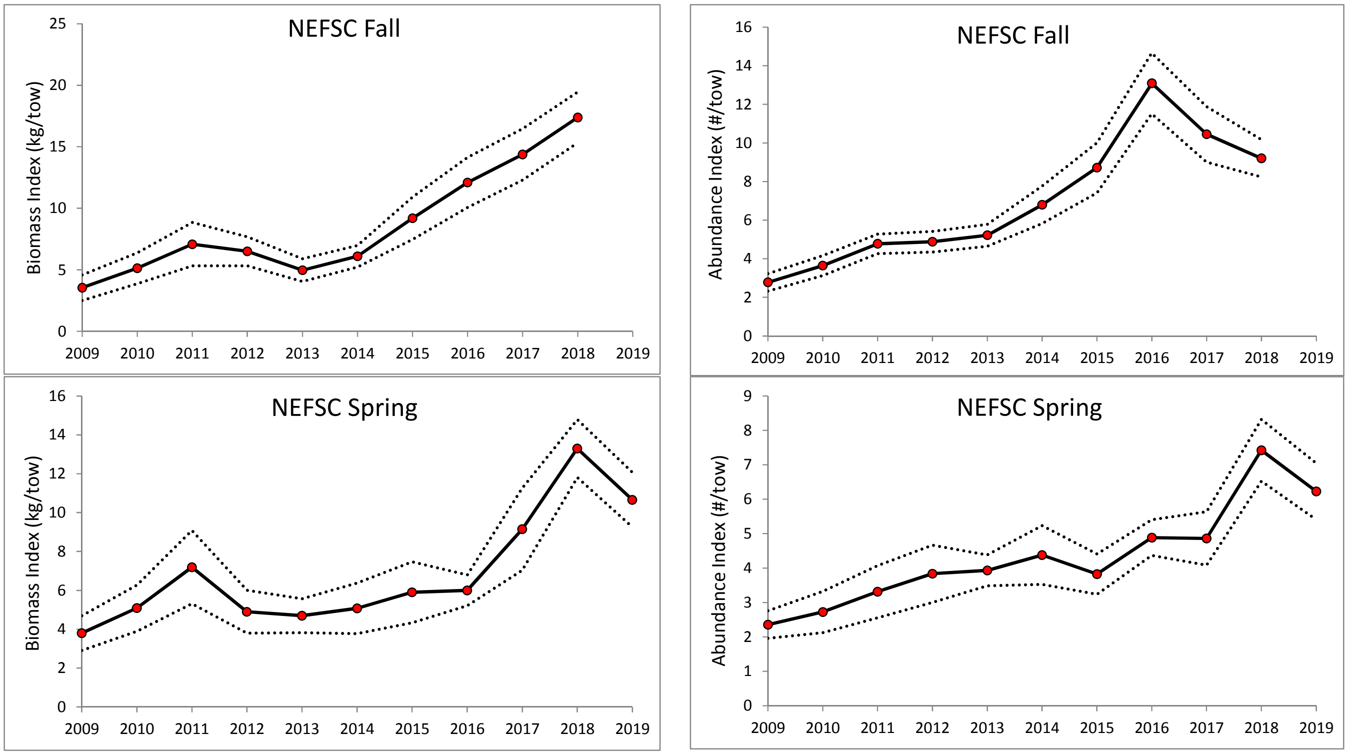


Figure D12. Survey indices from surveys conducted on the FRSV Bigelow in the northern management area, not converted to Albatross units. Note: y-axis scale varies.

Fall Spring

A.

B.

C.

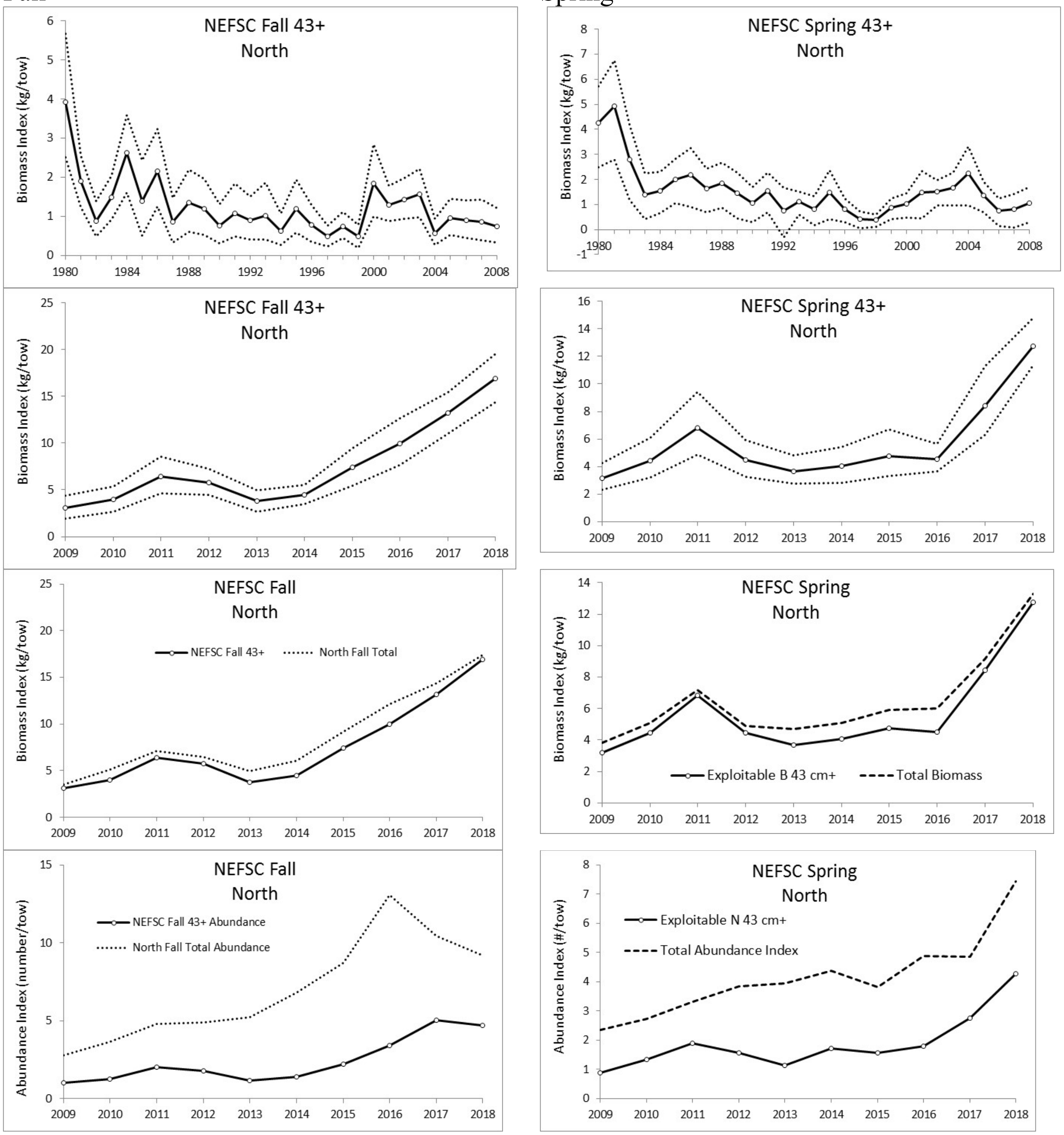


Figure D13. Exploitable biomass (≥ 43 cm total length) indices for monkfish from fall and spring surveys in the NMA. A. Exploitable biomass indices with 95% confidence intervals, 1980-2008 (surveys conducted on RV Albatross). B. Exploitable biomass indices with 95% confidence intervals, 2009-2018 (surveys conducted on RV H.B. Bigelow) C. Total biomass vs. exploitable biomass indices, 2009-2018, D. total abundance vs. exploitable abundance, 2009-2018.

North

Biomass Abundance

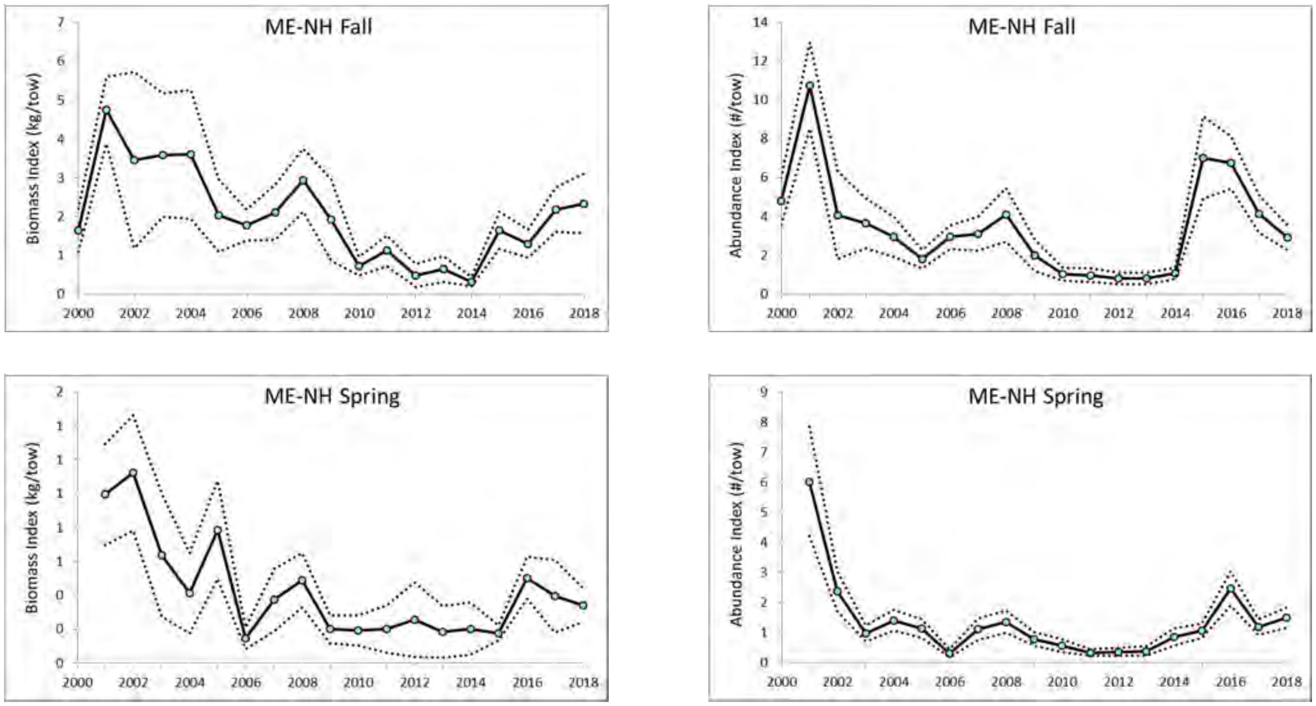


Figure D14. Survey indices for monkfish from Maine-New Hampshire inshore surveys. Data courtesy of Maine Department of Marine Resources.

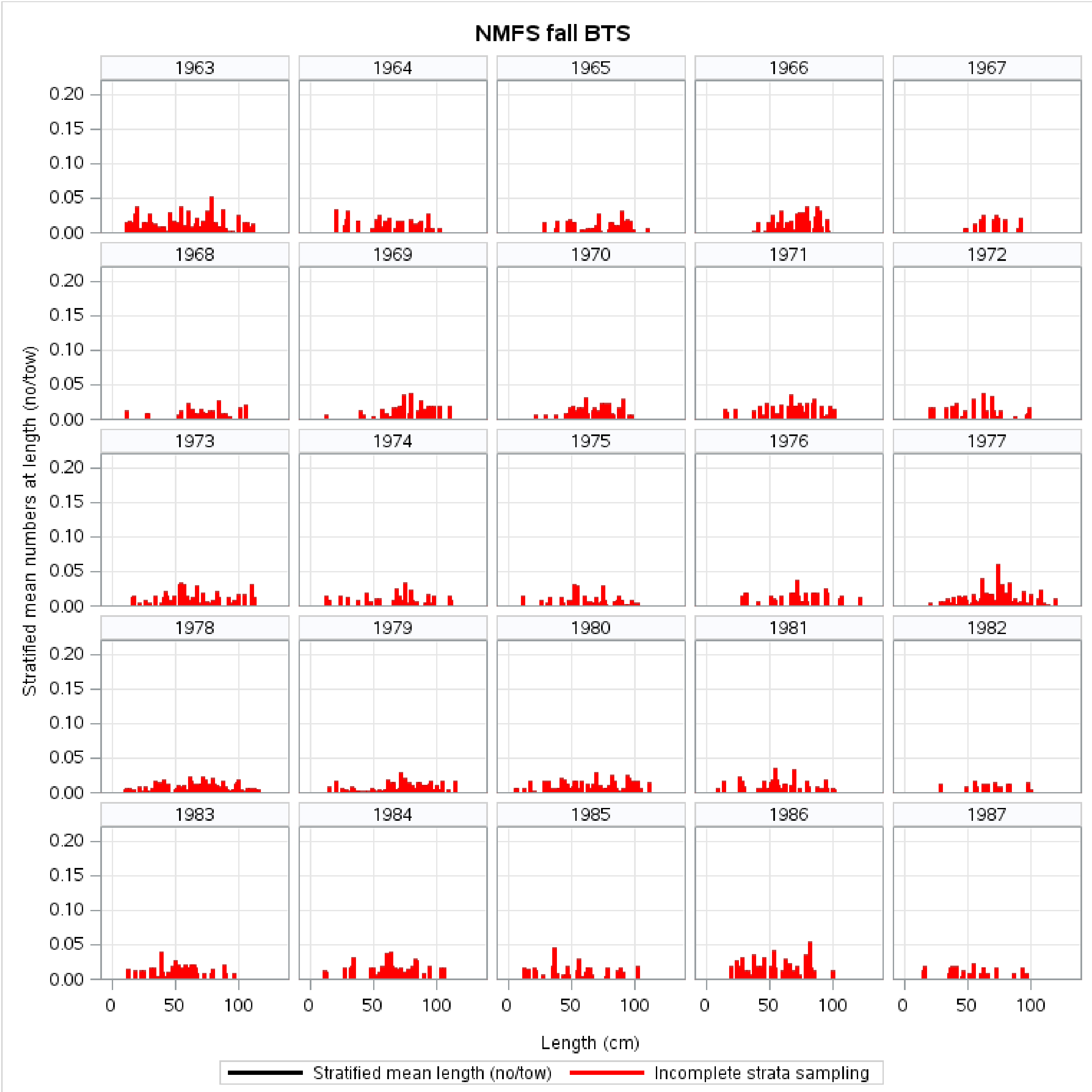


Figure D15. Abundance at length from NEFSC fall surveys in the northern management area.

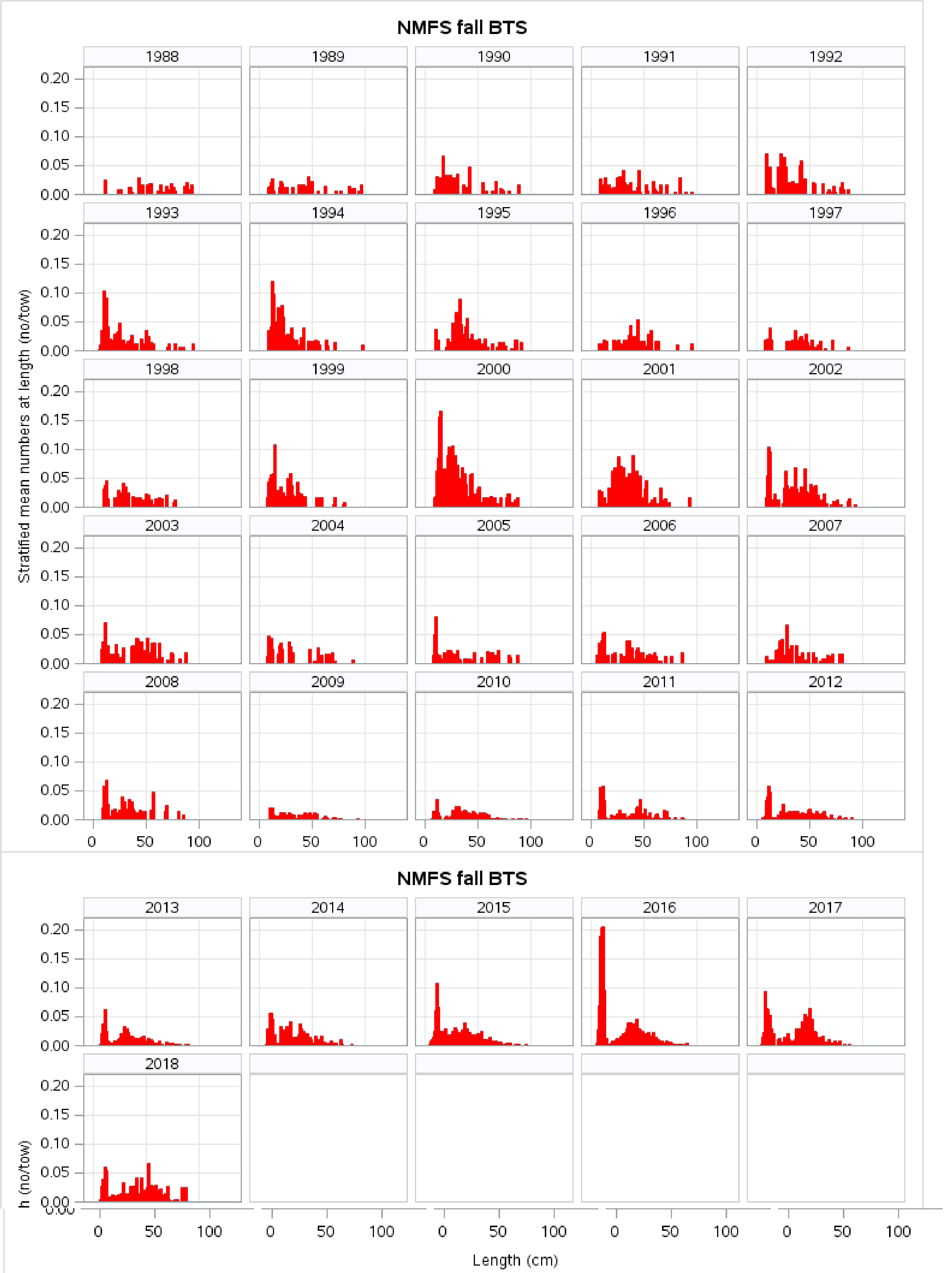


Figure D15, cont'd. (fall surveys, north)

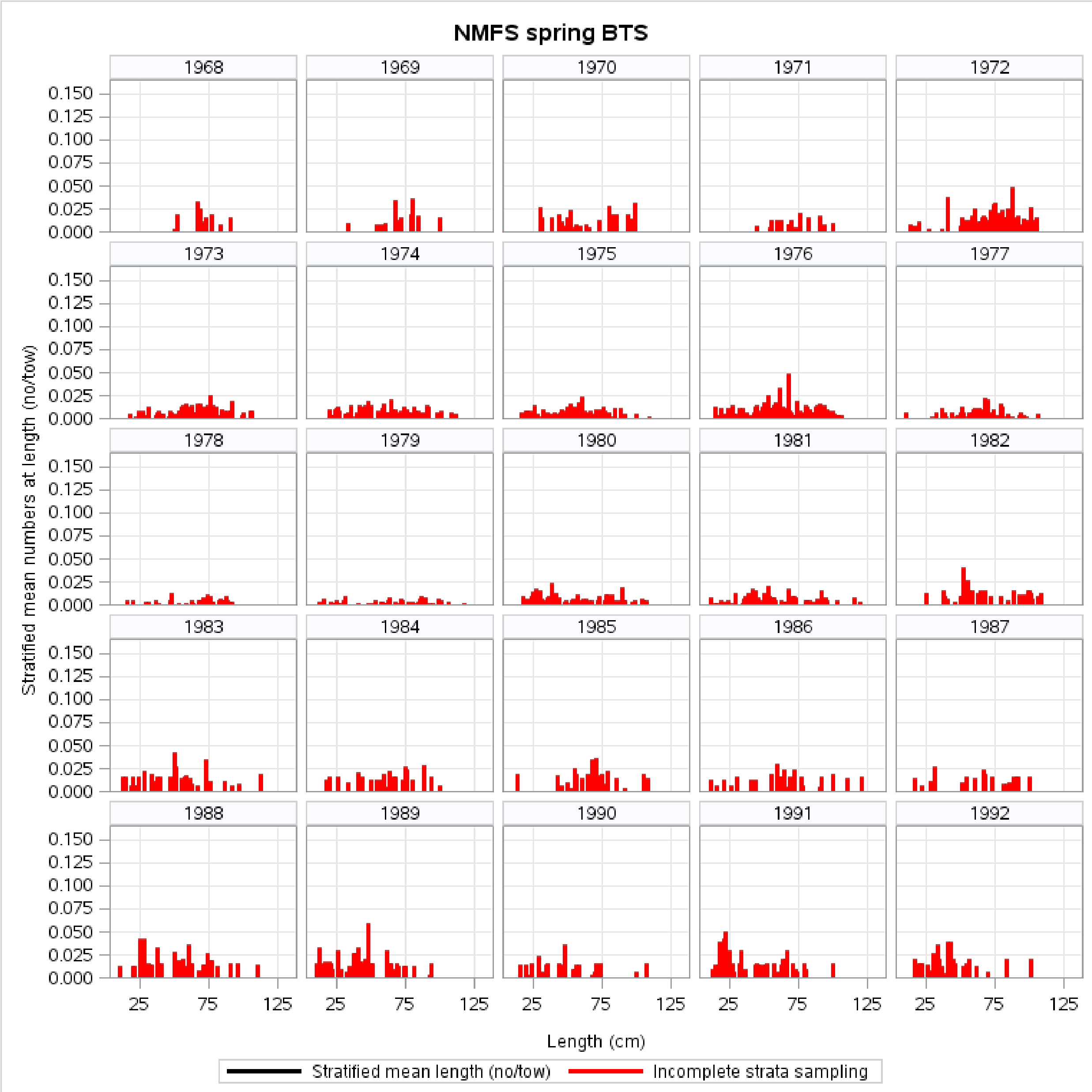


Figure D16. Abundance at length from NEFSC spring surveys in the northern management area.

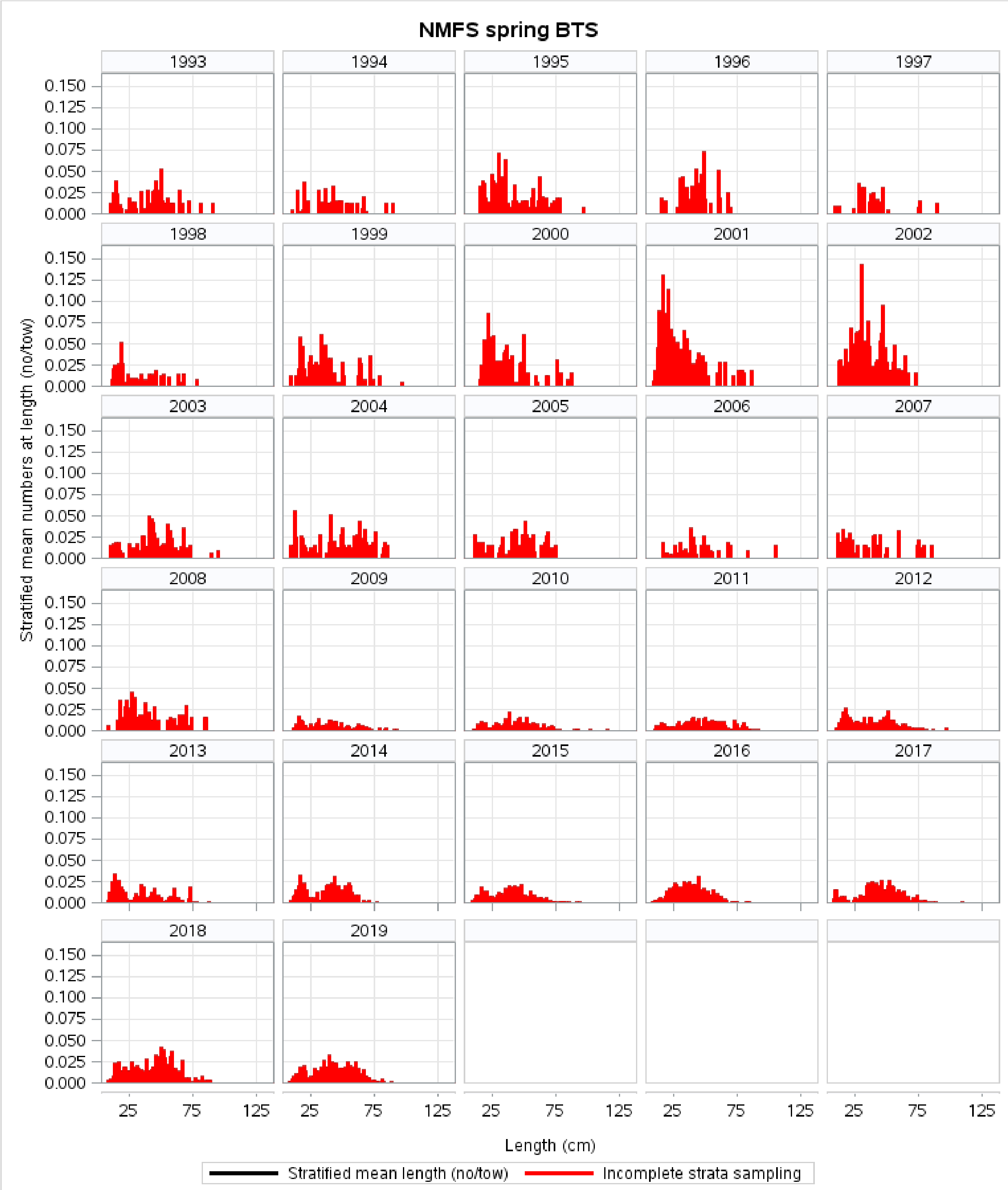


Figure D16, cont'd. (spring surveys, north)

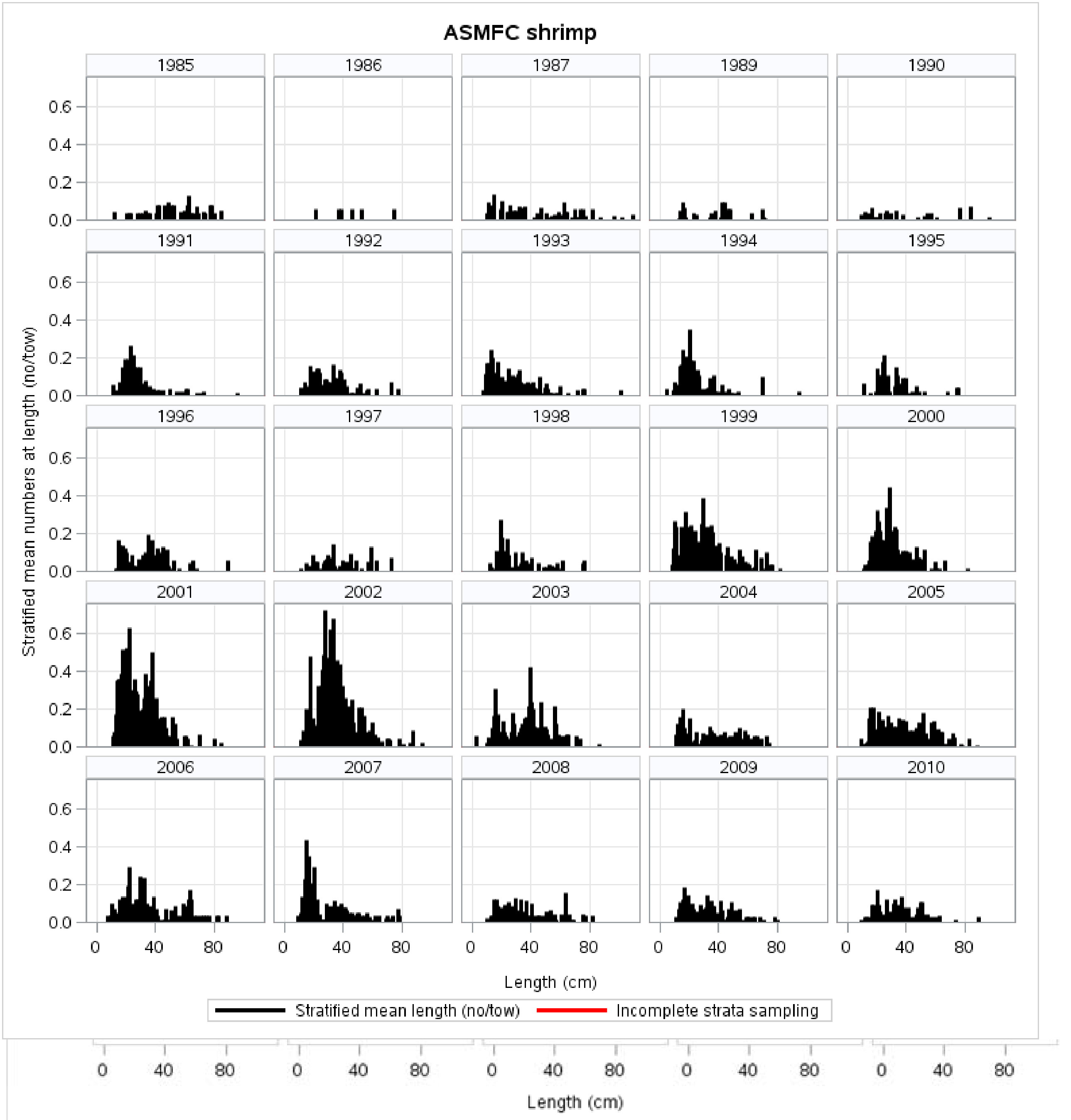


Figure D17. Abundance at length from ASMFC summer shrimp surveys in the northern management area.

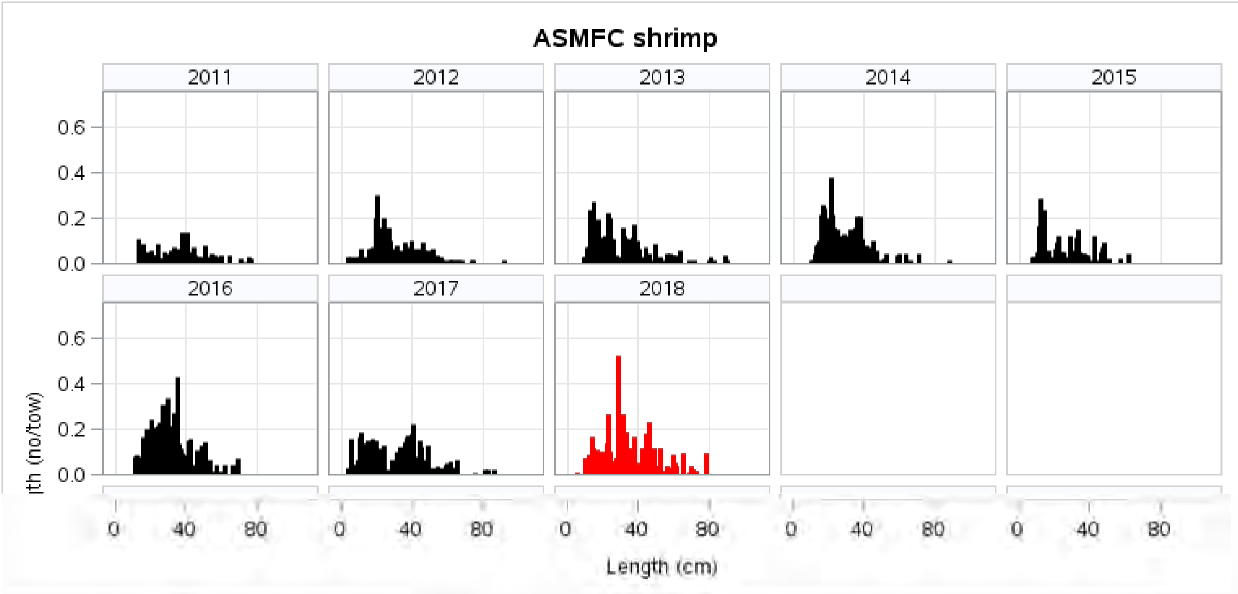


Figure D17, continued (shrimp surveys, north)

Fall

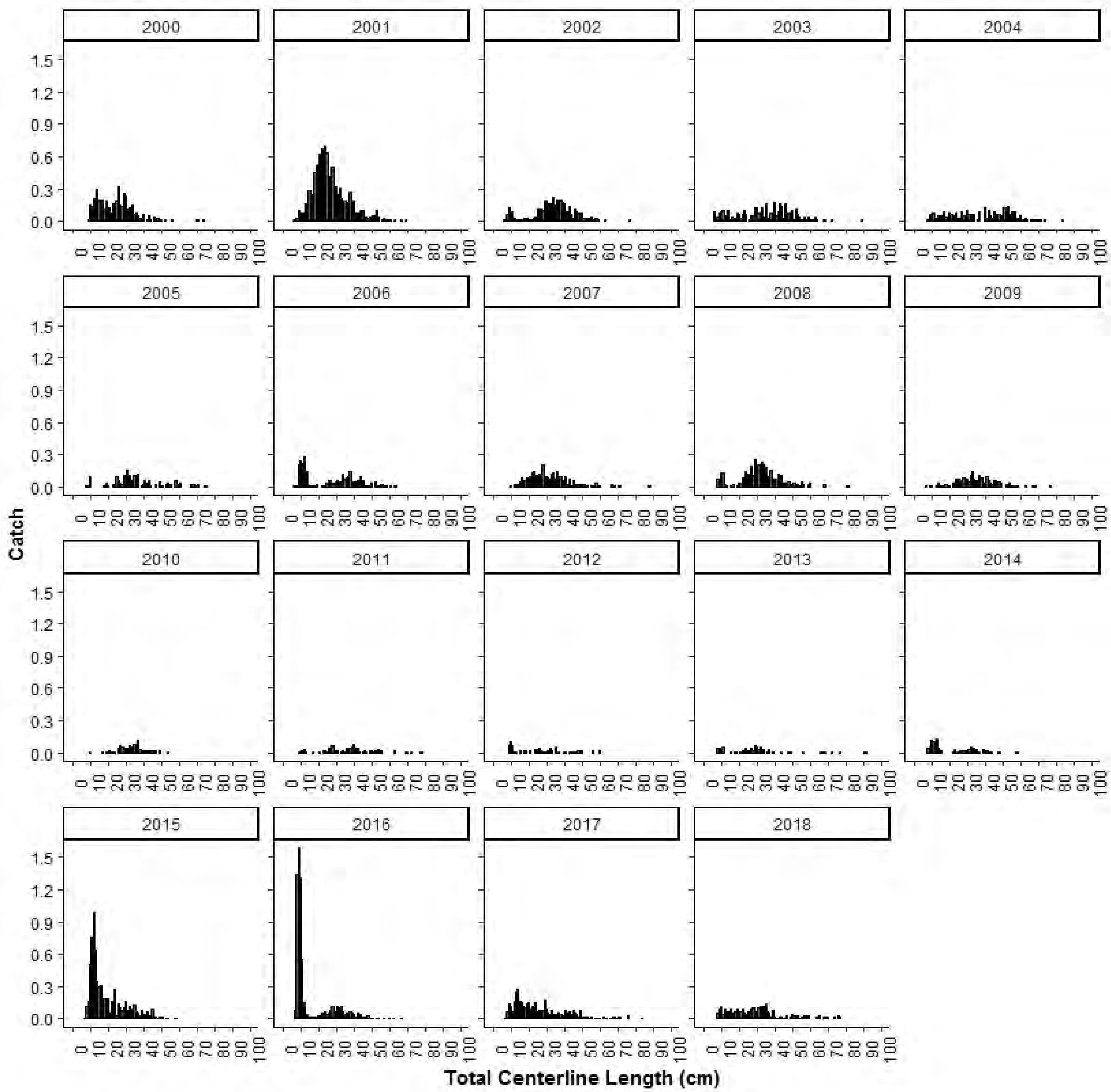


Figure D18. Abundance at length from ME/NH fall inshore trawl surveys in the northern management area. Data courtesy of Maine Department of Marine Resources.

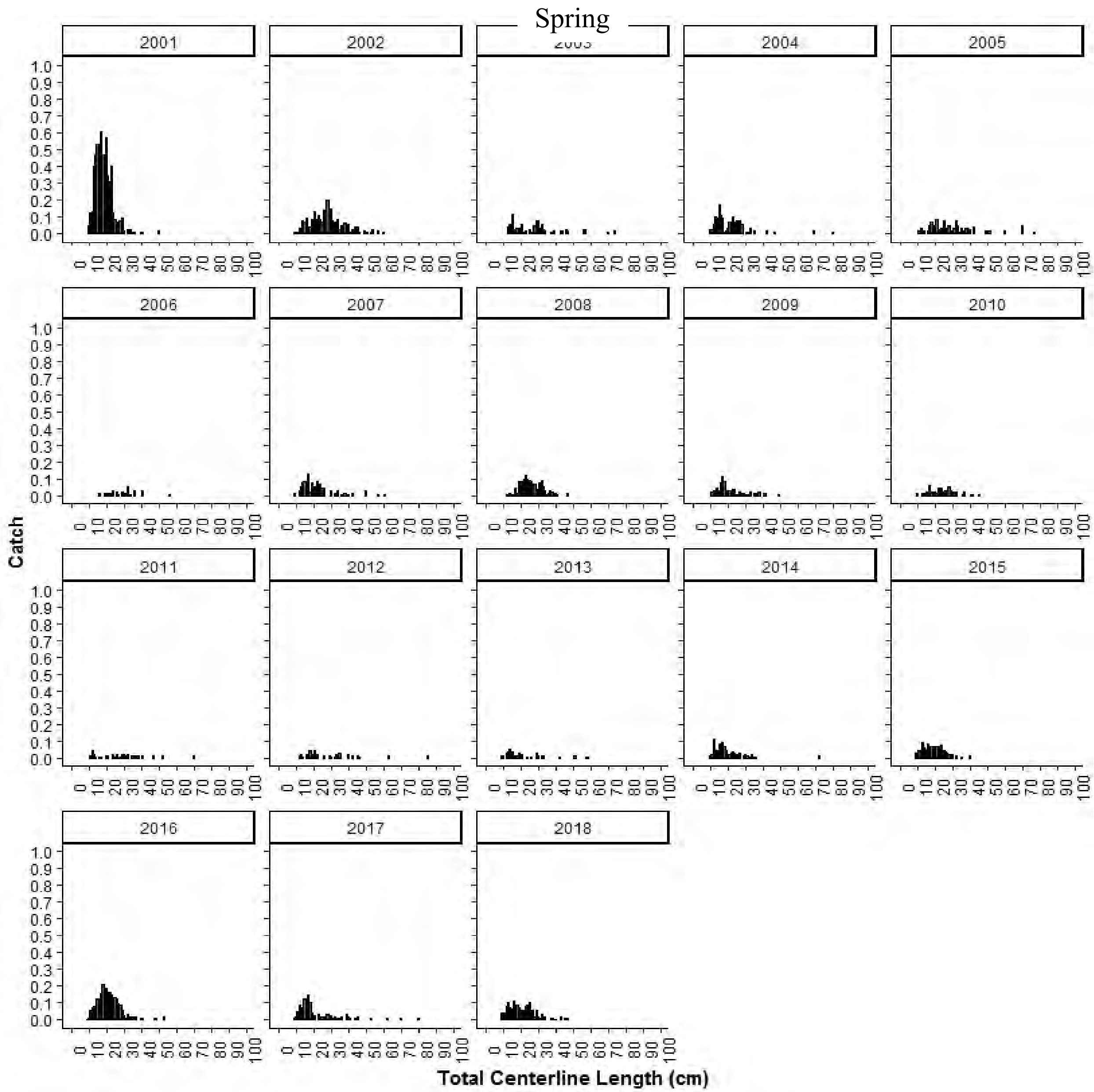
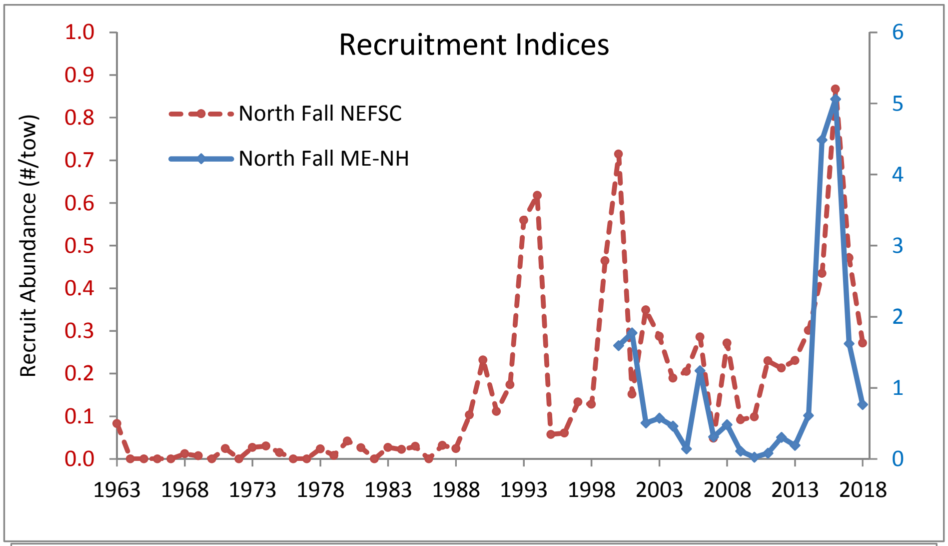


Figure D19. Abundance at length from ME/NH spring inshore trawl surveys in the northern management area. Data courtesy of Maine Department of Marine Resources.

A.



B.

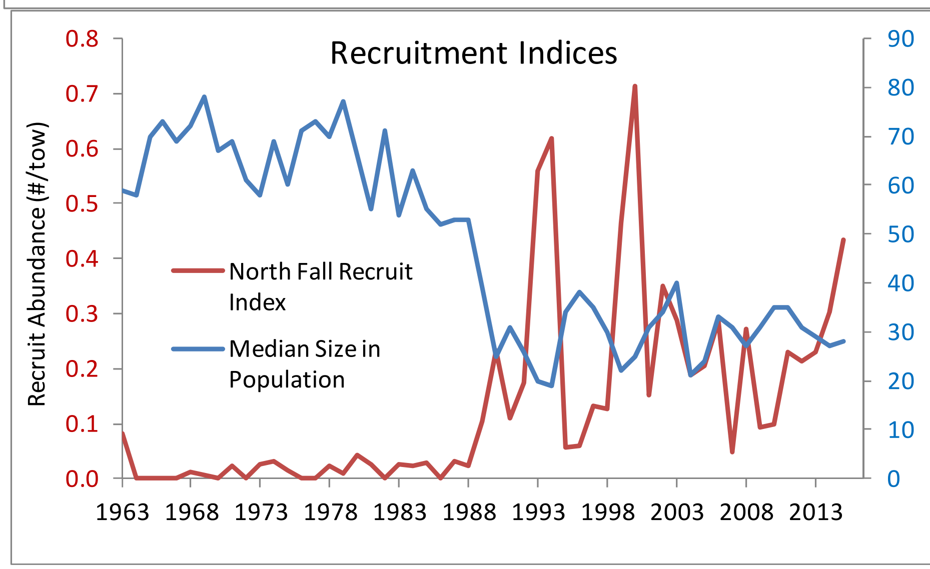


Figure D20. A. Recruitment indices for monkfish in the northern management area. Indices include monkfish in size ranges thought to represent young-of-year (age 0) in each area and season. B. Recruitment indices vs. median size of monkfish in the population (based on NEFSC fall surveys).

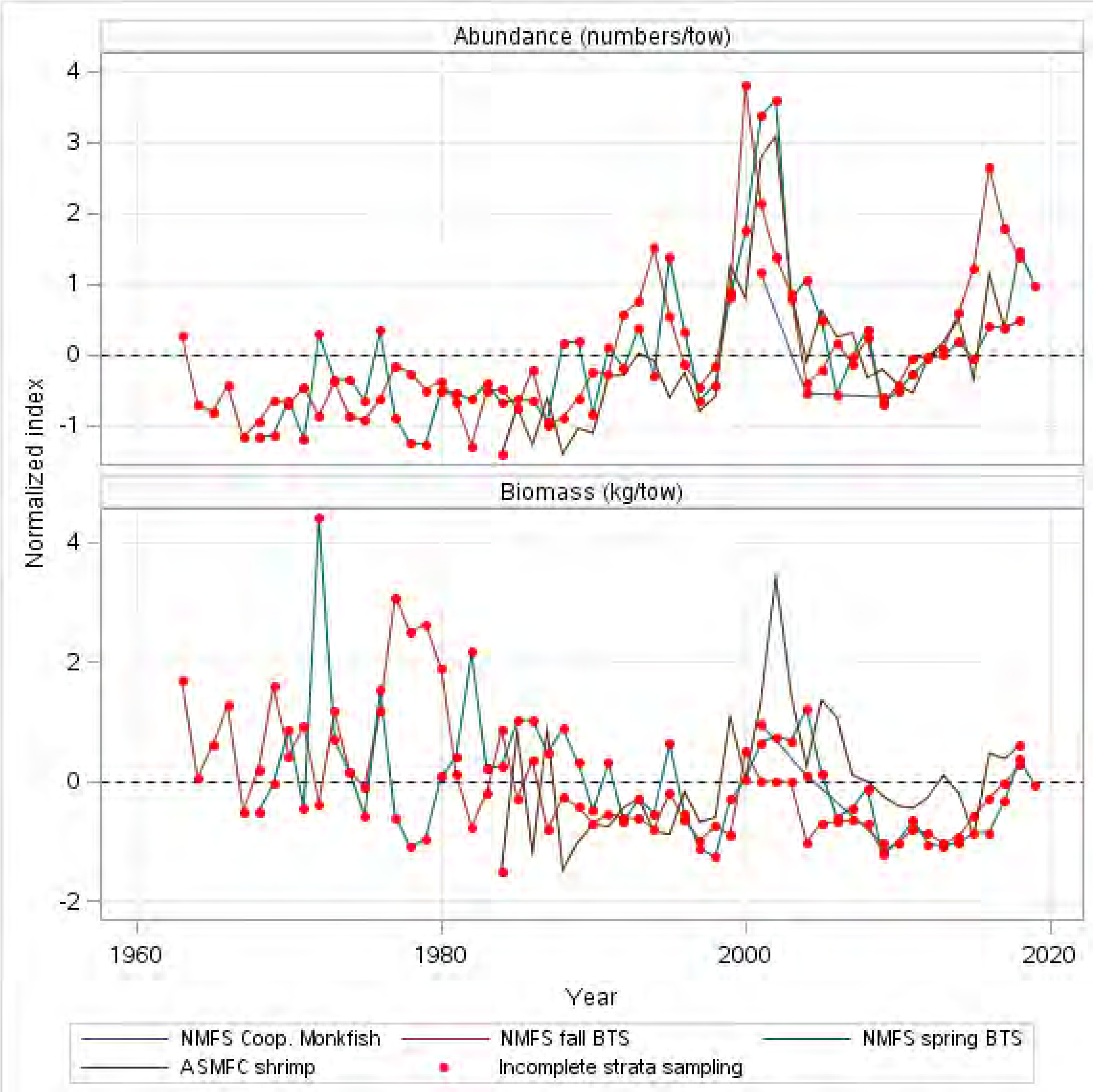
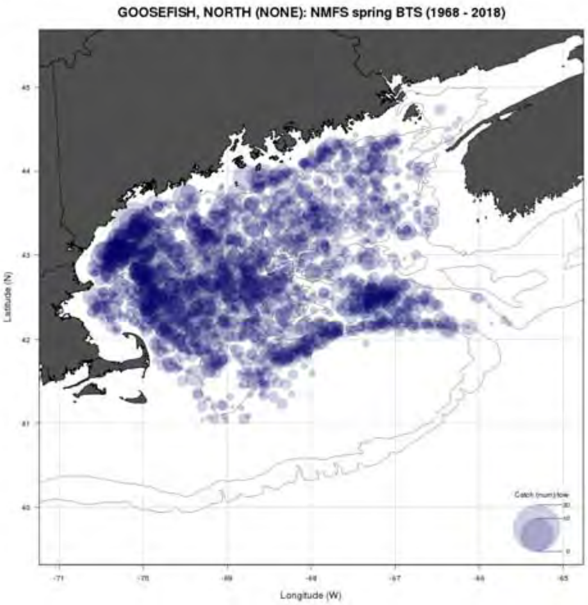
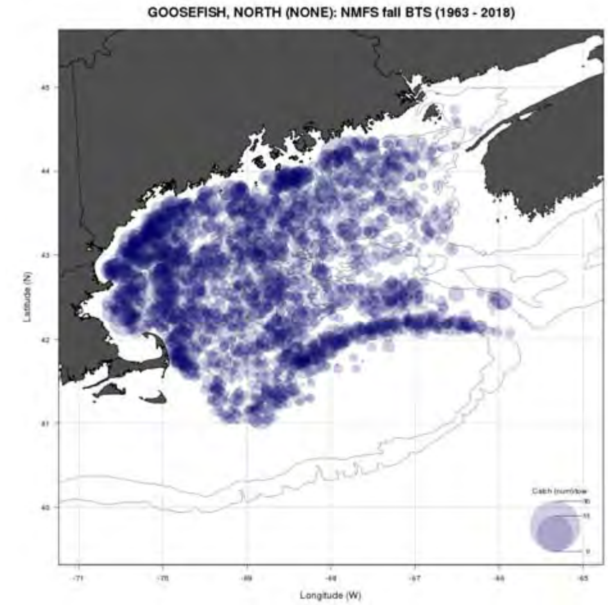


Figure D21. Normalized surveys for monkfish in the NMA.

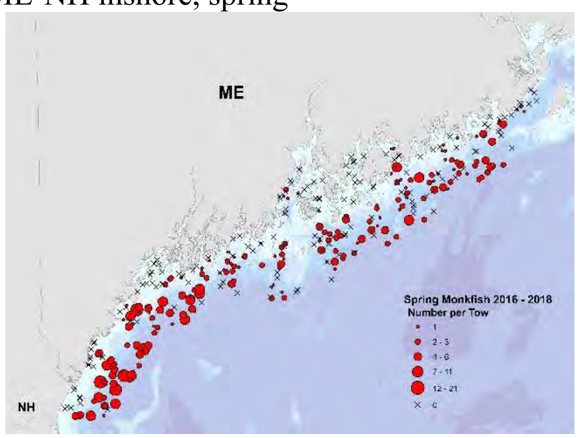
Spring



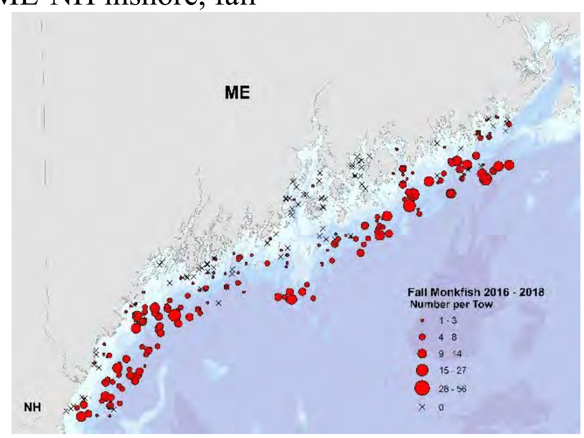
Fall



ME-NH inshore, spring



ME-NH inshore, fall



Summer shrimp

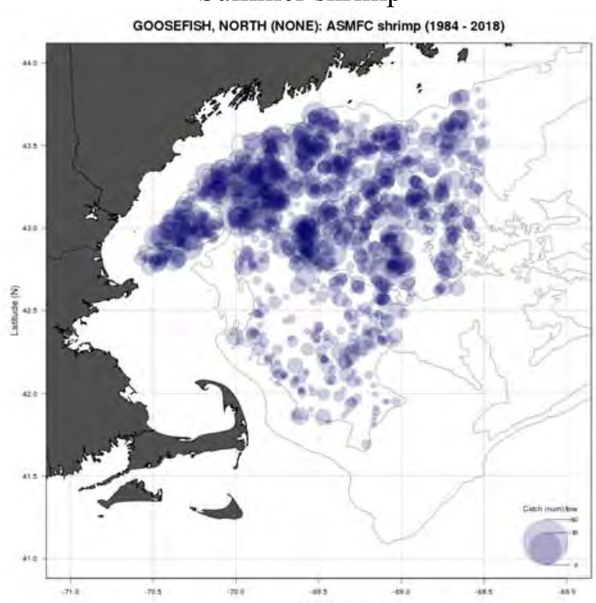


Figure D22. Distribution of monkfish in surveys in the northern management area.

South Biomass Abundance

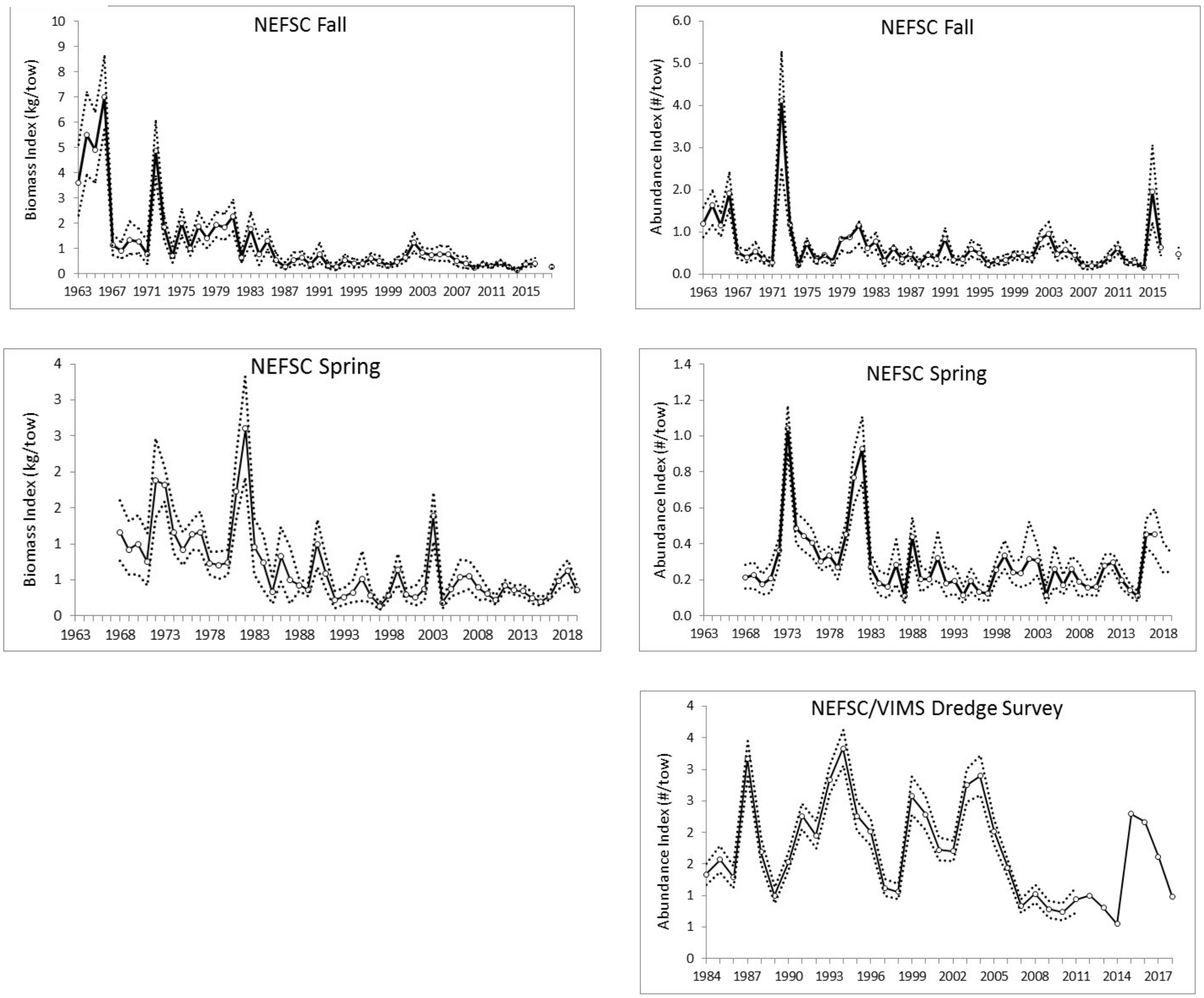


Figure D23. Survey indices for monkfish in the southern management area. Points after 2008 for NEFSC trawl surveys were conducted on the FSV Bigelow, converted to Albatross units as described in the text. Scallop dredge survey indices after 2011 were calculated from combined data from surveys conducted by NEFSC and Virginia Institute of Marine Science.

South

Biomass Abundance

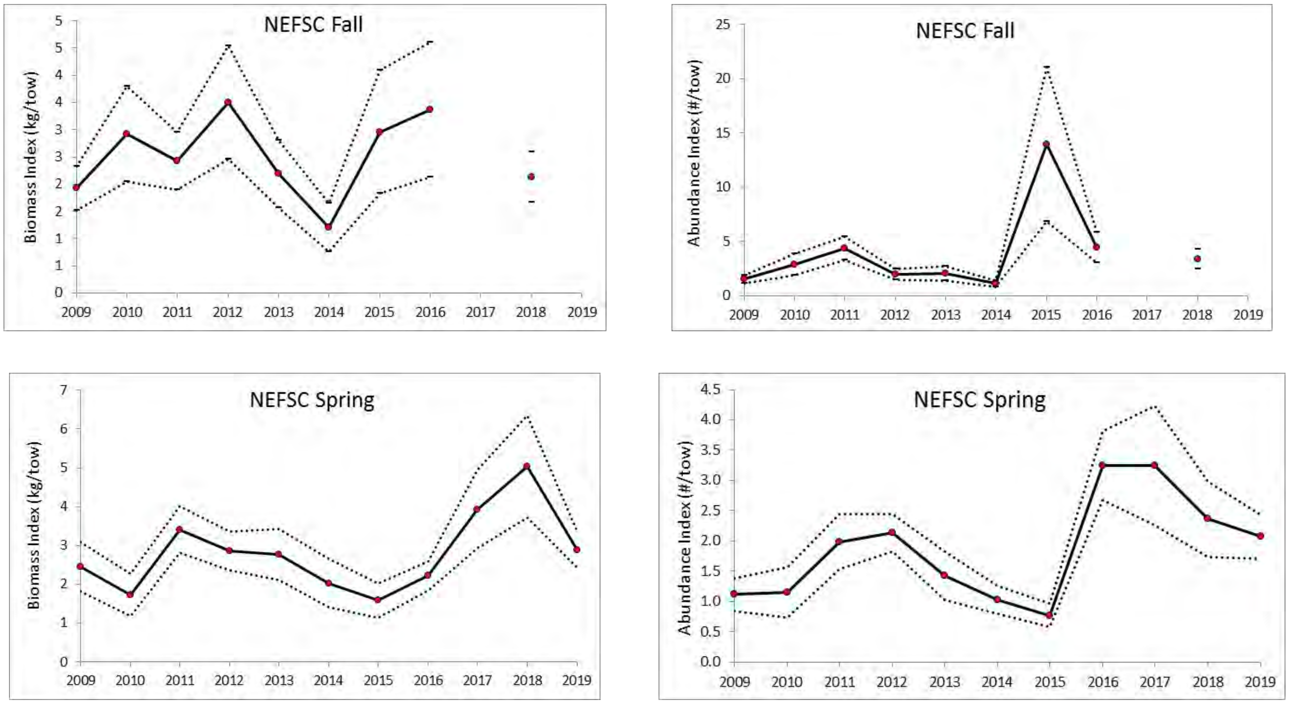


Figure D24. Survey indices from surveys conducted on the FRSV Bigelow in the southern management area, not converted to Albatross units.

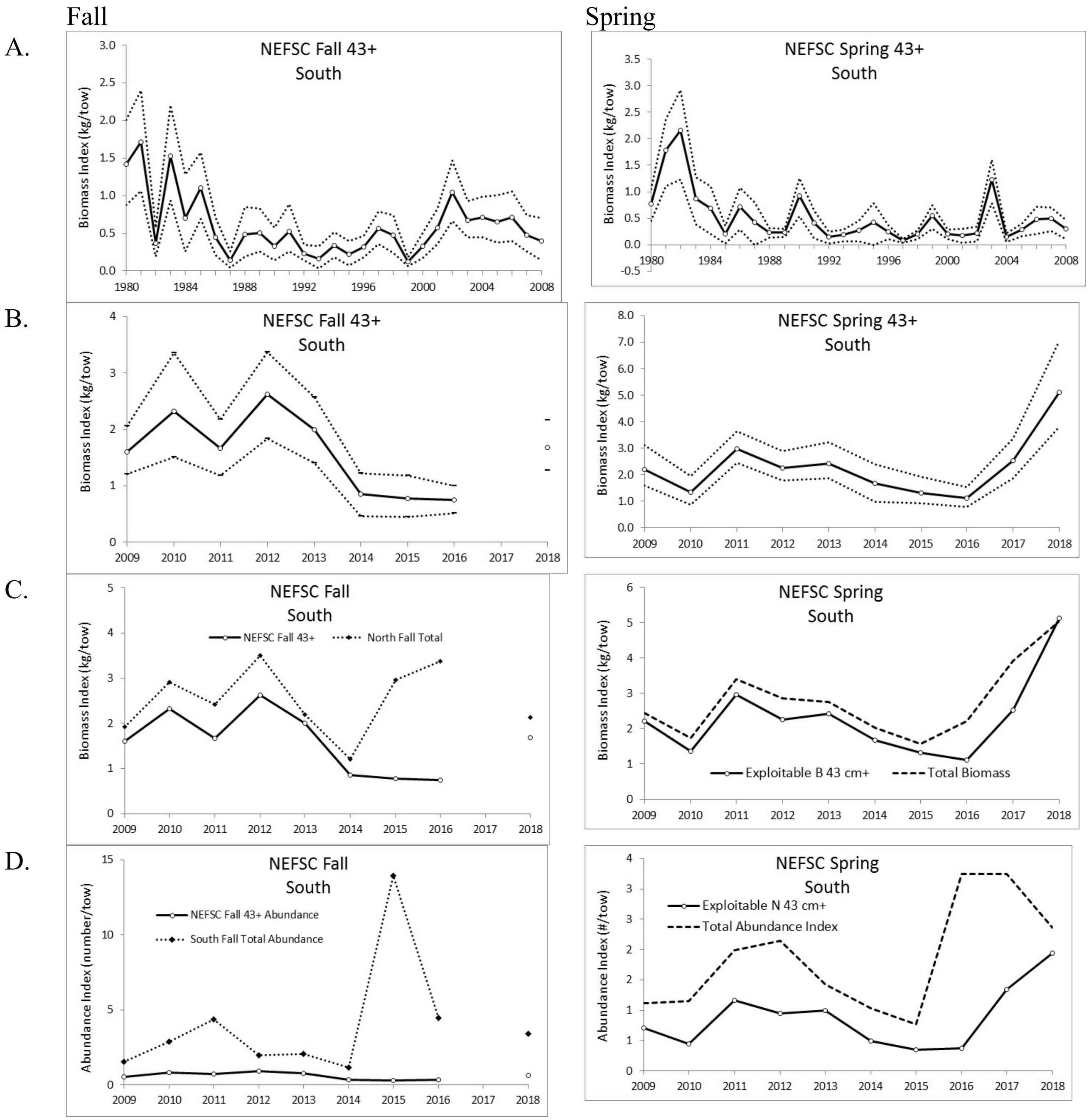


Figure D25. Exploitable biomass (> 43 cm total length) indices for monkfish from fall and spring surveys in the SMA. A. Exploitable biomass indices with 95% confidence intervals, 1980-2008 (surveys conducted on RV Albatross). B. Exploitable biomass indices with 95% confidence intervals, 2009-2018 (surveys conducted on RV H.B. Bigelow) C. Total biomass vs. exploitable biomass indices, 2009-2018, D. total abundance vs. exploitable abundance, 2009-2018.

South

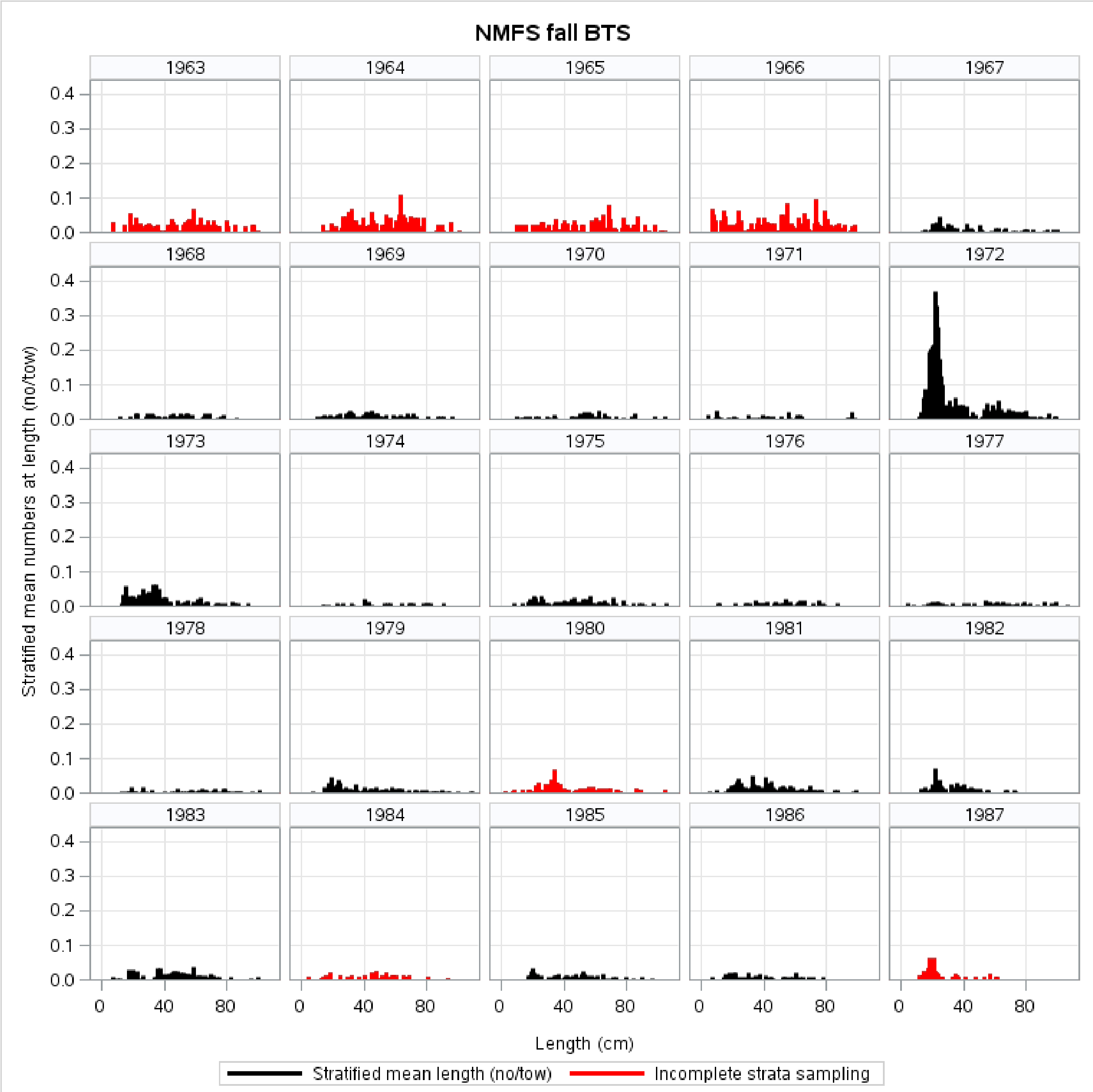


Figure D26. NEFSC fall survey indices of abundance at length, southern management area.

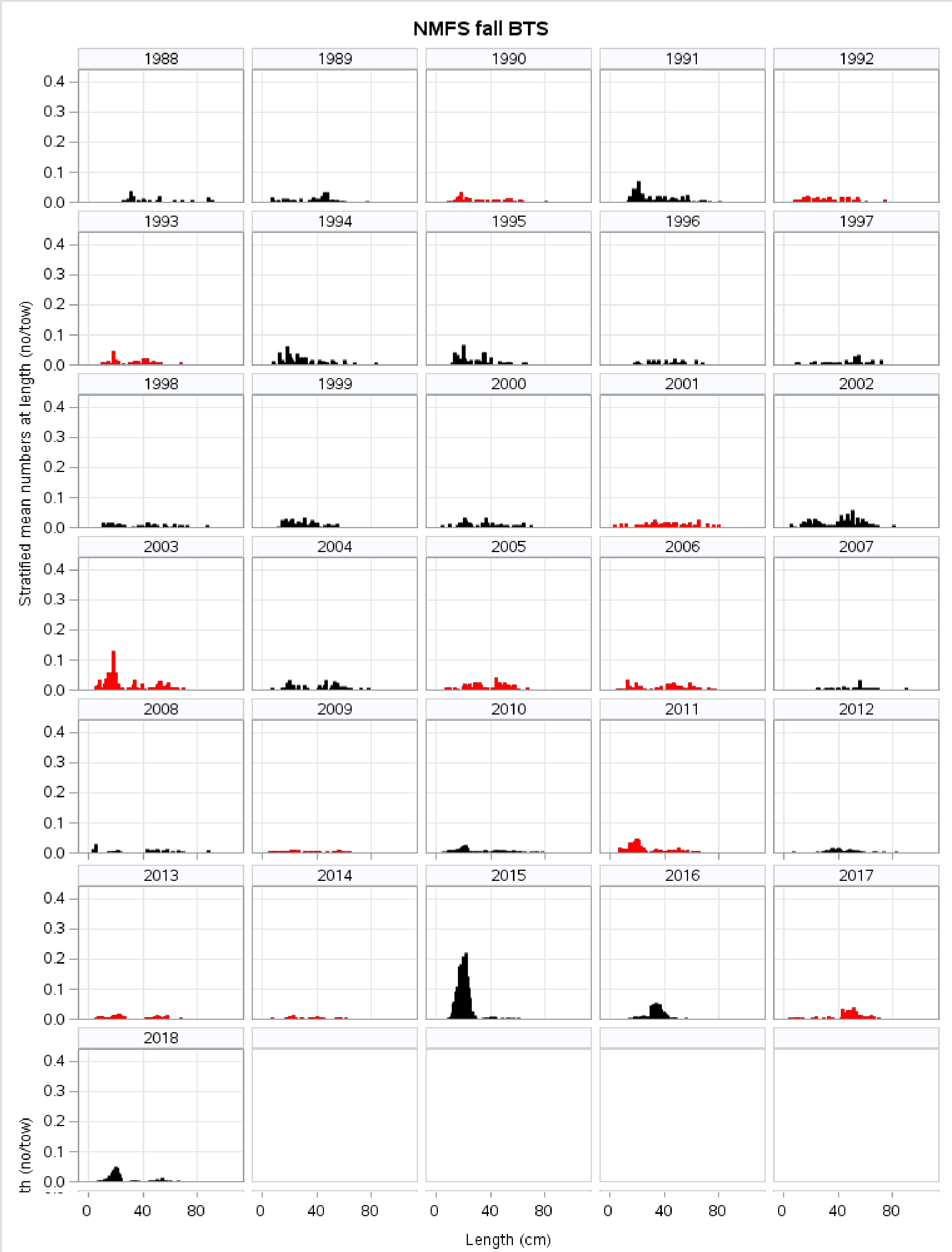


Figure D26, cont'd. (fall survey, south)

South

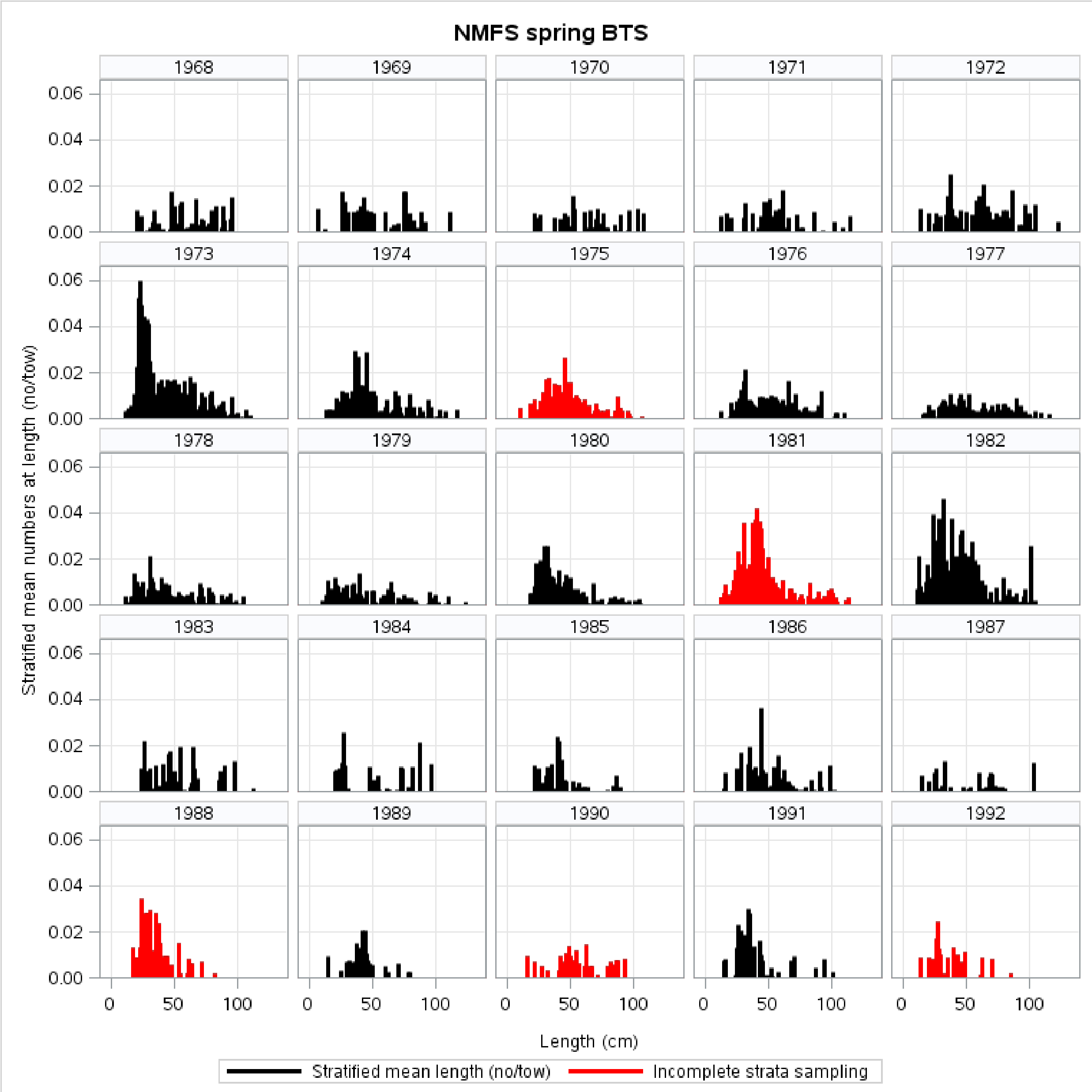


Figure D27. NEFSC spring survey indices of abundance at length, southern management area.

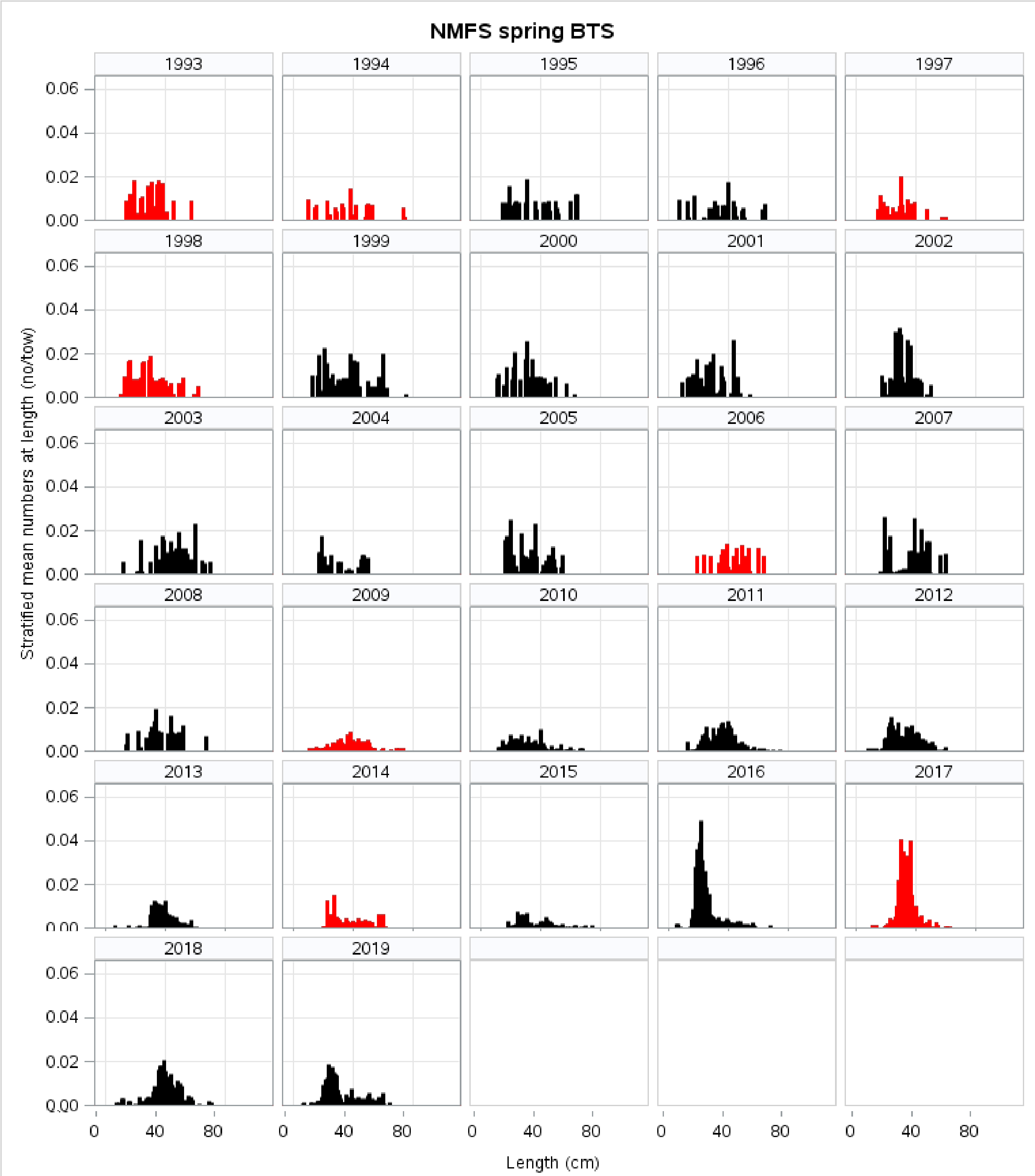


Figure D27, cont'd. (spring survey, south)

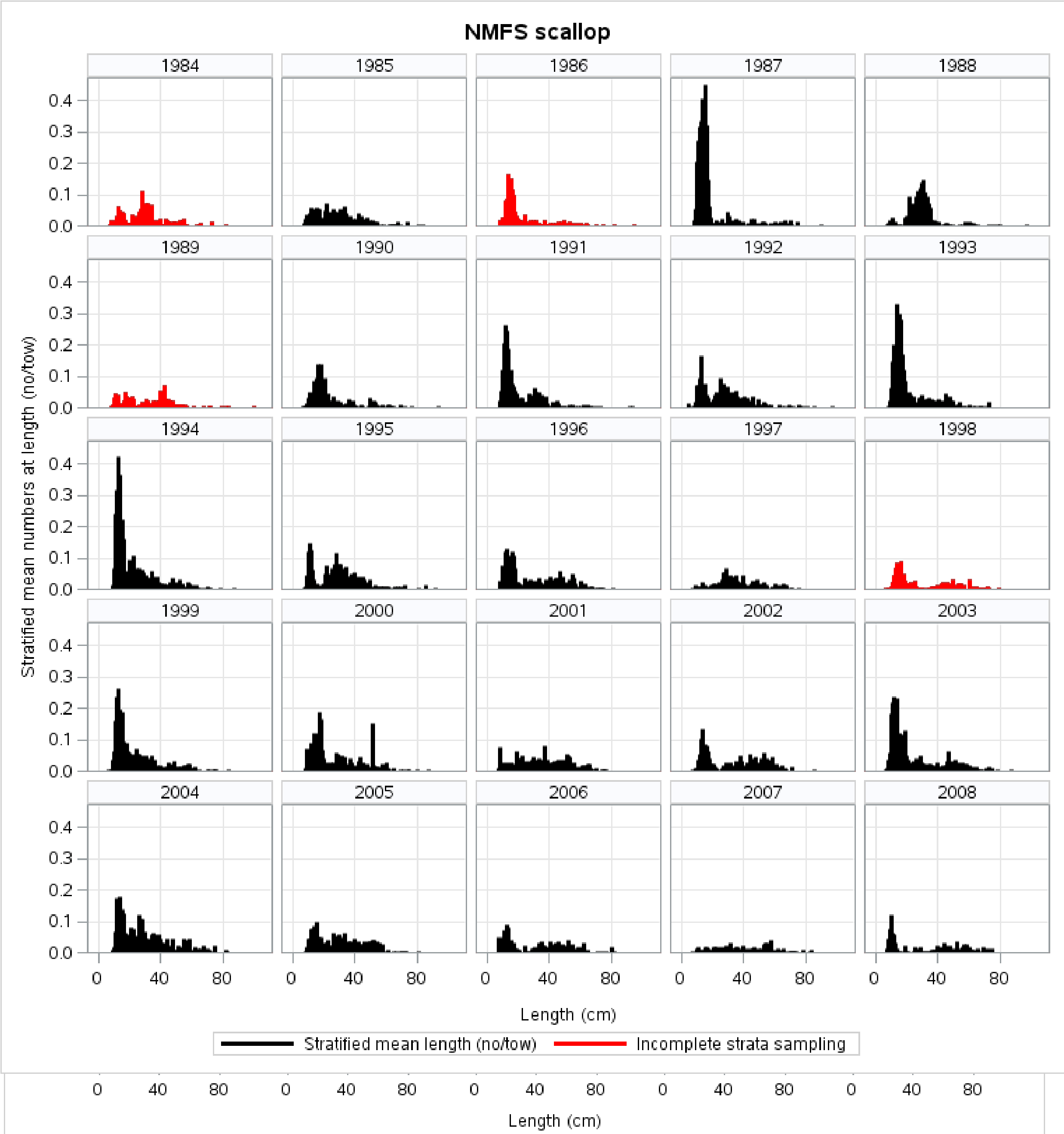


Figure D28. NEFSC spring/summer scallop dredge surveys. Survey timing shifted from summer to spring in 2009. These plots do not include sampling conducted by VIMS after 2011 (see Figure D23).

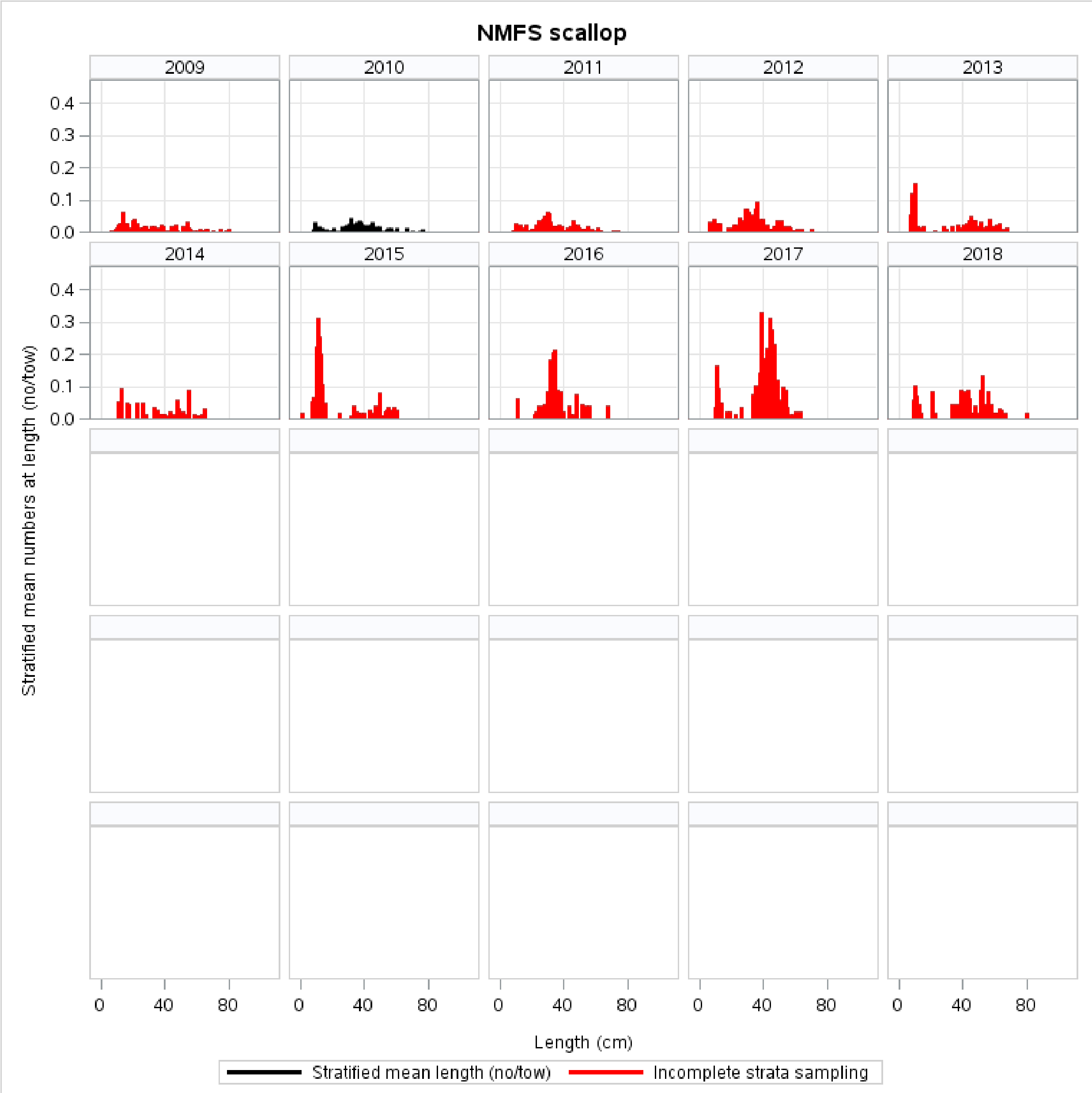
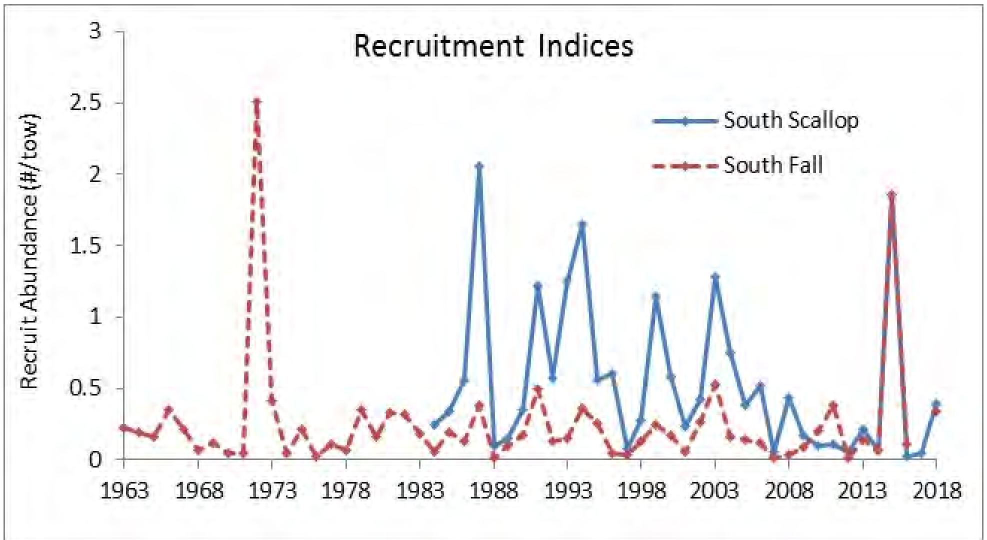


Figure D28, continued (NEFSC scallop dredge survey, south)

A.



B.

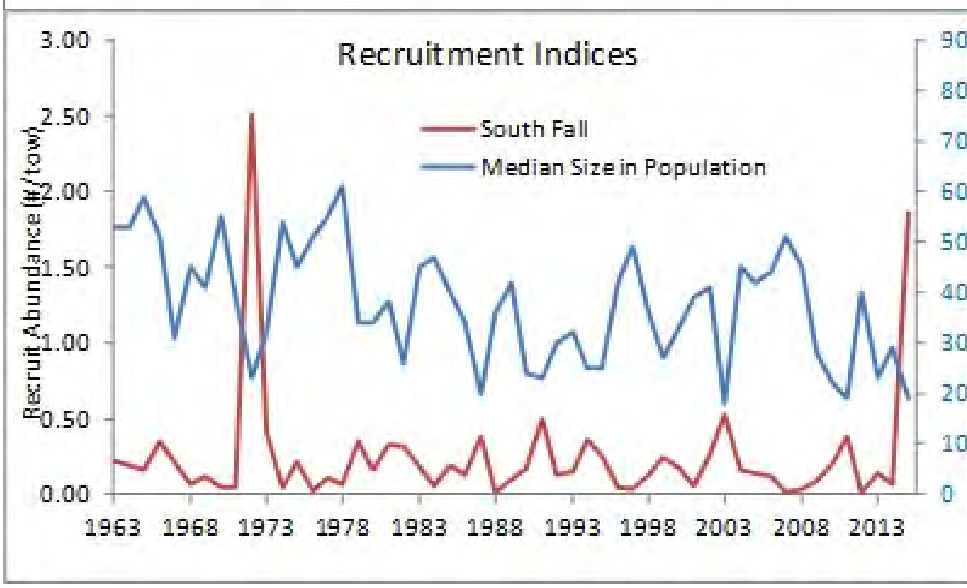


Figure D29. A. Recruitment indices for monkfish in the southern management area. Indices include monkfish in size ranges currently thought to represent young-of-year (age 0) in each season. There are no data for the fall survey in 2017 for the SMA. B. Recruitment indices vs. median size of monkfish in the population (based on NEFSC fall surveys).

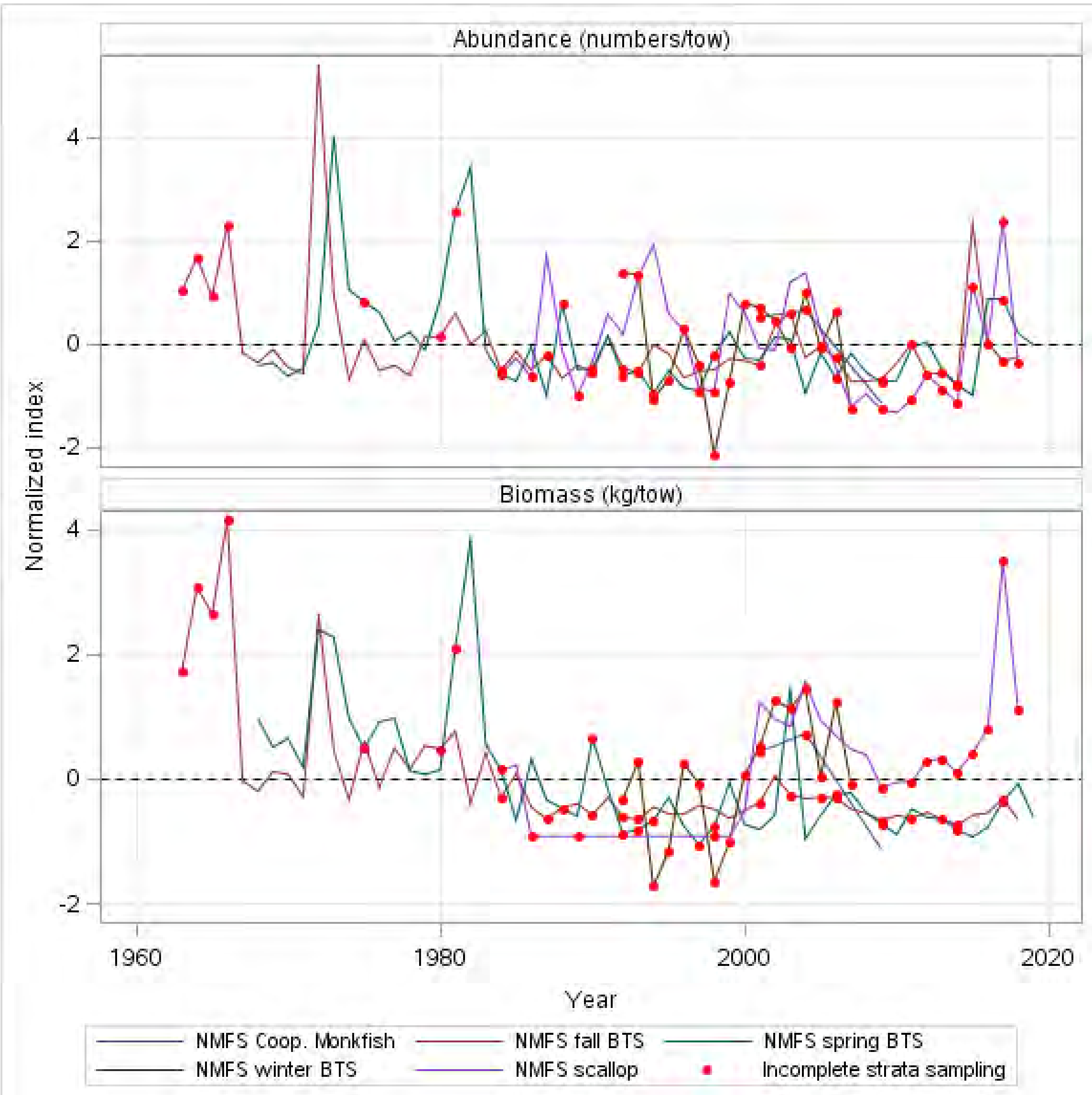
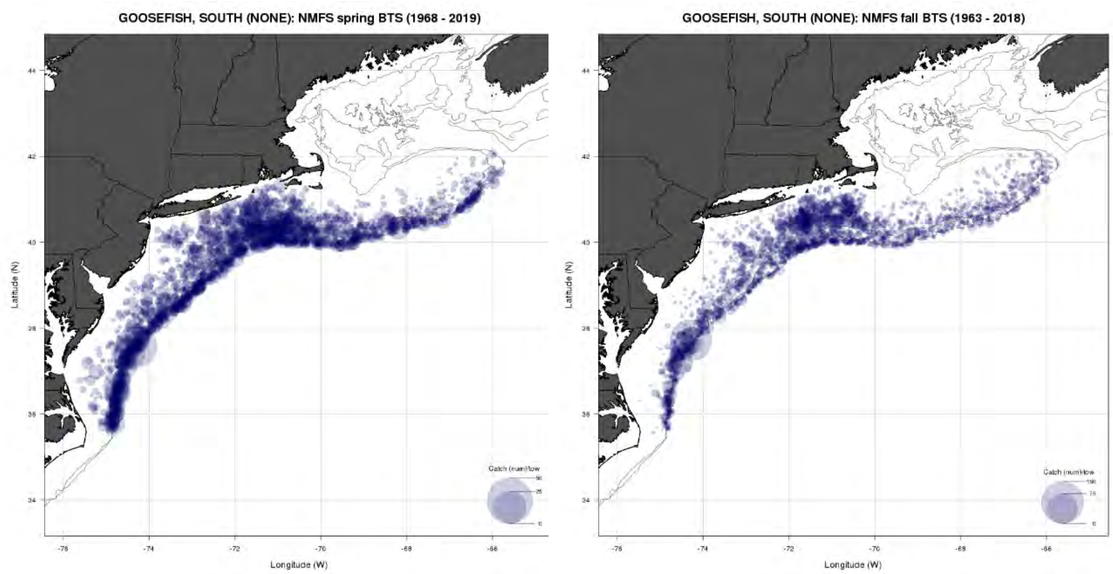


Figure D30. Normalized survey indices for monkfish in the southern management area. Scallop survey indices do not include VIMS portion of the survey starting in 2012.

Spring Fall

NEFSC bottom trawl surveys



Spring/Summer Scallop Survey

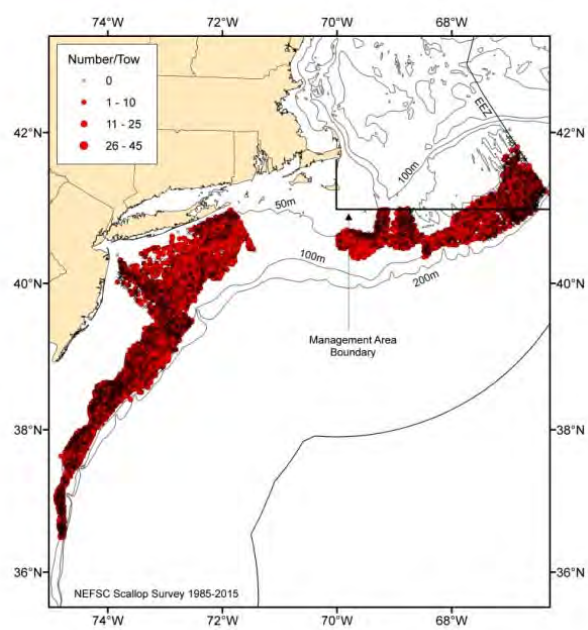
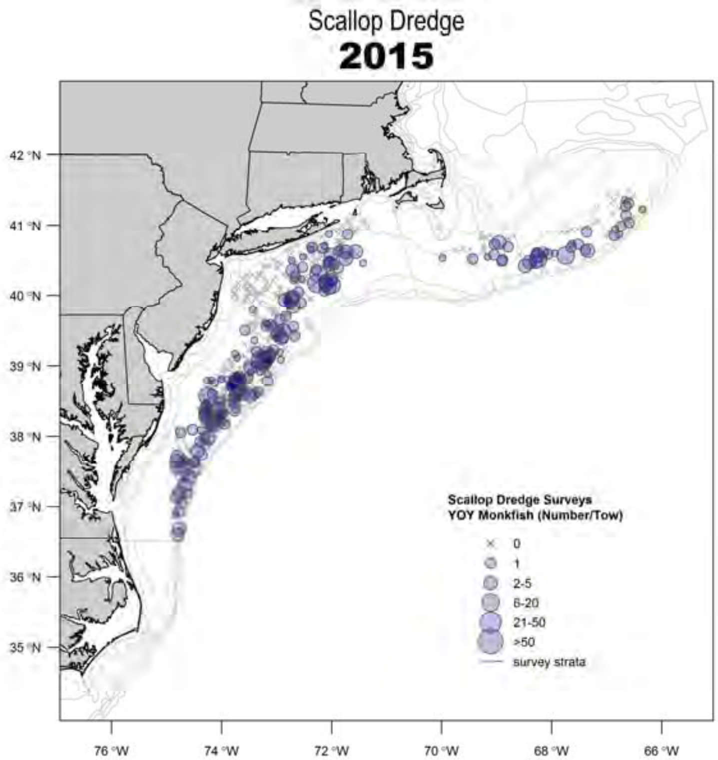


Figure D31. Distribution of monkfish in the southern management area from NEFSC spring (1968-2019) and fall (1963-2018) bottom trawl surveys and NEFSC and NEFSC/VIMS spring/summer scallop dredge surveys (1984-2015).

A.



B.

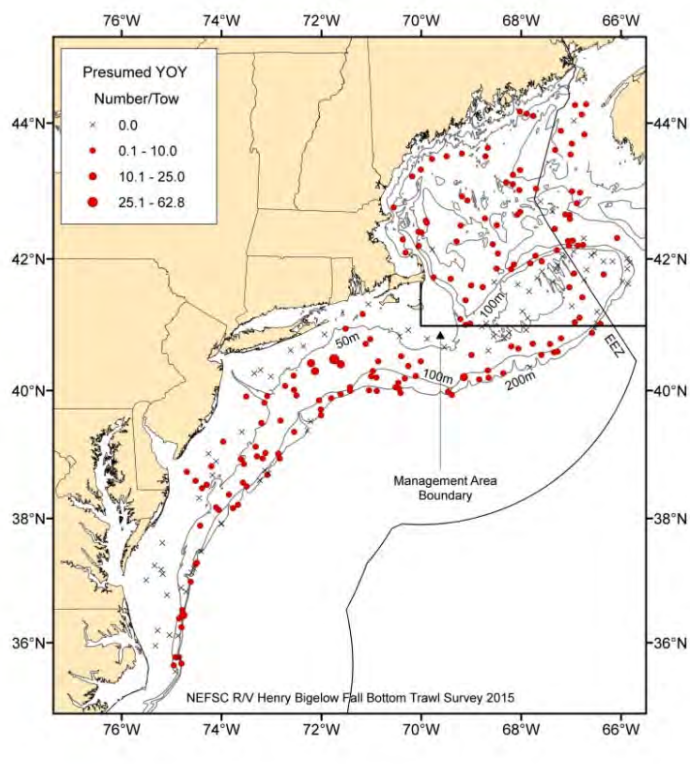


Figure D32. Distribution of presumed young-of-year monkfish in 2015 in (A.) NEFSC and VIMS scallop dredge survey tows (late spring), and (B.) NEFSC fall surveys.

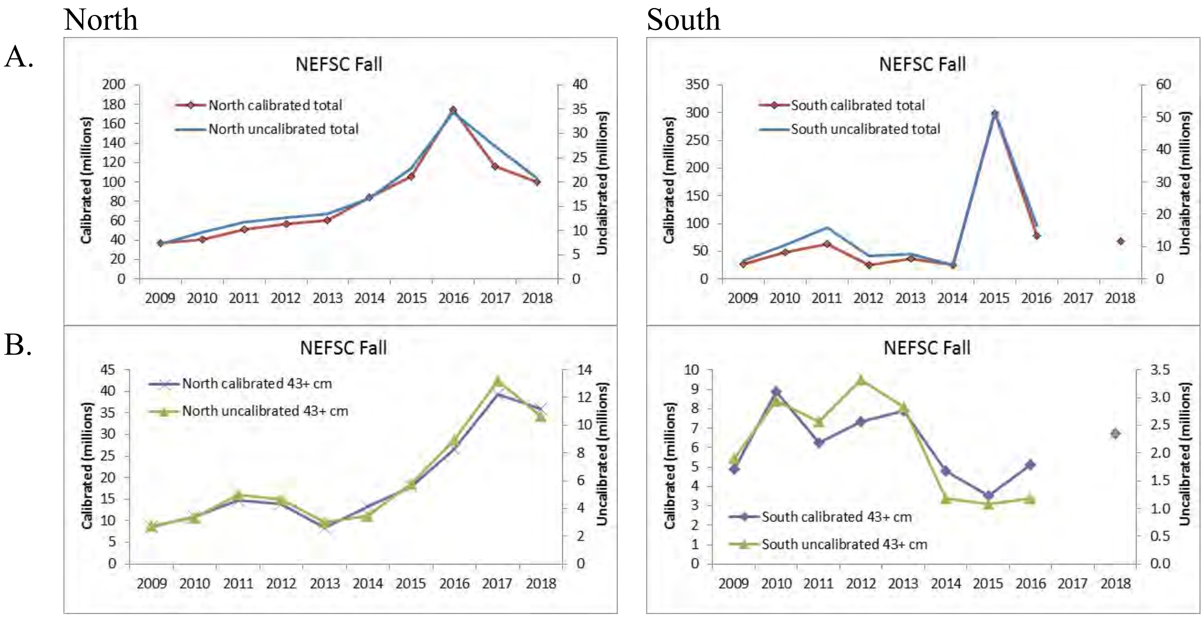


Figure D33. Area-swept abundance estimated from NEFSC fall surveys using adjustments from chain-sweep study compared to unadjusted estimates. A. total abundance, B. exploitable abundance (43+ cm).

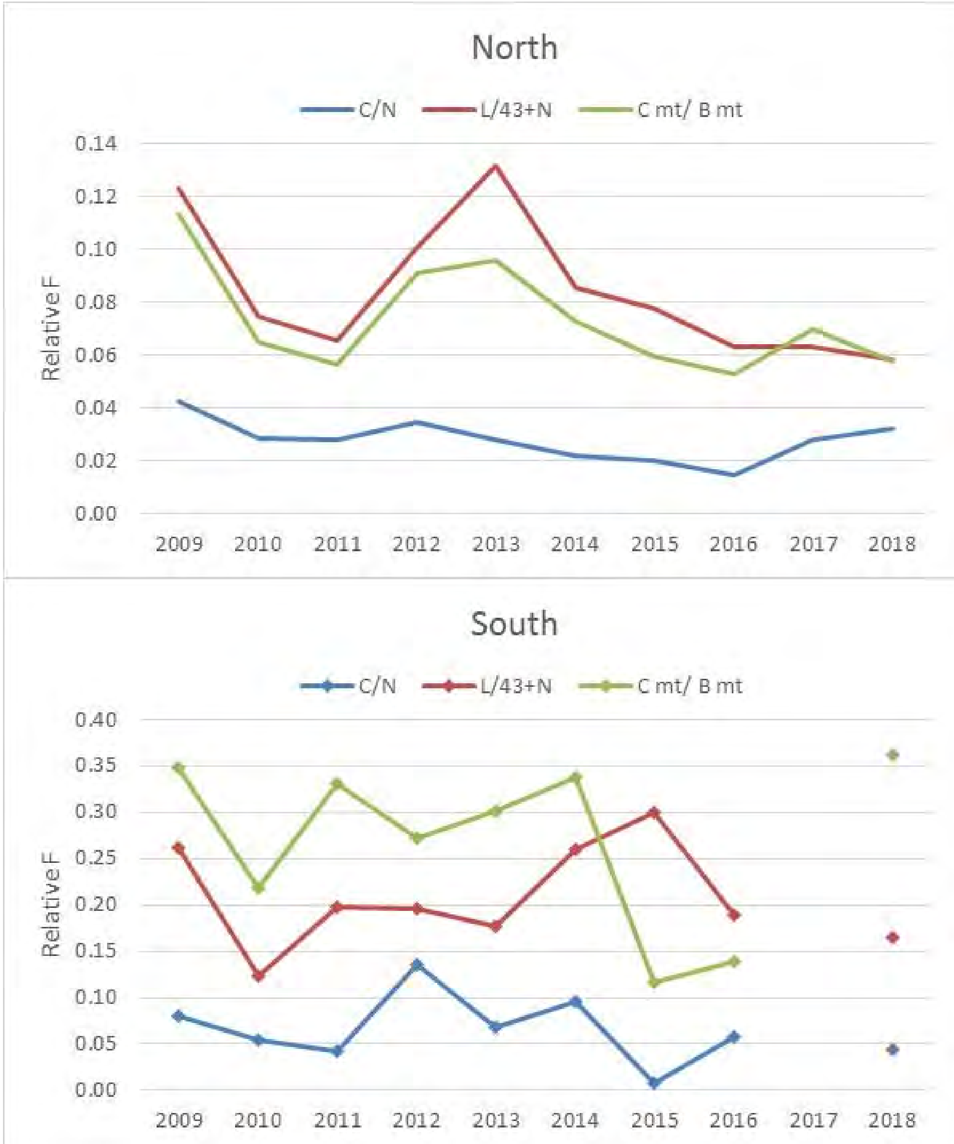
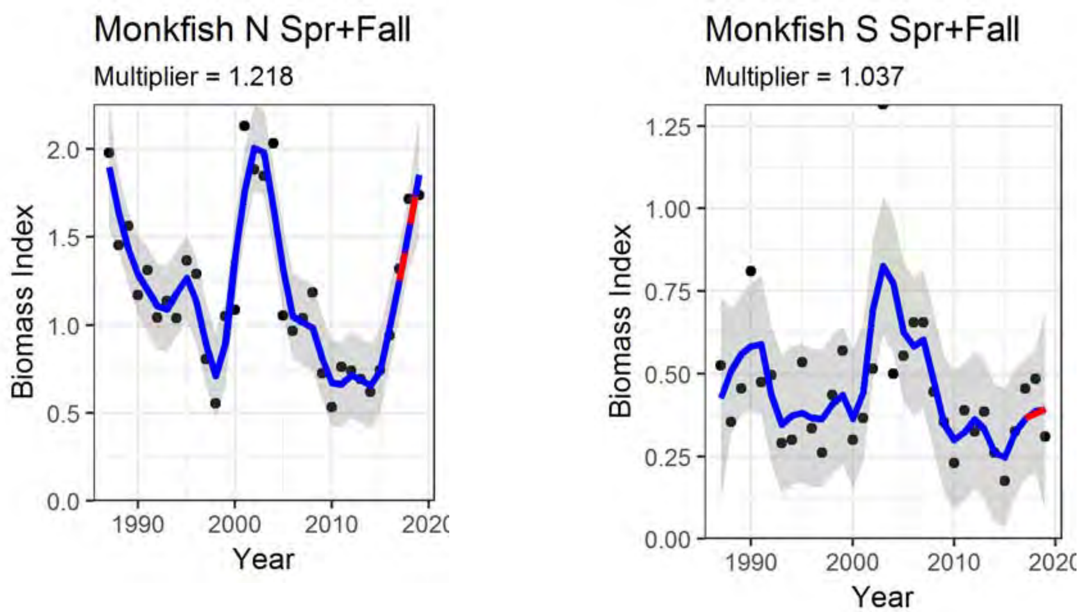


Figure D34. Estimates of relative exploitation from NEFSC fall surveys using minimum area-swept numbers or biomass adjusted for sweep type (adjusted to chain sweep), assuming that 100% of monkfish encountered by the trawl are captured and accounting for missed strata in some years.

A.



B.

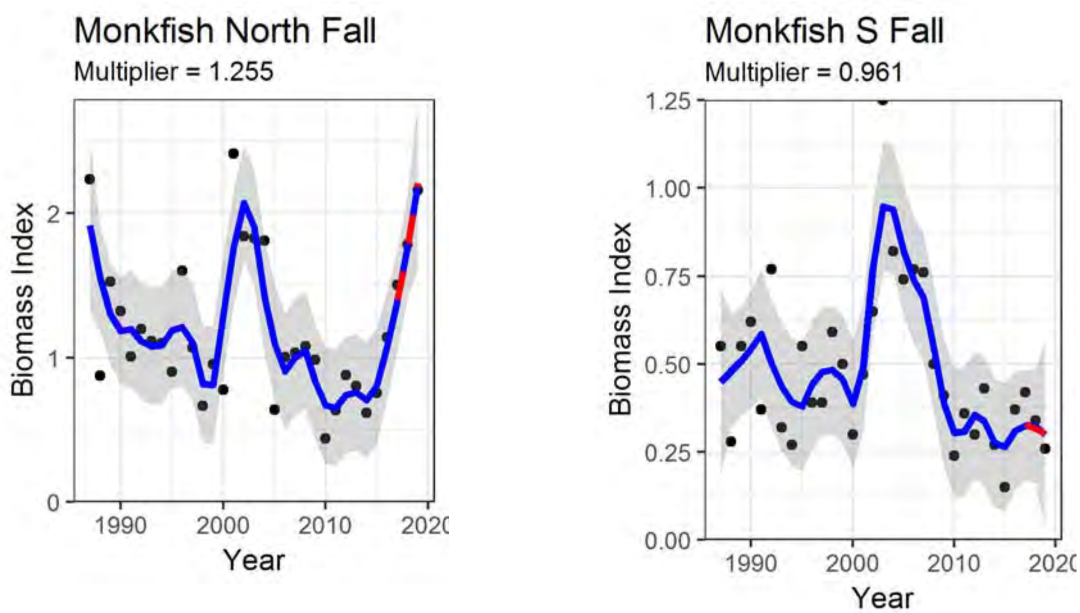


Figure D35. Results of "Plan B" analysis. Points are observed biomass indices, lines are loess-smoothed indices, "multiplier" is slope of log-linear regression through terminal three smoothed points. A. Results using both spring and fall indices, B. Results using fall survey indices only.

Appendix 1. Summary of Assessment Oversight Panel Meeting (May 20, 2019)

May 20, 2019
Woods Hole, Massachusetts

The NRCC Assessment Oversight Panel (AOP) met to review the operational stock assessment plans for four stocks/species (scup, black sea bass, bluefish, monkfish). The stock assessments for these stocks/species will be peer reviewed during a meeting from August 5-7, 2019.

The AOP consisted of:

Mike Celestino, Atlantic States Marine Fisheries Commission, NJ Division of Fish and Wildlife

Jason McNamee, Chair NEFMC Scientific and Statistical Committee, RI Department of Environmental Management

Paul Rago, member of the MAMFC Scientific and Statistical Committee, NOAA Fisheries (retired)

Russell W. Brown, Population Dynamics Branch Chief, Northeast Fisheries Science Center, Woods Hole

Meeting Participants:
The participants in Woods Hole included: Mark Terceiro (NEFSC), Gary Shepherd (NEFSC), Tony Wood (NEFSC), Anne Richards (NEFSC), Michele Traver (NEFSC), Michael Simpkins (NEFSC), Steve Cadrin (SMAST), Fiona Hogan (NEFMC - staff), Larry Alade (NEFSC), Kathy Sosebee (NEFSC), Kiersten Curti (NEFSC), Brian Linton (NEFSC), Dan Hennen (NEFSC).

Remote participants via webinar included: Adam Nowalsky (MAFMC), Allison Murphy (GARFO), Cate O'Keefe (MADMF), Charles Perreti (NEFSC), Chris Batsavage (MAFMC), Chris Spires, Cynthia Ferrio (GARFO), Harvey Yekinson, James Dopin, Jason Boucher (DEDFW), Jennifer Courte, Kiley Dancy (MAFMC – staff), Jessica Blaylock (NEFSC), John Maniscalco (NYDEC), Julia Beaty (MAFMC – staff), Matt Seeley (MAFMC – staff), Mike Plaia (MAFMC – advisor), Nichola Merserve (MD-DMF), Rich Wong (DE-DFW), Steve Heins, Steven Doctor, Tony DeLernia (MAFMC), Victor Hartman (MAFMC – advisor), Vince Cannuli (MAFMC – advisor), Greg DiDomenico (MAFMC – Advisor).

Meeting Details:
This meeting represented the initial implementation of the newly approved Management Track stock assessment process outlined in the NRCC stock assessment guidance memo. Four background documents were provided to the Panel: (1) an updated prospectus for each stock; (2) an overview summary of all salient data and model information for each stock; (3) the NRCC Guidance memo on the Management Track Assessments; and (4) Operational Stock Assessment TORs for August 2019 review. The NRCC guidance memo was recognized as

particularly relevant during the deliberations of the AOP. Prior to the meeting, each assessment lead prepared a plan for their assessments. The reports were consistent across species and reflected both the past assessment and initial investigations. Before the meeting, the AOP panel met to preview the meeting and clearly outline the expectations of the panel.

The meeting began at 1:12 pm. Approximately 17 people participated in Woods Hole and another 25 individuals participated via teleconference and Webinar. There were some technical glitches with the audio portion of webinar/teleconference that required attention during the meeting.

The lead scientist for each stock gave a presentation on the data to be used, model specifications, evaluation of model performance, the process for updating the biological reference points, the basis for catch projections, and an alternate assessment approach if their analytic assessment was rejected by the peer review panel. In one case (monkfish) the stock was already being assessed using an "index-based" or "empirical" approach.

Common Issues Across the Species Reviewed:
For scup, black sea bass and bluefish a significant issue of concern is the introduction of the new recalibrated MRIP recreational catch estimates. For bluefish there seemed to be a simple rescaling across all years. The MRIP estimates have a temporal trend in rescaling which may pose problems for model performance for black sea bass. The most likely change is that the selectivity stanzas may need to be adjusted.

The proposed alternate assessment (Plan B) approach for scup, black sea bass and bluefish was a Loess smooth of survey index to adjust catch upwards or downwards based on recent trends. This should perform well for scup and bluefish, but for black sea bass an alternative to the proposed Plan B may be to use an area combined model (as opposed to the current two area assessment).

A question was raised about the designated length of the projections. It was decided that the AOP would inquire about the preference of the MAFMC (scup, black sea bass, bluefish) and recommend projection lengths most useful to the management process. As a result, the AOP is recommending 2 year projections for scup, black sea bass, and bluefish. Projections cannot be generated for monkfish given the current assessment approach.

Scup:
In the most recent stock assessment, spawning stock biomass was estimated to be approximately twice the SSB_{MSY} threshold and F is approximately 60% of the F_{MSY} threshold. The selectivity pattern for this stock has remained relatively stable over time. The discard to landings ratios have changed through time primarily due to dominate year classes passing through the population. The historically large 2015 year class is now fully recruited to the fishery so discards from this year class should decline.

During preliminary runs, the retrospective pattern from the previous assessment appears to degrade slightly with the inclusion of revised recreational catch data. The assessment will continue to use a continuous calibrated time series for the NEFSC multispecies bottom trawl survey (not splitting the Albatross and Bigelow time series). The AOP discussed the possibility of recommending a Level 2 peer review, but ultimately recommended a Level 3 review due to the revised recreational catch estimates.

Black Sea Bass:
Two separate ASAP models (north and south of Hudson Canyon) will be developed with the result combined for final stock status determination as was done in the most recent assessment. In the previous assessment, spawning stock biomass in 2015 was ~2.3 times SSB_{MSY} and F was approximately 75% of F_{MSY}.

In the southern area, the new MRIP catch estimates generally scale up across the time series. However in the northern area, there is a change in both scale and trend starting around 2010, and the 2011 year class seems to drive the catch in the north. There was some discussion about changing the M estimate for black sea bass if the model experiences diagnostic problems. Since the M parameter rescales the population and may change other key parameters, notably catchability, this should be done as a last resort. Given the temporal trend in the ratio of new to old MRIP estimates there may be some value in reconsidering introduction of one or more selectivity stanzas between 1989 and 2018.

Concern was expressed about the larger retrospective pattern in the northern area which may make this model unacceptable in this update. Potential solutions include increasing the CV on the non-trawl (recreational) catch input, reducing M in the northern area from 0.4 to 0.2 which conforms to the approximate minimum AIC in the northern ASAP likelihood profile (least preferred option), or eliminating the two-region approach and producing a single overall model. The combined model appears to perform about as well as the split model (northern and southern stock) and may be a viable alternative to the proposed Plan B if the split model has diagnostic problems.

During public comment, concern was expressed about considering the assessment history and noting that the single area ASAP model was not supported by the 2015 peer review. A major concern is that the stock appears to have a very strong 2015 year class. Concern was expressed that a simple index smoother is likely to miss the signals of incoming year class strength and may create similar catch and management problems that arose when the 2011 year class was not factored into catch projections.

The AOP recommended a Level 3 peer review based on the significant revisions to the recreational catch estimates and the potential for significant modifications to the existing ASAP models.

Bluefish:

The recreational fishery accounts for approximately 80% of the catch so revised recreational catch estimates will have a significant impact on the assessment. The assessment is likely to be a simple rescaling of the population since there does not appear to be any temporal trend in the ratio of new to old recreational catch estimates. Discards have a minor trend so problems could arise but these can probably be handled by changing selectivity. Another generic approach that was addressed for all species was to reduce the effective sample size for catch at age estimates (or equivalently, increasing the CV). This approach allows some deviation between the observed and predicted catch at age.

There is an issue with missing recreational discard length data for Rhode Island recreational discards for 2018. The AOP agreed that the assessment lead should do whatever is required to recover the data but if not possible some sort of imputation may be necessary. That decision should fall to the assessment lead.

It was noted in the last assessment that an $F_{40\%}$ reference point was set by the working group, and subsequently the peer review panel accepted those values. The MAFMC SSC then changed the reference point to $F_{35\%}$. The assessment lead plans to re-estimate the $F_{35\%}$ and the associated spawning stock biomass reference point.

The AOP recommended a Level 3 assessment review, given revised recreational catch estimates that may necessitate model changes (e.g. changes in CVs or implementation of selectively blocks to accommodate increased catch) may be necessary to achieve satisfactory performance. Additionally, the treatment of the missing length information may require additional review, so a level 3 Management Track would allow for these contingencies.

Monkfish:
Monkfish were previously assessed using a SCALE model (forward projecting age-structured model), but this approach was abandoned in 2016 when ageing methods were invalidated.
The absence of a validated growth curve precludes any length or age based approaches. To date, various research efforts to address this have not been definitive. It appears that monkfish grow faster than predicted which may help explain its relatively stable productivity. The monkfish assessment was proposed as a "Plan B" assessment approach based on the last operational stock assessment review. The assessment lead plans to employ this approach for the 2019 assessment update.

The AOP recommended an expedited (Management Track Level 2) assessment to address potential ways of dealing with the missing 2017 survey information in the southern stock. This was recommended because of transparency concerns and the fact that the NEFMC sets 3 year specifications. In the last assessment the trend adjustment from the status quo were -2% in the north and -14% (or -11%) in the south. The PDT recommended no change in either area but that determination was based on expert judgment rather than a specific statistical threshold. It may be useful to get some input from the peer review panel on different techniques that can be used for the survey information, and there may be some discussion about tweaking the sensitivity of the loess smooth to allow for more sensitivity to trend in the most recent years. The AOP recommends including existing research recommendations in the final report.

Major Recommendations:
In general, the AOP approved the plans presented, but highlighted a number of clarifications that are summarized below:

Stock	Lead	Major Recommendations
Overview of the Process	Russell Brown	The NRCC approved, generic Terms of Reference for operational stock assessment be used.
Scup	Mark Terceiro	Management Track Level 3 – Enhanced ReviewIncorporate new MRIP recreational catch estimates. Alternative assessment approach: Loess smooth of relevant survey indices 2 Year projections should be generated
Black Sea Bass	Gary Shepherd	Management Track Level 3 – Enhanced Review Incorporate new MRIP recreational catch estimates Alternate assessment approach: Consider a combined area model if the split area models are problematic or Loess smooth of relevant survey indices 2-Year projections should be generated
Bluefish	Tony Wood	Management Track Level 3 – Enhanced Review Incorporate new MRIP recreational catch estimates Attempt to recover missing length data for Rhode Island recreational discarded fish for 2018 Alternative assessment approach: Loess smooth of relevant survey indices 2-Year projections should be generated
Monkfish	Anne Richards	Management Track Level 2 – Expedited Review Address potential ways of dealing with the missing 2017 survey information in the southern stock Alternative approach is to recommend status quo catch.

In summary, the meeting was productive and a good implementation of the new assessment planning document. The meeting concluded at 4:30 pm. The peer review panel will meet from August 5-7, 2019 to complete their review.

Appendix 2. Operational Assessment, Aug. 5-7, 2019, Attendee List

Tom Miller (MAFMC SSC – Review Chair)
Kate Seigfried (SEFSC – Reviewer)
Mike Wilberg (MAFMC SSC – Reviewer)
J .J. Mcquire (NEFMC – Reviewer)
Anne Richards (NEFSC – Monkfish Assess Lead)
Gary Shepherd (NEFSC – Black Sea Bass Assess Lead)
Mark Terceiro (NEFSC – Scup Assessment Lead)
Tony Wood (NEFSC – Bluefish Assessment Lead)
Jon Deroba (NEFSC)
Susan Wigley (NEFSC)
Kiersten Curti (NEFSC)
Katherine Sosebee (NEFSC)
Tim Miller (NEFSC)
Chris Legault (NEFSC)
Steve Cadrin (SMAST)
Cate O'Keefe (MADMF)
Russ Brown (NEFSC, PDB Chair)
Toni Chute (NEFSC)
Michele Traver (NEFSC)
Mike Celestino (NJDFW)
Richard Merrick (NEFMC SSC)
Alan Bianchi (NCDMF)
Eric Schneider (RIDMF)
Greg DeCelles (MADMF)
Jennifer Couture (GARFO)
Jessica Blaylock (NEFSC)
Pater Lu (Harvard)
Libby Etrie (NEFMC)
Patricia Clay (NEFSC)
Charles Perreti (NEFSC)
Mike Fogarty (NEFSC)
Ariele Baker (NEFSC)
Julia Beaty (MAFMC – staff)
Fiona Hogan (NEFMC – staff)
Brandon Muffley (MAFMC – staff)
Caitlin Starks (ASMFC – staff)
Tara Trinko (NEFSC)
Mark Wuenschel (NEFSC)
Kiley Dancy (MAFMC – staff)
Jeff Brust (NJDEP)
Sam Truesdell (MADMF)
Shanna Madsen (ASMFC)
John Maniscalco (NYDEC)
Doug Zemeckis (Rutgers University)
Emily Slesinger (Rutgers University)
Allison Murphy
Cynthia Ferrio
Alicia Long (NEFSC)
Paul Nitschke (NEFSC)
Charles Adams (NEFSC)
Thomas Heimann (CFRF)
Karson Coutre (MAFMC – Staff)
Matt Seeley (MAFMC – Staff)
Scott Steinback (NEFSC)
Richard McBride (NEFSC)
James Weinberg (NEFSC, SAW Chair)

Appendix 3. Operational Assessment, Aug. 5-7, 2019, Meeting Agenda

Operational Assessment Peer Review Meeting
Monkfish, Black Sea Bass, Scup, Bluefish
Clark Conference Room, NEFSC, Woods Hole, MA
August 5-7, 2019

Monday, August 5, 2019

Time	Activity	Lead
1:00 p.m.	Welcome and Introductions	Russ Brown/Jim Weinberg
1:10 p.m.	Overview and Process	Russ Brown
1:30 p.m.	Monkfish	Anne Richards
3:00 p.m.	Break	
3:10 p.m.	Monkfish Discuss/Review/Summary	Review Panel
4:10 p.m.	Black Sea Bass	Gary Shepherd
5:40 p.m.	Public Comment	Public
5:55 p.m.	Adjourn	

Tuesday, August 6, 2019

Time	Activity	Lead
8:30 a.m.	Brief Overview and logistics	Russ Brown/Jim Weinberg
8:40 a.m.	Black Sea Bass cont.	Gary Shepherd
10:10 a.m.	Break	
10:25 a.m.	Black Sea Bass Discussion/Review/Summary	Review Panel
11:25 a.m.	Scup	Mark Terceiro
12:40 p.m.	Lunch	
1:40 p.m.	Scup Cont.	Mark Terceiro
2:55 p.m.	Break	
3:10 p.m.	Scup Discussion/Review/Summary	Review Panel
4:10 p.m.	Bluefish	Tony Wood
5:25 p.m.	Public Comment	Public
5:40 p.m.	Adjourn	

Wednesday, August 7, 2019

Time	Activity	Lead
8:30 a.m.	Brief Overview and logistics	Russ Brown/Jim Weinberg
8:40 a.m.	Bluefish cont.	Tony Wood
9:55 a.m.	Break	
10:10 a.m.	Bluefish Discussion/Review/Summary	Review Panel
11:10 a.m.	Public Comment	Public
11:25 a.m.	Lunch	
12:30 p.m.	Report Writing/Species Summaries	Review Panel
2:25 p.m.	Break	
2:40 p.m.	Report Writing/Species Summaries	Review Panel
4:30 p.m.	Adjourn	

Summer Flounder, Scup, and Black Sea Bass Advisory Panel Webinar

September 24, 2019

The Mid-Atlantic Fishery Management Council's (Council's) Summer Flounder, Scup, and Black Sea Bass Advisory Panel (AP) met jointly with the Atlantic States Marine Fisheries Commission's (Commission's) Summer Flounder, Scup, and Black Sea Bass AP via webinar on September 24, 2019. The objectives of this meeting were to:

- Review 2019 scup and black sea bass operational stock assessments and the 2019 summer flounder data update.
- Review Scientific and Statistical Committee (SSC) and Monitoring Committee recommendations for 2020-2021 specifications for black sea bass and scup and 2020 specifications for summer flounder.
- Review analysis of commercial scup discards.
- Discuss commercial minimum mesh size requirements for all three species.
- Provide input on 2020-2021 specifications for all three species.

Please note: Advisor comments described below are not necessarily consensus or majority statements. Additional advisor comments provided by email or phone regarding the issues discussed at this meeting are provided as an appendix to this document.

Council Advisory Panel members present: Katie Almeida (MA), Carl Benson (NJ), Jeff Deem (VA), James Fletcher (NC), Carl Forsberg (NY), Jeff Gutman (NJ), Greg Hueth (NJ), Howard King (MD), Arnold Leo (NY), Michael Pirri (CT), Michael Plaia* (CT), Bob Pride (VA), Chris Spies (NY), Robert Ruhle (NC), Robin Scott (NJ), Steve Witthuhn (NY)

Commission Advisory Panel members present: Frank Blount (RI), Paul Caruso (MA), Jack Conway (CT), Greg DiDomenico (NJ), Mark Hodges (VA), Marc Hoffman (NY), Joseph Huckemeyer (MA), James Little (DE), Michael Plaia* (RI), Kevin Smith (VA), James Tietje (MA), Wes Townsend (DE)

*Serves on both Council and Commission Advisory Panels.

Others present: Chris Batsavage (Council member, NC DMF), Julia Beaty (MAFMC Staff), Steve Cannizzo (NY RFHFA), Dustin Colson Leaning (ASMFC Staff), Karson Coutré (MAFMC Staff), Kiley Dancy (MAFMC Staff), Justin Davis (CT DEEP), Glenn Evans, Kara Gross (NEFSC), Adam Nowalsky (Council member, NJ), Brad Ries (NY RFHFA), Caitlin Starks (ASMFC Staff), Joe Tangel (NY RFHFA), Wes Townsend (Council member, DE), Sam Truesdell (MA DMF)

Summer Flounder

No comments were provided on summer flounder 2020 specifications. Some comments were provided on commercial minimum mesh size regulations for all three species, as summarized below.

Black Sea Bass

One advisor asked what the 2020 acceptable biological catch (ABC) level would have been if the SSC had recommended a 60% overfishing limit (OFL) coefficient of variation (CV) instead of a 100% CV. Staff noted that under a 60% OFL CV, the 2020 ABC would have been about 0.9 - 1.1 million pounds greater than the ABC recommended based on a 100% OFL CV, depending on if the standard/varying or averaged/constant ABC approach is used. This represents a 6-7% difference in the ABC, depending on the approach used.

Many advisors expressed frustration with the fact that the potential 2020 recreational harvest limit (RHL) is about 30% lower than 2018 recreational harvest. One advisor asked why the RHL is not set at a higher level given that biomass is so much greater than the target level. He said it is irrational to require reductions in recreational harvest when biomass is so high. He said this is an example of why more flexibility needs to be built into the process.

Many advisors said they have no trust in the Marine Recreational Information Program (MRIP) data. One advisor said it's not true that we now know that recreational catch is higher than we previously thought because we don't know that the revised numbers are accurate. Future revisions could tell us that the current numbers are also wrong. He added that the SSC cited concerns about uncertainty in the MRIP data as one of their main reasons for using a 100% OFL CV instead of a 60% CV. One advisor described specific instances of unreasonable estimates in New York in certain waves and years.

One member of the public asked how far above the target biomass must be before recreational liberalizations are allowed. Another member of the public said that if recreational management measures become much more restrictive in 2020, non-compliance will increase. He added that New York will likely not go along with the potential restrictions described on the webinar.

Three advisors said consideration should be given to reducing the recreational minimum size limit as this would reduce the total weight of fish landed in the recreational fishery and could reduce discards. One advisor noted that the stock was rebuilt under a lower minimum size limit. One advisor said discards could be reduced with a total cumulative length limit, where the length of all retained fish cannot exceed a certain total amount, coupled with a prohibition on discards.

One advisor asked if consideration has been given to increasing the reporting requirements for recreational fishermen, especially private anglers, to help address uncertainty in the MRIP data.

Two advisors said the for-hire sector should be managed differently than the private and shore modes. The for-hire sector reports electronically within 48 hours of returning to port and they make their living off fishing. One advisor said that because of these existing reporting requirements, the major changes in the MRIP data were not driven by the for-hire sector.

The black sea bass commercial quota has the potential to increase substantially mid-year in 2020. Two advisors said this could have negative economic impacts. For example, it could result in fish flooding the market and causing prices to drop, thus requiring fishermen to land more fish to make the same amount of profit.

One advisor said the federal trawl survey does not sample far enough offshore to accurately represent the true abundance of black sea bass. He said lobster fishermen are catching black sea bass far offshore in their traps. He added that consideration needs to be given to the impacts of black sea bass on other fisheries. For example, he said the high abundance of black sea bass is wiping out inshore shellfish fisheries.

One advisor asked if changes to the commercial and recreational allocation for black sea bass can be made through a framework/addendum rather than an amendment. He noted that the New England Fishery Management Council agreed to allow changes to the groundfish recreational allocation through a framework. Council staff clarified that NOAA Fisheries advises the Council on which actions require an amendment and their advice has been that a change to the commercial and recreational black sea bass allocation requires an amendment.

Scup

One advisor would like to see a report on how imported tilapia has affected the scup fishery and noted that the US now imports 95% of fish consumed. He said we needed to move towards total retention and recommended that the Monitoring Committee explore lowering the size limit and having a cumulative total length management measure in the recreational fishery to decrease discards. Another advisor agreed with the idea of a cumulative length limit.

One advisor said that state regulations such as seasons and trip limits are contributing to discard problems due to low trip limits for scup when they are being caught during targeted black sea bass trips. Another advisor agreed with this perspective.

One advisor agreed that discards need to be reduced and felt that there could be more outreach and education on recreational fishing methods. He recommended reaching out to the saltwater angler registry and showing them the best methods of releasing fish, how to optimize quality, and how to fish for a certain size. This advisor noted that there are a lot of poor practices out there and people haven't learned new methods that correspond with current management measures.

One advisor asked why underages can't be applied to future years similar to how overages are applied to future years. Staff responded that taking more than the SSC recommends has biological implications and increases the risk of overfishing. This advisor felt that if a stock is over 100% of the target biomass it should be handled differently and with more flexibility.

One advisor preferred the averaged ABC approach to promote stability for the commercial fishery.

One advisor asked what the reduction in harvest would be in 2020 to meet the RHL. Staff responded that the 2018 recreational landings were about double the potential 2020 RHL.

Minimum Mesh Size Regulations

Staff summarized the results of the 2018 mesh size selectivity study by Hasbrouck et al. (2018)[1] and past Monitoring Committee comments on this issue. The AP was asked whether further analysis and gathering of industry input to explore potential mesh size regulation changes should still be a priority going forward, and if there were particular mesh size regulation issues that should be addressed.

Two advisors stated that evaluating this issue should not be a high priority in the near term. Discards and bycatch are complicated issues due to multiple driving factors (e.g., mesh size, gear

[1] Available at: http://www.mafmc.org/s/Tab08_SFSBSB-Mesh-Selectivity-Study-Apr2018.pdf

configuration, season, area, recruitment, minimum fish size limits). Mesh size regulations should be considered once the Council and Board have dealt with other priorities including the implications of the revised MRIP data on commercial and recreational management and allocations.

As discussed at the Monitoring Committee meeting, one advisor noted that the Science Center for Marine Fisheries (SCeMFiS) has funding to conduct an analysis of discards of demersal species to further understand the causes of discards and potential solutions for discard reductions.

Another advisor said this issue should be moved to the highest priority, and the Council and Board should consider a uniform 4.5" or 5" mesh size for all three species, with corresponding changes in the minimum fish sizes to be appropriate for this mesh. He stated that part of the scientific information used to set the original mesh size for summer flounder incorrectly incorporated small migrating southern flounder caught off North Carolina, and that this should be corrected for. He also noted that the recent summer flounder stock assessment indicates that summer flounder are now growing and maturing more slowly, and that measures need to be adjusted accordingly.

Another commercial industry advisor stated that going to a common mesh size at least for scup and black sea bass would be extremely beneficial. If the minimum mesh size is decreased for any species, the minimum fish size should decrease proportionally. This approach would turn discards into landings. From an economic standpoint, the cost to re-rig a vessel is not cheap as the net needs to be configured for a specific vessel and species. This can cost between $3,000 and $15,000 per net depending on the circumstances. This advisor would like to know how many vessels are currently using 6" square to fish for summer flounder and stated that this information could be evaluated from Vessel Trip Reports.

APPENDIX: Additional Comments Submitted Regarding September 24, 2019 Advisory Panel Meeting

---

From: Vetcraft Sportfishing <vetcraft@aol.com>
Sent: Sunday, September 22, 2019 7:36 PM
To: Kiley Dancy
Subject: Re: Materials for 9/24 Summer Flounder, Scup, Black Sea Bass AP webinar

Kiley, I apologize but my veterinary duties will not let me attend the upcoming AP so I would like to submit the following comments and report:

Fluke fishing in the southern NJ area gets more dismal each year and this year was no exception. We not only are seeing few keeper size fish on most days, but the number of undersized fish is rather diminished as well. Many of the charter boats gave up going towards the end of the season. The party boats could only got out on days when they found enough patrons to go. The most popular party boat is Cape May, the "Porgy" is going up for sale due to lack of patrons. Most of the Delaware boats fish off of NJ as their fluke population is even worse than ours.

The artificial reefs in my area that normally account for upwards of 75% of the fluke caught in NJ, were very sparsely populated with fluke compared to years past. Roughly I would say there are less than 10% of the number of fluke there than there was 10 years ago. Each year it gets worse.

We really are in need of some relief to keep the remaining fishery related businesses from failing.

I see the causation as follows:

1. We have allowed regional depletion of fluke populations in the southern half of their range
2. The minimum size requirements are not only detrimental to the species, but also preclude 90% or more of anglers from bringing a fish home on any given day.
3. The uneven distribution of the commercial fluke quota has caused relative overfishing in the southern half of the range of the species.
4. Commercial dragging has destroyed much of the inshore structure causing few fluke to populate the once popular inshore sloughs and bivalve beds.
5. Commercial draggers continue to target fluke when they come in range of the summer recreational fleet. I personally have seen them dragging circles around our artificial reefs. In fairness to the recreational industries, we need a 12 mile limit for dragging during the recreational season.

Sea bass...........We see some sea bass in federal waters but by no means would I say they are abundant.

Porges..............Only ones I have seen are juveniles several inches long.

Capt Harv
Vetcraft Sportfishing
Cape May, New Jersey
Call or Text 610-742-3891
Email: vetcraft@aol.com
www.vetcraftsportfishing.com

-----Original Message-----
From: Kiley Dancy <kdancy@mafmc.org>
To: Advisors - SFSBSB <Advisors-SFSBSB@mafmc.org>
Cc: Leaning, Dustin Colson <dleaning@asmfc.org>; cstarks@asmfc.org <cstarks@asmfc.org>; Beaty, Julia <jbeaty@mafmc.org>; Coutre, Karson <KCoutre@mafmc.org>; Luisi, Michael <michael.luisi@maryland.gov>; Gilbert, Emily <emily.gilbert@noaa.gov>; Rootes-Murdy, Kirby <krootes-murdy@asmfc.org>; cstarks@asmfc.org <cstarks@asmfc.org>; Beaty, Julia <jbeaty@mafmc.org>; Coutre, Karson <KCoutre@mafmc.org>
Sent: Mon, Sep 16, 2019 1:49 pm
Subject: Materials for 9/24 Summer Flounder, Scup, Black Sea Bass AP webinar

NEW YORK RECREATIONAL & FOR-HIRE FISHING ALLIANCE

"LET US FISH"

FROM: NY RFHFA 09.24.19

TO: Julia Beaty (MAFMC), Kiley Dancy (MAFMC), Caitlin Starks (ASMFC)

SUBJECT: Public Comment in reference to Summer Flounder, Scup, & Black Sea Bass AP Webinar on Sept. 24, 2019

Julia, Kiley and Caitlin

The New York Recreational & For-Hire Fishing Alliance would like to thank all of you for the information provided as well as question and comment discussion on summer flounder, black sea bass and scup at today's AP webinar. Representatives who were on this morning webinar, Captain Joe Tangel, Captain Carl Forsberg (also an AP advisor), Captain Kenny Higgins and myself (Steven Cannizzo) have discussed what transpired on the BSB and scup discussion, and it was difficult to contain our frustration due to the most troubling issues on the direction be taken by the SSC as it concerns black sea bass (BSB) and scup with the negative implication to future regulation decisions for 2020 and 2021.

The general tone of the participants on today's AP are with the answers given when the biomass of a stock increases, there is a corresponding scaling up of harvest and discards. This resulted in the contentious debate over the SSC decision to increase the Default CV from 60% to 100% on scientific uncertainty based upon and in their own words "the implausible MRIP data" that resulted in, and as stated by staff of 1 million lbs of BSB being removed from the ABC due to the increase of the CV by the SSC. There was also the pencil whipping in the projections in the regulatory discards which are the result of management decisions which has led angler behavior over the past decade to transition the BSB fishery from one of harvest to one which is a de jure catch & release fishery due to long closed periods, extremely constrained possession limits, inappropriate high minimum sizes due to the productivity of a given area in state waters as well as the BSB fishery interacting and mixing in other nearshore recreational fisheries such as scup, red hake, cod, tautog and fluke.

The most troubling part is in the explanation to stakeholders and the general fishing public is on the management for BSB, as the current catch is intended to fish the population down to MSY given that we are currently above the threshold and exceeded the SSB target. Therefore, and due to the risk policy and increased scientific uncertainty in the process we are witnessing, ACLs (Annual Catch Limits) are now not only projected to decline in the coming years, but also is not a positive indicator for potential future liberalizations for the most robust finfish stock managed by the MAFMC. This is now playing out with the not too subtle regulatory news on BSB for the recreational sector of a 30% to 35% reduction projected for 2020.

As I mentioned during the webinar in dealing with outlandish and spiking estimates that have grown much worse over the three major changes of the MRIP program during the last 12 years, and culminating with private vessel estimates increasing by 2-3x and shore bound mode estimates 5x from previous and noted as 'old' MRIP estimates that even has led to the New York State "Wave 6 Specials" as stated by NYS Chief John Maniscalco during the Monitoring Committee Meeting. How many improbable and as much implausible MRIP data sets from any fishery, state, wave, mode and or average weight can be presented at various fishery meetings for the technical staff, fishery specialist, advisors and council people to understand that MRIP should not be used as a gauge to assess harvest and discards, and has an consistent proven history for extremely low statistical precision for management use in setting allocations and the corresponding regulations? What consideration has been given for and to the for-hire party boat and charter modes which is currently monitored and in compliance with electronic reporting and has an extremely low percentage of landings (as per your 'percentage of recreational landings' table) in the BSB fishery?

The biggest question that stakeholders and the fishing public have to ask at this very time is if this is to be expected of any stock which is not only rebuilt, but considered robust when it exceeds the target - in that recreational regulations become that much more restrictive and commercial quota grow by unimaginable "leaps and bounds" after a stock assessment? How much more restrictive will BSB, and as we heard today with a projected reduction for the recreational sector in the vicinity of 50% for scup? How can the MAFMC staff be a conduit in passing along not only our angst, but now bitter frustration that fishery management is proverbially "all over the map" in properly maintaining regulatory stability for rebuilt fisheries as well as lessening the negative economic impact to the fishing industry and businesses that rely upon fishing related activities?

Once again thank you for your patience and consideration for what the NY RFHFA has stated here.

Steven Cannizzo – NY RFHFA

Captain Joe Tangel, Director – fv KING COD

Captain James Schneider – JAMES JOSEPH Fleet

Captain Carl Forsberg – VIKING FLEET

Captain Kenny Higgins – CAPTREE PRIDE

Captain Anthony Testa Sr. – fv STEFFANI ANN

Captain Anthony Testa Jr. – fv STEFFANI ANN

TO: Julia Beatty (MAFMC Fishery Specialist) 09.26.19

FROM: Captain Steven Withuhn (AP Advisor)

SUBJECT: Public comment in reference to **Summer Flounder, Scup, and Black Sea Bass Advisory Panel Webinar on 09.24.19**

Additional comments provided by advisor Steven Witthuhn (NY) to Council staff over the phone following the September 24, 2019 Advisory Panel (AP) webinar meeting:

- The recreational fishery has a growing sentiment that they will have to pay for past management mistakes. Managers are currently admitting that they mistakenly assumed that recreational catch was much lower than it really was and now have adjusted upwards the harvest and discard estimates according to the new MRIP data.
- The numbers presented at the AP webinar regarding the recreational harvest limit, recent harvest, and potential needed reductions are outrageous. What will advisors say to the fishermen in their home states come 2020 on further cuts in what they now take home during a day of fishing?
- Advisors stand united against the estimates seen for management purposes from MRIP. The previous MRFSS number were bad, but the MRIP numbers are worse and have grown even more outrageous with the recent revisions to the point where they will impact both those stocks and future allocations.
- The New York fishing community made up of the for-hire industry and general fishing public will not sit back and absorb these cuts. The state fishing industry, that being the for-hire modes have had it as they currently open BSB now in late June with a by-catch possession limit,an overly large minimum size which is not reflective of the productivity within the majority of areas within NYS waters and an extremely small fall and early winter fishery

harvest allowance for the angler. The for-hire industry cannot take any more cuts to the black sea bass fishery.

- Fishermen want regulator stability in order to plan for and have viable fishing opportunities. They cannot understand how liberalizations are off the table for black sea bass when the stock is deemed 240% of SSBmsy. They wish for a process of stable management measures across a three year time year period in order to then reassess and make changes reflective to stock size, different modes of harvest, and fishing driven mortality. This is why there were no comments on summer flounder fishery performance during the AP webinar. Advisors and stakeholders realized that they are lucky to be able to have three years of stable management measures in that fishery. This helps to provide a pattern of steady data signals to both the SSC and the Council on the impact and effect of the management policies.
- Managers, that being both the technical and federal and state regulators are not able to manage successfully rebuilt fisheries. How long should we give management a chance to enjoy rebuilt fisheries? "Uncertainty" has become the proverbially "get out of jail free card" for managing stocks and a default term used by the SSC in their answer to increasing risk to stocks well above the threshold and exceeding the SSB Target. This is counter-intuitive to what fishermen see in fishing reports and catch throughout the season with black sea bass and scup.
- Discards, both alive and dead are held and charged in removals for setting the RHL against fishermen. A great day of recreational fishing could include many released fish, especially with a 15 inch minimum size limit. For-hire captains make a point of educating their customers about sustainability, proper and responsible usewith catch and release practices in order to take a few fresh fish for a meal. The 15% assumed discard mortality rate penalizes recreational fishermen for catch and release and is not applicable to discarded BSB in water depths under 20 fathoms where the majority of recreational fishing occurs.

- Recreational fishermen are providing more accurate and timelydata streams, most recently with the new mandated requirement that for-hire vessel trip reports be submitted electronically within 48 hours of returning to port. Regulations have grownmore restrictive and fishermen now have a sense that their data continues to being used against them in setting the following years regulations.
- Seasons are measured in open days whichhas a greater economic priority than overly generous bag limit for both party and charter fishermen, as open days during a season allows one and provides the opportunity to work around the seasonal spatial and temporal abundance of nearshore accessible species. The key talking point for the for-hire industry and businesses that rely upon fishing related activities is that they prioritizein being able to go out and fish and provide that opportunity to the public.
- There is a different mentality on charter boats than on for-hire party/headboats. For example, the customers on charter boats frequently know each other and sharing or comingling of fish amongst all participants is traditionally viewed and generally more acceptable on charter boats than on party boats.
- Fishermen are not only observing but catching more black sea bass with stomachs full of the popular fish attractant Gulp bait. How quickly does Gulp bait degrade in their stomachs? Could this be negatively impacting discard mortality? This is not a priority issue, but should be kept in mind over the coming years if certain artificial baits do impact fish mortality.

Thank you,

Captain Steven Withuhn

TOP HOOK charters - Montauk

NYS MRAC advisor

AP advisor Summer Fluke, Black Sea Bass, Scup

NYS commercial limited Food Fish License holder

Kiley Dancy

From: James Fletcher <unfa34@gmail.com>
Sent: Monday, September 30, 2019 8:25 AM
To: Coutre, Karson; Moore, Christopher; Kiley Dancy
Subject: Re: Draft AP meeting summary for review by Tuesday

PLEASE ADD THIS QUESTION:
WHY DOES THE COUNTRY WITH THE SECOND LARGEST EEZ IN WORLD; IMPORT 93% TO 94% OF SEAFOOD CONSUMED IN U.S.A.
WHY HAS THE U.S.A. NOT SET A NATIONAL PRIORITY AGENDA TO STRONGLY SUPPORT DOMESTIC SEAFOOD PRODUCTION FOR BOTH WILD CATCH AND AQUACULTURE, IN COUNTRY?

THE COMMENTS FOR FLOUNDER , SCUP & BLACK SEA BASS WERE TO REDUCE MESH SIZE TO FIVE [5] INCHES AND ADJUST THE FISH SIZE DOWN SO ALL SPECIES CAUGHT WERE LANDED AND SOLD.
RECREATIONAL TOTAL LENGTH WOULD REQUIRE NO SIZE LIMIT AS ALL FISH CAUGHT WOULD APPLY TO TOTAL LENGTH.
I THINK STAFF COULD & SHOULD REFLECT WHAT ADVISORS SUGGEST BETTER. ADVISORS WERE ALL IN FAVOR OF REDUCING OR ELIMINATING DISCARDS!

On 9/27/2019 9:31 AM, Coutre, Karson wrote:

> Hello Summer Flounder, Scup, and Black Sea Bass Advisors,
>
> Thank you for your participation in our meeting this week. Attached is a draft meeting summary for your review. This meeting summary will be posted as supplemental materials to the October Council meeting briefing page along with associated submitted comments next week. Given that timeline, please respond with any comments or edits to this summary by the end of the day **Tuesday, 10/1.**
>
> Thank you,
>
> Karson Coutre
> Fishery Management Specialist
> Mid-Atlantic Fishery Management Council
> 800 North State St, Suite 201
> Dover, DE 19901-3901
> (302) 526-5259
> KCoutre@mafmc.org or karson.coutre@noaa.gov

--
James Fletcher
United National Fisherman's Association
123 Apple Rd.
Manns Harbor, NC 27953
252-473-3287

Kiley Dancy

From: MARC K.HOFFMAN <mkhoffman@optonline.net>
Sent: Monday, September 30, 2019 2:03 PM
To: Leaning, Dustin Colson
Subject: Re: Following up on our phone call

Recently, a number of recreational fishermen informed me that the price of clam baits has doubled because of a shortage of clams. The harvesters blame the seabass which eat juvenile clams as well as lobsters and other shellfish. I think it is important for AP staff who attend the meetings for lobsters, clams, crabs, etc., to ask the other panel members about the effects of the over population of seabass and where are they finding seabass. If the seabass are being found well offshore this might indicate that the biomass is much larger than the 240% we are using.

On September 30, 2019 at 1:24 PM "Dustin C. Leaning" <DLeaning@asmfc.org> wrote:

Hi Marc,

In the interest of including your comments to the Summer Flounder, Scup and Black Sea Bass Advisory Panel summary document that will be posted for the October meeting briefing materials, could you provide us with a few sentences summing up your thoughts? It would be great to include your written ideas in the document so that I can best capture our conversation. If you are able to write back before the meeting summary deadline (tomorrow at 5pm), that would be great.

Thanks,

Dustin

Dustin Colson Leaning

Fishery Management Plan Coordinator

Atlantic States Marine Fisheries Commission

1050 N. Highland Street, Suite 200A-N

Arlington, VA 22201

703.842.0714

dleaning@asmfc.org

www.asmfc.org

Kiley Dancy

From: Ryan Landolfi <landolfi.rr@gmail.com>
Sent: Tuesday, October 1, 2019 12:09 PM
To: Moore, Christopher; Kiley Dancy
Subject: Supplemental Comment for October 19, 2019 Council Meeting

Dear Dr. Moore and Ms. Dancy,

I'd like to take this time and thank you for the opportunity to have comments included in the upcoming council meeting and to voice some specific concerns I have, in particular with regard to Summer Flounder.

My 2019 summer flounder season has been far and away my least productive. The quality of the fishing in the NY Bight for summer flounder has been steadily declining, with the only observable changes being the increasing size limits and decreasing bag limits. The philosophy that removing the larger spawning females from the population, with a relatively much lower percentage of large male fish, seems to have put this fishery into a tailspin. While I understand there are many factors at play including predictive models, catch surveys, commercial quotas, etc., I believe the regulations are not functioning as intended (to protect the stock) and are having a deleterious effect on the overall health of the fishery. This does not seem to only be a New Jersey issue, although I do feel the fishing pressure in this area only exacerbates the problem.

In reviewing the briefing materials from Tab 12, I came across the comments made by Tom B. Smith, and I could not agree more. Several factors have contributed to the decline of this fishery including commercial discards, commercial harvest of spawning stock biomass during spawning months prior to dropping eggs, recreational discard mortality, etc.; however, I believe the ever-increasing size limits, removing spawning age and size fish from the population, is ultimately endangering this great fishery to a point of collapse. Anglers from the NJ/PA/NY area are now travelling yearly to MA to go on 2-day fishing trips in Cape Cod just to have the chance to catch some sizable fish that will pass regulatory restrictions. At a certain point, many anglers are going to decide that the investment made into recreational fishing tackle, gear, boating costs, party and charter boat fares, etc. are not worth the 2 fish over 18 inches they see per season. I don't believe it is the intention of this council to dissuade recreational fishing, but that time has come for many.

I ask that you please consider implementing a recreational slot limit to protect not only the future of the summer flounder fishery, but also the future of recreational fishing for the generations to follow.

Thank you,
Ryan Landolfi
Concerned New Jersey Recreational Angler

Kiley Dancy

From: Bill Klimas Billfish <billfish715@aol.com>
Sent: Tuesday, October 1, 2019 6:22 PM
To: Moore, Christopher; Kiley Dancy

Subject: Supplemental Material For The Website

Please add these comments to the supplemental material on the Council meeting web page.

Some of us have been around for quite a few years and have watched saltwater fishing evolve. Fishing tackle has continued to improve
by leaps and bounds, from lighter rods and reels to line, hooks and terminal tackle. Electronics, boats, social media, and techniques have all given new dimensions to fishing. Through all of these advances and years, never has there been a year when there were no fluke to catch. They are resilient.

When size limits were below 15", there was no outrage about overfishing. Even if there was a lot of pressure on the fluke population, they kept on coming back. Do we need to have size limits at 18" or more in order to save the future of fluke fishing? The future somehow becomes the past very quickly. Ask any person who is retired. When I look at the past, I've always been able to find and catch fluke. If I'm fishing for a dinner or two, do I need an 18" fish to eat? No. Would I be happy to catch and eat a 15" or 16" fluke? Yes. Will I destroy the fluke fishing for the future by keeping some of the sandwich-sized fluke? No.

For me, the past was once the future and never has there been a season when I went without having fluke for dinner. The recreational fishermen will never destroy the future of summer flounder fishing. Commercial guys won't either unless they are encouraged and allowed to drag for them during the winter on their spawning beds.

Recreational guys never destroyed the winter flounder fishing or the striped bass and bluefish and weakfish and tuna and ling and whiting and mackerel yada, yada, yada..........but the recs pay the price for the mismanagement of the guys who have the most influential lobbyists.

The past is behind us with its 14.5", 15", 15.5", 16", 16.5", 17", 17.5" limits and still the fluke are here but we can't keep them. Why are the "scientists" afraid of the future of the summer flounder? With the scientists or without them, the fluke are still here. The science is glorified numbers crunching and mathematical equations with incomplete data input and variables. One scientific haul seine for data research and data, taken in the wrong area will give much different information than the same haul seine done only a few miles away. One sample will indicate a much smaller total than the another. It might indicate how few fluke are on the bottom. As a result, you guessed it, the results would indicate a dire future for the fish and fishermen

Had the haul been done with different equipment or in a different area where the fluke were, there would be a different outcome. The past has proven itself. If there has to be a compromise and the committee insists that the summer flounder have to be regulated, then settle on a reduced size limit. We are being encouraged to harvest the mature females with the most eggs when most of us would settle to take home a few smaller fluke which have far fewer eggs.

It's about time someone calls out the regulators and their advisors about their failed management policies over all these years. If their efforts to engineer the future of the summer flounder were successful, the current size and possession limits would never be necessary. Think of how many size increases have been made over the last 20 years. Each change indicates one failed plan after another and yet, the failed science continues. "Insanity" ....Doing the same thing over and over again and expecting different results.

Admit the failure of the program and stop punishing recreational fishermen who just want to enjoy fishing and bring home a few fillets.

Bill Klimas
New Jersey

Kiley Dancy

From: Hart, Larry <larry.hart@credit-suisse.com>
Sent: Tuesday, October 1, 2019 5:47 PM
To: Moore, Christopher; Kiley Dancy
Subject: Fluke 2020

Please consider a "slot" regulation for Fluke this year so that recreational anglers are no longer forced to remove the larger female breeders from the stock. Also please consider a commercial ban on Fluke landings during their winter Spawn off-shore. . . Thanks, Larry Hart (New Jersey recreational fisherman)

Larry Hart
CREDIT SUISSE SECURITIES (USA) LLC
CS Sec USA LLC | EM OPS IT - Princeton, MIOM 87
Princeton Forrestal | Princeton NJ 08540-6689 | Americas
Phone +1 212 325 9992
larry.hart@credit-suisse.com | www.credit-suisse.com

Kiley Dancy

From: Tom K. <tomkaye@verizon.net>
Sent: Tuesday, October 1, 2019 5:09 PM
To: Moore, Christopher
Cc: Kiley Dancy
Subject: Recreational Fluke regulations meeting

If you would be so kind Gentlemen. please include my comments below in the Supplemental Material for the meeting on October 8th

I am 70 years-old and although I got into it late, have been a recreational fluke fisherman for more than 45 years.
Have owned multiple boats but since Sandy have fished Party & primarily Charter operators.
Have seen and adhered to changing regulations over the years to the point that I can now barely catch a legal keeper fluke for dinner,
maybe once every other or every third trip. Of eleven trips specifically targeting fluke this 2019 season, I have taken a limit only three times,
three times went home with one or two, and five times with no keepers but dozens of shorts thrown back.

It's not about the meat on the table or in the freezer for me but I am more troubled by the fact that regulations require me to keep the
bigger breeder females and toss back the "shorts" which are predominant and scientifically proven to be usually males.
WHERE DOES IT END ??

To what lengths will my heirs have to go to in order to retain a legal fluke ??? 20---22--24 inch fish ????
It is time for sensible regulations and seasons coinciding with other states so that the species is perpetuated
and future generations can enjoy the sport.

Time for slot fish for fluke anglers similar to what has been done with other species elsewhere.
Thanks for listening.

Tom Kowalik
10 Susan Lane
Byram Township, NJ 07821

Kiley Dancy

From: Mark Seidman <markhseidman@gmail.com>
Sent: Wednesday, October 2, 2019 9:43 AM
To: Moore, Christopher
Cc: Kiley Dancy
Subject: Fluke (Summer Flounder) Management Commentary

Good Morning Dr. Moore,

I am writing to include my comments in the Supplemental Material Disclosure for the upcoming Joint Meeting of the ASMFC & MAFMC.

As a recreational angler who primarily practices catch & release, I am a strong proponent of instituting a slot limit for Summer Flounder in the 15"-18" range. Sexually mature fish (females generally over 18" in length) should be protected rather than targeted in order to repopulate this over-exploited resource. Such regulations would most certainly put a halt to commercial netting operations targeting this species, but the same was done for striped bass many years ago and look how that fishery rebounded. It is time for laws to be put in place to protect and serve the general public for the long term rather than a commercial interest in the short term. I would hazard a guess that dollars pumped into the overall economy from recreational anglers quite possibly outweighs contributions made by commercial net draggers. Thank you for providing a medium through which our voices can be heard, and I implore you to make the best decision to conserve this dwindling resource.

Sincerely,

Mark Seidman
Westampton, NJ

Kiley Dancy

From: Moore, Christopher
Sent: Wednesday, October 2, 2019 9:54 AM
To: Kiley Dancy
Subject: FW: Summer Flounder

From: Bruce corrnine <brewlugger@gmail.com>
Sent: Wednesday, October 2, 2019 8:59 AM
To: Moore, Christopher <cmoore@mafmc.org>
Subject: Fwd: Summer Flounder

---------- Forwarded message ----------
From: **Bruce corrnine** <brewlugger@gmail.com>
Date: Wednesday, October 2, 2019
Subject: Summer Flounder
To: cmoore@marmc.org

---------- Forwarded message ----------
From: **Bruce corrnine** <brewlugger@gmail.com>
Date: Wednesday, October 2, 2019
Subject: Summer Flounder
To: cmoore@marmc.org

Please consider implementing a slot limit that excludes the harvest of Summer Flouder over 18 inches.

Kiley Dancy

From: Moore, Christopher
Sent: Wednesday, October 2, 2019 10:08 AM
To: Kiley Dancy
Subject: FW: Summer Flounder Comments

-----Original Message-----
From: Tim Anfuso <tanfuso@aol.com>
Sent: Wednesday, October 2, 2019 6:17 AM
To: Moore, Christopher <cmoore@mafmc.org>
Subject: Summer Flounder Comments

Director Moore;

Please consider the following two comments to improve the summer flounder breeding stock and young of the year.

1. Close all fishing during the spawning season.

2. Since must fish 18 inches or larger are females, stop forcing anglers to target large females who produce the most eggs. Implement a slot fish for summer flounder to protect the breeders

Thank you for your consideration.

Tim Anfuso
50 Society Hill Way
Tinton Falls, NJ 07724

Sent from my iPad

Kiley Dancy

From: Moore, Christopher
Sent: Wednesday, October 2, 2019 10:10 AM
To: Kiley Dancy
Subject: FW: NJ fluke regulations

From: Merle Lockhart <merle705@gmail.com>
Sent: Tuesday, October 1, 2019 9:08 PM
To: Moore, Christopher <cmoore@mafmc.org>
Subject: NJ fluke regulations

I feel as a recreational fisherman that these rules are terrible. Not only to a family man or woman spending the money for a fun day out looking to bring home some dinner it's insane go catch 1 fish at 18"s let alone 3. How about a guy hooked fish that might be undersized but is gonna die anyway I dont see the reason why this "meal" has to go to waste because of a size limit. Dont even get me started on the daggers being allowed to keep 14" fish than that fluke being sold at a store for 9.99 and up a pound it's a joke. All these formulas put in place are down right sickening there should be a universal rule for the entire coast with a set season set limit and size and a closure to the offshore winter dragging total BS.
Thank you

Kiley Dancy

From: Bill Klimas <billfish715@aol.com>
Sent: Wednesday, October 2, 2019 12:11 PM
To: Moore, Christopher; Kiley Dancy
Subject: Re: Supplemental Material For The Website

One more thing to ponder........After looking back over all of the size limit increases, I had to think, once again, about the science involved with all of the changes and management. If the science and management was accurate and trustworthy, why did the size limits continue to increase? Someone and something had to be wrong, otherwise the increases would never have continued. They would not have continued for so many years either. The mistake would have been discovered and admitted and rectified. Instead, mistakes kept being made for decades. Many of the younger fishermen can't remember the shorter size regulations and they are being fed incorrect information about who is to blame for the current state of affairs. Many of young fishermen believe that their fathers and grandfathers are to blame. WRONG! Look to the legislators who are socially engineering everything including the future of fluke fishing.

No one is held accountable except the fishermen who now are pitted against each other while the rules' makers get off scott free. Think about it. Their management plans have not worked and yet they continue to call the shots. Will they ever admit their failures? Don't hold your breath. Even though we fishermen are many and they are few , we continue to comply, but for how long? Let fishermen set the rules and standards.

Sent from my iPad

Kiley Dancy

From: Mike Yocius <mike@rclsolar.com>
Sent: Wednesday, October 2, 2019 2:41 PM
To: Moore, Christopher
Cc: Kiley Dancy
Subject: Council Meeting Public Comment

Greetings DR. Moore,

I would like to request that my comments be in included in the supplemental material at the upcoming council meeting.

Regarding Summer Flounder Stocks:

- It is purely common sense that if you are trying to rebuild a fish stock, it should not be possible for said stock to be fished commercially DURING THE PRIME SPAWNING PERIOD, AT THE PRIME SPAWNING GROUNDS!
- It is purely common sense that if you are trying to rebuild a fish stock, the minimum size limit should not be so large that only prime breeding females are able to be legally harvested by recreational anglers.

Respectfully,

Michael Yocius
Bridgeton, NJ
mike@rclsolar.com

Kiley Dancy

From: john riccardi <jwriccardi1224@gmail.com>
Sent: Wednesday, October 2, 2019 8:18 PM
To: Kiley Dancy
Subject: October Fluke Meeting

I have been fishing for over 30 years, and sadly as restrictions have tightened the fishing has gotten worse. One would believe larger size limits and reduced quota would help rebuild overfishing, but in the case of Fluke and sea bass we can see after years it has in fact gotten much worse. As noted in the comments almost 95% of the fluke over 18 inches are breeders and they are the ones recs are killing(if we are lucky). Fishing in cape may nj this was the worst season I have ever seen. I stated last few years it can't get any worse but surely it has. We would go trips without even catching any keepers and some not even shorts. I would imagine it is very hard to keep 2 sides happy as well as do what's best for the fishery but in the case of Fluke and sea bass we are making it worse. After reading tab 12 what troubled me most was this.

Because commercial discards resulted in the commercial ACL being exceeded in 2017 and likely in 2018 as well, trends in commercial discards should continue to be monitored closely for potential future incorporation into ACT recommendations. However, commercial catch and landings limits were increased substantially in 2019 and will be maintained at this higher level for 2020 and 2021. To me the recreational angler this says overfish and well increase your quota. Seems greatly unfair especially for two more years when the fishery is in dire trouble.

2nd alarming comment

Extremely revealing chart regarding commercial discards comparing percentages on observed trawls to percentages obtained from FVTR's. Source is 57th SAW page 302. Could not find comparable information in 66th SAW Assessment Report. If available, would be interested in reviewing years 2012 – 2017. The disparity between observed versus unobserved discard rates (those reported on VTR's) is substantial and if representative would have significant implications quantifying annual commercial catch levels and associated discard mortality rates.

Why would actual vessel trips be ignored and flawed scientific dat be used when we have factual???

One other comment is MRIP. It has been proven time and time again how flawed and unrealistic the data actually is, yet we continue to us it. In today era of technology there is no reason not to have anglers report their catch via some sort of app, Yes some would be resistant and not have the technology but I think far more anglers would provide data if they knew it would be for the good of the fishery. Please consider in this meeting lowering the size limits for recreational fisherman as well as preventing off shore decimation during the prime breeding season in the offshore canyons.

Concerned Angler
John Riccardi
Cape May NJ

Kiley Dancy

From: Mike Skirka <skirkam@comcast.net>
Sent: Wednesday, October 2, 2019 5:12 PM
To: Moore, Christopher
Cc: Kiley Dancy
Subject: Please Include These Comments in the Supplemental Material for the Meeting October 8 - Summer Flounder Specifications

Dear Dr. Moore:

I am a recreational angler and marine conservationist based near Atlantic Highlands, NJ and have been fishing our coastal waters for summer flounder for over 45 years – since before the time that there were ANY size limits on the species. I have a degree in biology and have tried to remain informed on the entire process of marine fisheries management by attending related webinar presentations sponsored by Rutgers NJAES and Dr. Doug Zemeckis.

I know how government scientists hate and discount “anecdotal evidence” from recreational fishermen and private charter/party boats, but 2019 was the worst year for summer flounder in my memory and this experience is shared by ALL of my friends and reflected in ALL recreational fishing websites that I check on.

The government has a somewhat reasonable method of tracking and monitoring the commercial catch. The November 2018 benchmark stock assessment found that the summer flounder stock is not overfished and overfishing is not occurring. The commercial quota for 14” fish and above was raised 49%. The mesh size of 6” square is believed to minimize under size discards, yet there is an estimated 80% discard mortality rate for summer flounder caught in trawls, so they are allowed to keep all they scoop up rather than “waste” the resource.

Compared to the methods used to track commercial catches, the methodology for “estimating” recreational landings is full of uncertainty with a strong bias for overly conservative overestimation. As a result, although a 49% increase in the recreational allowable catch was believed to be OK, the estimated landing “data” indicated that the recreational catch was already too large to allow for a further increase without a severe shortening of the season. We are allowed to only keep 3 fish over 18”. We must discard under-sized gut-hooked or gill-damaged fish, even though these fish will most likely die. Another “anecdotal” observation of mine is that I have never have seen so many bottom trawlers in operation on the flat bottom areas offshore of Sandy Hook during late summer flounder season. There is no other species that they could be legitimately targeting. I’ll bet most of the recreational discards are swooped up within a week by these commercials. NOT FAIR OR PRUDENT.

Recruitment of juvenile summer flounder to the fishery has been below average since about 2011 and the driving factors behind this trend have not been identified. It should be very clear to those in positions responsible for trying to manage and regulate this fishery THAT SOMETHING IS WRONG WITH THE APROACH FOR SUMMER FLOUNDER MANAGEMENT. Please consider these options;

- As for striped bass, allow recreational fishermen to keep 3 slot sized fish under 18 inches. The evidence is that most all fish over 18” are breeding females. Save these fish to help restore the fishery. Most summer flounder are sexually mature around 12”, so most slot sized fish will have had at least several years to spawn.
- HOOK AND LINE FISHERMEN WILL NEVER DECIMATE A FISHERY. Immediately reduce and freeze the commercial quota to the level before the 49% increase. Increase the mesh size to 8 inch square and work with the other branches of government to authorize a 100% tax reimbursement for the cost of the new gear in the year of purchase. Ban the offshore netting of summer flounder during the winter spawning season (or whenever best science has determines that spawning occurs).
- Keep these regulations in place for a number of years and see what happens.

Thank you for your consideration of these comments and I wish you and all those involved well in the honest and fair pursuit of good and practical management for our summer flounder.

Michael A. Skirka
5 Oakdale Run
Atlantic Highlands, NJ 07716

Sent from Mail for Windows 10

NEW YORK RECREATIONAL & FOR-HIRE FISHING ALLIANCE

"LET US FISH"

TO: Dr. Chris Moore, Kiley Dancy and Julia Beatty October 3, 2019

FROM: NEW YORK RECREATIONAL & FOR HIRE FISHING ALLIANCE

SUBJECT: Supplemental comments concerning the Tom Smith summer flounder analysis

Dear Dr. Moore, Kiley & Julia (MAFMC Staff),

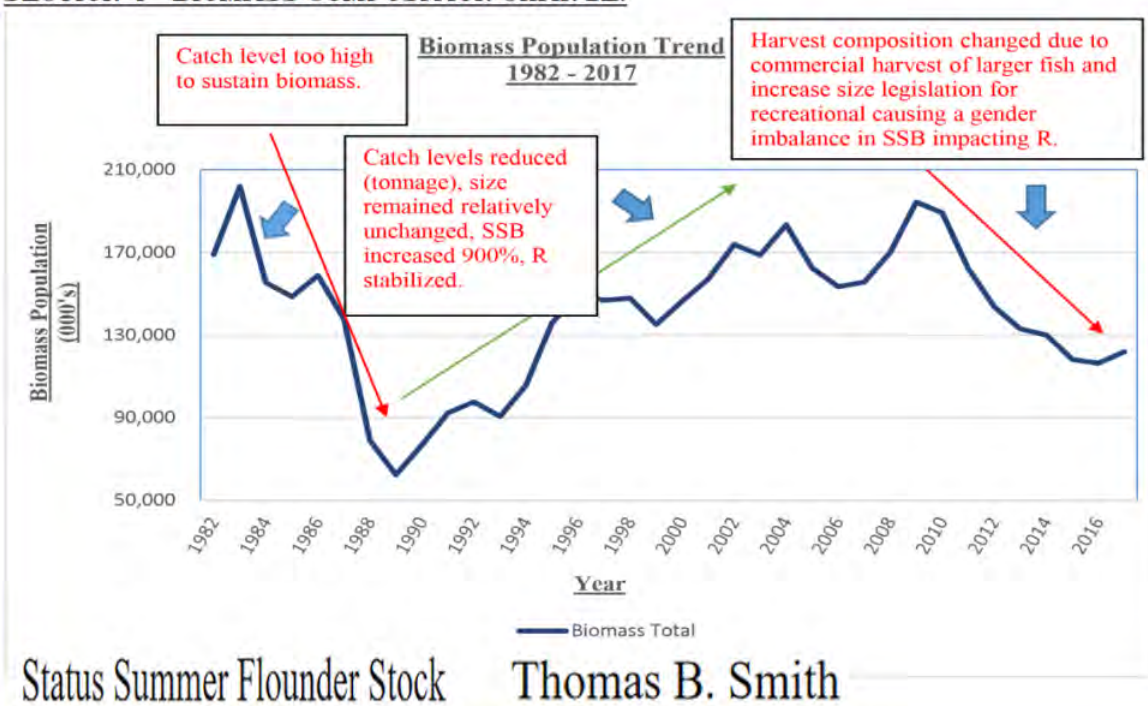
The NY RFHFA which represents the party and charter industry and recreational anglers with the New York State Marine Coastal District is submitting a supplemental comment due to what has been added to the MAFMC briefing material for the October 2019 meeting.

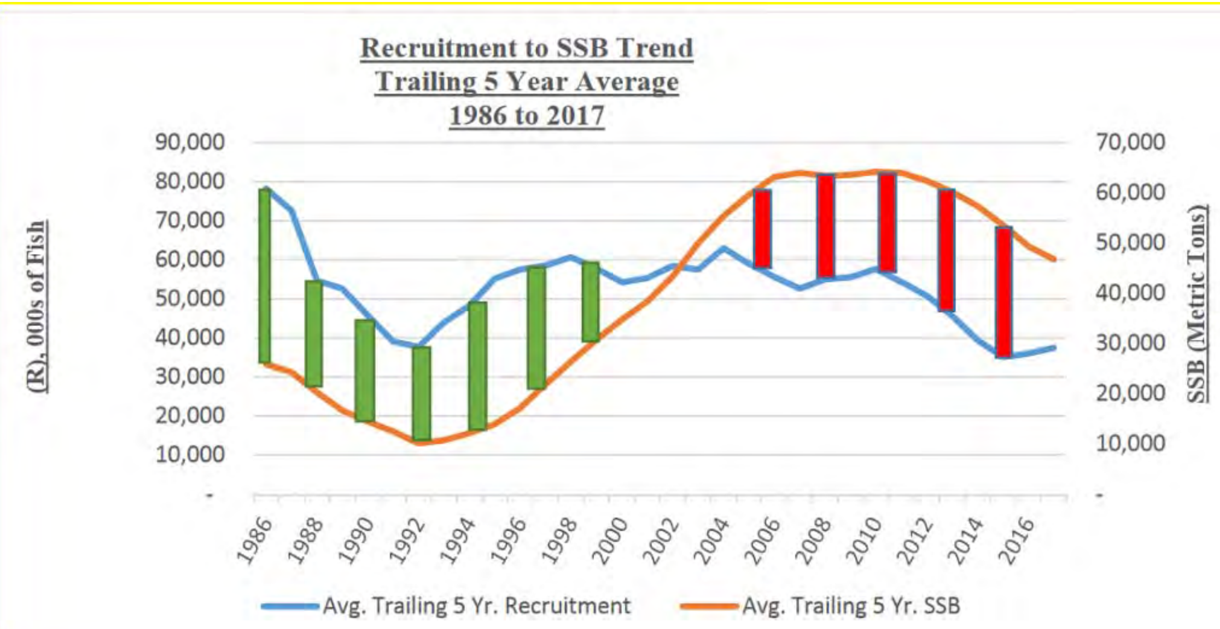
After reviewing the summer flounder memo material and analysis made by Tom Smith (NJ) found here:

https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5d8e3811aaf0456f3557619a/1569601560658/Tab12_Summer-Flounder-Specifications_2019-10.pdf

The NY RFHFA will highlight two charts which should provide some context to the questionable status of summer management policies and resulting regulations adopted. (Note: summer flounder = fluke).

SECTION 4 - BIOMASS COMPOSITION CHANGE:





During the summer flounder benchmark assessment review, stakeholders as well as other participants have consistently mentioned that the increase in minimum size for 'fluke' starting in 2003, has changed angling behavior to essentially have this fishery

skewing to higher minimum size retention which has resulted in the harvest of greater than >95% in the removals of female fluke. This gender bias in removals of one sex was also exacerbated during this time period with the commercial sector operating under low trip limits which leads to the retention of the largest fluke, females, due to the historically documented higher market returns.

The general consensus amongst a diverse group of commercial and for-hire industry participants is that this regulatory practice of removing the largest fluke had led to the reduced summer flounder recruitment for over the last decade, and the results based upon the last peer review assessment is in an overall decline in both total and female spawning stock biomass.

Those at the NEFSC and on the MAFMC SSC who monitor, research and make assessments on summer flounder population dynamics, seem to have taken issue with the analysis made by Tom Smith and a number of AP advisors, as well as stakeholders and those participants with their "daily on the water fishery performance perspective" as heard at the MC and AP. Anecdotal comments should carry some bearing on what the science and management policies result in the yearly performance of a fishery.

Past management approaches taken in regulating this fishery over the last 15 years in targeting the largest and most productive female fish have now resulted in a noticeable scarcity of fluke reaching the minimum harvesting size for a particular state, but also the extremely diminished abundance over the past few years of fish from within the inner bays, various sounds and nearshore beach fishery in a number of areas from New Jersey through to southern Massachusetts. Those on the MAFMC have to consider and adopt a vastly different management strategy in regulating the summer flounder fishery in the coming years.

We at the NY RFHFA thank you for your consideration of our concerns over the current management approach to the summer flounder fishery and hopefully discuss at the upcoming Council meeting the analysis laid out by Tom Smith.

Thank you,

Steven Cannizzo –NY RFHFA

Captain Joe Tangel, Director –fv KING COD

Captain James Schneider –JAMES JOSEPH Fleet

Captain Carl Forsberg –VIKING FLEET

Captain Kenny Higgins –CAPTREE PRIDE

Captain Anthony Testa Sr. –fv STEFFANI ANN

Captain Anthony Testa Jr. –fv STEFFANI ANN

Wednesday, October 2, 2019 12:48 PM

Name: Thomas Trageser

Topic(s): Summer Flounder Specifications

Comments: The summer flounder (and sea bass) management models are not yielding accurate results. As a result, recreational fisherman are being continually denied fishing opportunities. This regulatory overreach will have the reverse effect upon the constituents you wish to regulate.
According to the NOAA website on regulatory history of summer flounder,
(https://www.fisheries.noaa.gov/species/summer-flounder#management)
this vitally important species has been under management control for over 30 years! During that time size limits have increased from 14" and bag limits have been reduced. An unintended consequence of the regulations is recreational fisherman have been forced to cull through smaller, perfectly edible fish increasing mortality and only allowed to harvest breeding females. Furthermore, the research completed to determine the fact that 95% of the fluke over 18" are female was paid for by recreational fisherman. Sadly the people making the rules have little to no experience in the fishery!
Recreational fisherman have listened and abided by the rules during these three decades and received absolutely nothing in return. Our cooperation in regulations was based on the premise anglers would have a better fishery in the future. However, the efforts during this regulatory period have not yielded any results. It's time for the SSC and the extensive broader regulatory bodies (ASMFC, MAMFC, GARFO) to publicly admit failure in this fishery.
In the last 3 years recreational anglers have been providing intelligent and relevant analyses of your own data that supports the epic failures of the SSC. The analysis provided by Thomas Smith provides factual evidence that the population is being completely mismanaged by the current regulatory leadership. I am aware his analysis has been shared. I would like to know what will be done with it. At a minimum, the analysis provides strong evidence that the "best available" science is not being used.
The science being used, clearly isn't working and now recreational anglers are once again providing data that should be used to provide future regulatory enhancements.
Further regulatory pressure on this fishery will result in "waking the sleeping giant" and cause recreational fisherman to simply ignore revised regulations.

Email: ttrageser@oceanmhs.org

Wednesday, October 2, 2019 2:29 PM

Name: Lawrence Sehnal

Topic(s): Summer Flounder Specifications

Comments: Guys we need a Rec slot limit stop putting the pressure on all our females.

Email: captsehnal@gmail.com

Wednesday, October 2, 2019 11:00 AM

Name: rocky mcguigan

Topic(s): Summer Flounder, Scup, and Black Sea Bass Commercial/Recreational Allocations

Comments: The direction that our summer flounder management has been going is the wrong way and it has been for a long time now. It is very easy to see the continuing decline using your own data for proof. Please do not continue to make the same mistakes using bad science.

Thank you,

Rocky McGuigan

Email: rockyoutdoors@msn.com

Wednesday, October 2, 2019 2:49 PM

Name: Michael Reta

Topic(s): Summer Flounder, Scup, and Black Sea Bass Commercial/Recreational Allocations

Comments: Put an end to the offshore dragging of fluke during the spawn. Nothing is more detrimental to fish stocks than not allowing them to breed.

Email: mikreta@aol.com

Wednesday, October 2, 2019 4:34 PM

Name: Dennis O'Keefe

Topic(s): Summer Flounder, Scup, and Black Sea Bass Commercial/Recreational Allocations

Comments: I would just like to see something simple in regards to summer flounder or fluke as it is called in Nj. I would like to see a side limit of 16-17-18 inch fish with a limit of 3 total per day. In my view that would take pressure off the breeding fish (18 and above) and give fisherman a chance to bring meal home now and then. Personally, I throw back 18's and 19's sometimes. The limits you have previously set are difficult to achieve and it is doing great harm to the party and charter boats in the NJ area.
Thank You

Email: okeefed@msn.com

Wednesday, October 2, 2019 5:31 PM

Name: Henry Weiman

Topic(s): Summer Flounder, Scup, and Black Sea Bass Commercial/Recreational Allocations

Comments: Stop forcing the recreational angler to kill breeding female fish. Implement a lower size limit or slot, to allow the harvest of smaller male Summer Flounder.

Be honest with yourselves about the damage that the commercial fleet is doing to the Summer Flounder fishery.
I will accept a Recreational Moratorium on Summer Flounder as long as it is applied to the Commercial as well.

Email: henry.Weiman@hotmail.com

Thursday, October 3, 2019 12:45 PM

Name: William Scott

Topic(s): Summer Flounder Specifications

Comments: A slot size for the harvesting of Fluke should be considered as all of the fish 18" and larger are females needed to reproduce the biomass. Also, the season should be rescheduled to later in September as these fish are found in higher numbers later in September than the current season allows.

Email: scottlobi@optonline.net

Forage Management in the Mid-Atlantic

Forage species are small, low trophic level fish and invertebrates that play a central role in the marine food chain. These species facilitate the transfer of energy to higher trophic levels by consuming very small prey and then being eaten by larger fish, marine mammals, and seabirds.

In 2016, the Mid-Atlantic Council adopted a policy of supporting the "maintenance of an adequate forage base in the mid-Atlantic to ensure ecosystem productivity, structure and function, and to support sustainable fishing communities." The following sections describe the Mid-Atlantic Council's involvement in a range of forage fish management efforts.

Managed Forage Species

Mackerel, Squid, Butterfish

Since 1983, the Mid-Atlantic Council has managed four forage species – Atlantic mackerel, *Illex* squid, longfin squid, and butterfish – under a single Fishery Management Plan (FMP). The Council sets annual catch limits, accountability measures, and other management measures that are intended to prevent overfishing while allowing these fisheries to achieve optimum yield.

In March 2019, the Mid-Atlantic Council approved an amendment to add chub mackerel to the Atlantic Mackerel, Squid, and Butterfish FMP. Chub mackerel may be important to the diets of tunas, marlins, and other predators in the Mid-Atlantic and have also been harvested by commercial fishermen. If approved by NOAA Fisheries, the Chub Mackerel Amendment will establish catch limits, accountability measures, and other conservation and management measures required under the Magnuson Stevens Fishery Conservation and Management Act for stocks "in the fishery."

River Herring and Shad

The Atlantic States Marine Fisheries Commission (ASMFC) has primary management responsibility for river herring (alewife and blueback) and shad (American and hickory). There are no directed fisheries in federal waters for these species. However, because they are caught in fisheries targeting other species, the Mid-Atlantic Council limits the incidental catch of river herring and shad in the Atlantic mackerel fishery through a catch cap that can close the directed mackerel fishery if it is reached. The Mid-Atlantic Council reviews river herring catch and abundance information annually when setting the cap and also collaborates with NOAA Fisheries and the ASMFC on a Technical Expert Working Group to help address broader river herring conservation issues. The Council is currently developing a geographic interface ("story map") designed to allow managers and the public to conveniently access up-to-date survey and run count information for all monitored river herring and shad runs on the east coast.

Unmanaged Forage Species

In August 2016, the Mid-Atlantic Council approved the Omnibus Unmanaged Forage Amendment. This amendment designated 16 forage species groups as ecosystem components in all the Council's fishery management plans. The intent of this action was to prohibit the development of new and expansion of existing directed commercial fisheries on certain unmanaged forage species in Mid-Atlantic federal waters until the Council has had an adequate opportunity to assess the scientific information relating to any new or expanded directed fisheries and consider potential impacts to existing fisheries, fishing communities, and the marine ecosystem.

Mid-Atlantic Forage Species and Species Groups Designated as Ecosystem Component Species

- Anchovies
- Argentines/Smelt Herring
- Greeneyes
- Halfbeaks
- Lanternfishes
- Round Herring
- Scaled Sardine
- Atlantic Thread Herring
- Spanish Sardine
- Pearlsides/Deepsea Hatchetfish
- Sand Lances
- Silversides
- Cusk-eels
- Atlantic Saury
- Unmanaged pelagic mollusks except sharptail shortfin squid
- Species under 1 inch as adults (Copepods, Krill, Amphipods)

None of these ecosystem component species have been assessed, and there are no biomass or abundance estimates. Many forage species are short-lived and undergo substantial cyclic fluctuations in stock size. Abundance of many of these species is sensitive to environmental factors. These factors pose challenges for traditional stock assessment and management approaches.

MAFMC Staff Contacts

- **Unmanaged Forage and Chub Mackerel:** Julia Beaty, jbeaty@mafmc.org, (302) 526-5250
- **Atlantic Mackerel, Squid, Butterfish and River Herring and Shad:** Jason Didden, jdidden@mafmc.org, (302) 526-5254

Additional Resources

- River Herring and Shad Management: http://www.mafmc.org/rhs
- Omnibus Unmanaged Forage Amendment: http://www.mafmc.org/actions/unmanaged-forage
- Chub Mackerel Amendment: http://www.mafmc.org/actions/chub-mackerel-amendment
- Unmanaged Forage Species Identification Guide: http://www.mafmc.org/s/NOAA-Mid-Atlantic-Forage-Species-ID-Guide.pdf
- Mid-Atlantic Council Ecosystem Approaches to Fisheries Management Guidance Document: http://www.mafmc.org/eafm

FIFTH COAST GUARD DISTRICT ENFORCEMENT REPORT

01 August 2019 – 30 September 2019

Presented to the Mid-Atlantic Fisheries Management Council
Prepared By:
Enforcement Branch
Fifth Coast Guard District

Table of Contents — Page

List of Abbreviations

CFVS – Commercial Fishing Vessel Safety
HC-130 – USCG Fixed-Wing Aircraft
WPB – 87’ Patrol Boat
STA – USCG Small Boat Station
EPIRB – Emergency Position Indicating Radio Beacon
WMEC – 210’ or 270’ Medium Endurance Cutter
M/V – Motor Vessel
FRC – 154’ Fast Response Cutter
SAR – Search and Rescue
WLB – 225’ Buoy Tender
P/C – Pleasure Craft
F/V – Fishing Vessel
A/S – Air Station
SEC - Sector
M/T – Motor Tanker

I. Mid-Atlantic Fisheries Enforcement and Marine Protected Species Operations

Operations Summary

During this period, major cutters, patrol boats and stations conducted fisheries patrols in the Mid-Atlantic in an effort to curtail illegal fishing throughout D5's AOR. Throughout this period, units conducted 320 boarding's.

Boarding Statistics (Note: "This Period" data should be considered preliminary and is subject to change)

01 August 2019 – 30 September 2019 Activities		Comparison to FY18
Fisheries Boarding's	320	97
Fisheries Boarding's w/Fishery Violations	2	6
Violation Rate	1%	6.2%

Activities Fiscal Year 2019		Comparison to FY18
Fisheries Boarding's	1,188	997
Fisheries Boarding's w/Fishery Violations	32	14
Violation Rate	2.7%	1.4%

Violation Summary

CGC LAWRENCE LAWSON issued 02 EAR violations to separate commercial fishing vessels targeting scallop for illegal gear configuration.

Marine Protected Species Support Summary

1. NSTR

II. Commercial Fishing Vessel Safety Efforts

(August 1, 2019 – September 30, 2019)

Fishing Vessel Dockside Safety Examinations	This Period	Fiscal Year to Date
Dockside Exams	22	373
Decals Issued	20	327
Commercial Fishing Vessel Safety Terminations	00	12

III. Search and Rescue Highlights

From August 1, 2019 – September 30, 2019, there were 11 marine casualties reported involving commercial fishing vessels:

- Allision – **1**
    - OCEAN PRIDE (O.N. 973175) 16 Aug 19

- Capsize – **0**

- Collision – **1**
    - MD8750AK (O.N. MD8750AK) 09 AUG 19 – The F/V MD8750AK collided with the F/V MD7374BY.

- Damage to Environment (Pollution/Hazmat) – **0**

- Death – **0**

- Fire – 1
    - AMANDA JEAN (O.N. 935272) 17 AUG 19 – The F/V AMANDA JEAN caught fire while moored at the Atlantic Refuge Center.

- Flooding – 3
    - VA6498HH (O.N. VA6498HH) 19 AUG 19 – The F/V VA6498HH began taking on water from an unknown location while moored at the Wachapreague Town Marina.
    - MUGGY LEE JR (O.N. 924552) 11 SEP 19 – The F/V MUGGY LEE JR began taking on water from an unknown location.
    - OCEAN STINGER (O.N. 1087344) 14 SEP 19 – The F/V OCEAN STRINGER began taking on water 16 NM offshore Masonboro Inlet through the STBD engine cooling supply line.

- Fouling – **0**

- Grounding – **0**

- Injury – **3**
    - CAPT PHILLIPS (O.N. 634816) 14 AUG 19 – A crewman on board the F/V CAPT PHILLIPS began experiencing abdominal pains and internal bleeding.
    - MOONRAKER (O.N. 561210) 15 AUG 19 – The master of the F/V MOONRAKER suffered a severe injury to his pointing and middle fingers.
    - McKENZIE (O.N. 1069510) 27 AUG 195 JUL 19 – A crewmember onboard the F/V McKENZIE tried to commit suicide by a self-inflicted wound.

- Loss of Propulsion/Steering – 2
    - HOPE & SYDNEY (O.N. 637907) 07 AUG 19 – F/V HOPE & SYDNEY became disabled due to main engine using excessive oil.
    - DISCOVERY (O.N. 523444) – 17 SEP 19 - F/V RETREIVER became disabled as a result to loss of electronics.

- MEDEVAC – 2

- CAPT PHILLIPS (O.N. 634816) 14 AUG 19 – A crewman on board the F/V CAPT PHILLIPS was MEDEVAC after experiencing abdominal pains and internal bleeding.
- CAPT POTTER (O.N. 640224) 05 SEP 19 – A crewmember onboard the F/V CAPT POTTER MEDEVAC due to chest pains.

- Fall(s) Overboard – **0**

- Sinking – 0

- Terminations – 0

IV. Outreach - CFVS Information

The CGD5 Commercial Fishing Vessel Safety Coordinator position has been vacated. Mr. Troy Luna has moved on and taken a position with the CG-CVC-3 Fishing Vessel Branch at CG Head Quarters. In the interim, LTJG Alexander Lane will be filling in and can be contacted for fishing vessel safety related issues. He can be reached at (757) 398-6324 or by email at Alexander.J.Lane@uscg.mil.

National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office
Sustainable Fisheries Division
www.greateratlantic.fisheries.noaa.gov

Status Report of Greater Atlantic Region Actions

Prepared for the October 7-10, 2019
Meeting of the
Mid-Atlantic Fishery Management Council

October 7, 2019

Table of Contents

New England Council Actions

Small-Mesh Multispecies

Possession Limit Reduction for Northern Red Hake

On September 12, 2019, NOAA's National Marine Fisheries Service (NMFS) published a temporary rule in the *Federal Register* (84 FR 48081) to reduce the Northern red hake possession limit from 3,000 lb to the incidental limit of 400 lb for the 2019 fishing year, effective upon filing, on September 9, 2019. This reduction was necessary because landings were projected to reach the 37.9 percent trigger on or around September 5, 2019. The 400 lb possession limit will be in effect for the remainder of the fishing year (i.e., through April 30, 2020). For additional information, please contact Laura Hansen at (978) 281-9225 or email at Laura.Hansen@noaa.gov.

Groundfish

None at this time.

Scallops

Closure of the Mid-Atlantic Scallop Access Area to the Limited Access General Category Individual Fishing Quota Fleet

On October 2, 2019, NMFS closed the Mid-Atlantic Scallop Access Area to Limited Access General Category Individual Fishing Quota vessels for the remainder of the 2019 fishing year. The closure ensures that the fleet will not exceed its 2019 allocation of 1,713 trips into the area. For additional information, please contact Travis Ford at (978) 281-9233, or email at Travis.Ford@noaa.gov.

Herring

Amendment 8

On August 21, 2019, NMFS published a notice of availability in the *Federal Register* (84 FR 43573) for Amendment 8 to the Atlantic Herring FMP. This amendment would implement a control rule generating an acceptable biological catch (ABC) intended to account for herring's role in the ecosystem and meet specific criteria identified by the Council, including low variability in yield, low probability of the stock becoming overfished, low probability of a fishery shutdown, and catch limits set at a relatively high proportion of maximum sustainable yield. This amendment would set ABC for three years, but would allow ABC to vary year-to-year in response to projected estimates of biomass. In order to minimize localized depletion and user group conflict, when effort in the herring fishery overlaps with effort in fisheries targeting predators of herring (e.g., tuna, groundfish) or ecotourism industries, this action would also prohibit the use of midwater trawl gear within 12 miles of the shoreline from Canada to the Rhode Island/Connecticut border and within 20 miles of the shoreline off Cape Cod. The comment period closes on October 21, 2019. Comments received by October 21, 2019, will be considered in the approval or disapproval decision on the amendment. For additional information, please contact Carrie Nordeen at (978) 281-9272 or email at Carrie.Nordeen@noaa.gov.

Monkfish

None at this time

Atlantic Deep-Sea Red Crab

None at this time.

Skate

None at this time.

Mid-Atlantic Council Actions

Summer Flounder, Scup, and Black Sea Bass

Framework Adjustment 14

On August 8, 2019, NMFS published a proposed rule in the *Federal Register* (84 FR 38919) for Framework Adjustment 14. This action proposes several changes to the summer flounder, scup, and black sea bass FMP to provide more flexibility in the recreational fisheries for these species. Proposed measures include an annual conversation equivalency consideration for black sea bass, a federal waters transit zone around Block Island Sound, and a maximum recreational size limit for summer flounder and black sea bass. The comment period was open through September 9, 2019. NMFS anticipates publishing a final rule for this action as soon as possible. For additional information, please contact Emily Gilbert at (978) 281-9244 or email at Emily.Gilbert@noaa.gov.

Interim 2020 Specifications for Summer Flounder, Scup, Black Sea Bass, and Atlantic Bluefish Fisheries

On July 26, 2019, NMFS published a proposed rule in the *Federal Register* (84 FR 36046) to set status quo interim 2020 specifications for scup, black sea bass and bluefish so that measures will be in place at the beginning of the fishing year as these fisheries have no rollover provisions. Some changes and revised specifications are expected following the results of the August operational stock assessments for these fisheries, but updates will not be able to be implemented in time for the beginning of the fishing year. This action also proposes 2020 and projects 2021 specifications for summer flounder. The comment period was open through August 26, 2019.

The final rule for this action is expected to publish as soon as possible to ensure specifications are in place for the beginning of the 2020 fishing year. For additional information, please contact Emily Gilbert at (978) 281-9244 or email at Emily.Gilbert@noaa.gov.

Scup Winter II Period Quota and Possession Limit Increase

On September 30, 2019, NMFS published a temporary rule to roll over unused quota from the Winter I period to the Winter II period for the scup fishery. The full amount of unused 2019 Winter I quota was transferred to Winter II, resulting in a revised 2019 Winter II quota of 9,090,487 lb. Because the amount transferred was between 5.0 and 5.5 million lb, the Federal per trip possession limit increased from 12,000 lb to 27,000 lb.

Summer Flounder Quota Transfers

On September 3, 2019, NMFS received two requests for quota transfers from North Carolina to Virginia and Maine to Connecticut. These transfers will allow North Carolina to transfer 12,500 pounds of summer flounder commercial quota to Virginia and Maine to transfer 5,224 pounds to Connecticut. After the temporary rule is published in the *Federal Register*, the revised summer flounder quotas for calendar year 2019 will be: North Carolina, 2,957,742 lb; Virginia, 2,390,710 lb; Maine, 0 lb; and Connecticut, 253,119 lb. The temporary rule was published in the *Federal Register* on October 1, 2019 (84 FR 52039). On **September 23, 2019** and **October 3, 2019** we received requests to transfer quota from North Carolina to Rhode Island and North Carolina to Virginia, resepectively. We are working on the requests and expect to publish a notice in the *Federal Register* in the next few weeks. For additional information, please contact Laura Hansen at (978) 281-9225 or email at Laura.Hansen@noaa.gov.

Surfclam and Ocean Quahog

Surfclam and Ocean Quahog ITQ Cost Recovery

The 2019 cost recovery tag fees were announced on September 3, 2019, as $0.92 per surfclam tag and $0.55 per ocean quahog tag. Cost recovery bills based on these cage tag fees will be sent in early 2020 based on the number of cage tags used during the 2019 fishing year. For additional information, please contact Doug Potts at (978) 281-9341 or email at douglas.potts@noaa.gov.

Habitat Clam Dredge Exemption Framework

On September 17, 2019, NMFS published a proposed rule (84 FR 48899) to establish three exemption areas within the Great South Channel Habitat Management Area (HMA) where vessels could fish for Atlantic surfclams or mussels using dredge gear. Comments on the proposed measures must be received by October 17, 2019. The HMA was created by the New England Fishery Management Council's Omnibus Habitat Amendment 2, which prohibited the use of all mobile bottom-tending fishing gear in the HMA. The HMA contains complex benthic habitat that is important for juvenile cod and other fish species, and it is susceptible to the adverse impacts of fishing gear. There was a 1-year delay of the HMA closure that allowed the surfclam fishery to continue fishing with hydraulic clam dredges in the HMA. The 1-year delay ended on April 9, 2019, and the HMA is currently closed to all mobile bottom-tending fishing gear. For additional information contact Doug Potts at 978-281-9341 or Douglas.Potts@noaa.gov.

Atlantic Bluefish

None at this time

Spiny Dogfish

None at this time

Atlantic Mackerel, Squid, and Butterfish

Proposed Rule for Framework Adjustment 13 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan
On June 7, 2019, NMFS published a proposed rule in the *Federal Register* (84 FR 26634) for Framework 13. This proposed rule includes measures that would adopt a 5-year rebuilding plan for Atlantic mackerel to rebuild the stock by 2023, set Atlantic mackerel specifications for 2019-2021 based on the rebuilding program, modify in-season management measures to slow the directed fishery to allow for Atlantic mackerel bycatch in other fisheries, and update the river herring and shad catch caps in the Atlantic mackerel fishery. The comment period was open through July 8, 2019, and we expect to publish a final rule in early fall. For additional information, please contact Aly Pitts at: (978) 281-9352, or email at alyson.pitts@noaa.gov.

Tilefish

None at this time

Other Actions

Paperwork Reduction Act

Comment Period for American Lobster Trap Transfer Program Form
NMFS published a notice in the *Federal Register* (84 FR 47495) on September 10, 2019, requesting comments for the Paperwork Reduction Act in effort to reduce paperwork and respondent burden for the Amercian lobster Trap Transfer Program form. Comments are invited on the necessity of the collections, the accuracy of the agency’s estimate of burden, ways to enhance the collection, and ways to minimize the burden on respondents. The comment period for the information collection is open through November 12, 2019

Direct all written comments to Adrienne Thomas, PRA Officer, NOAA, Room 159, 151 Patton Avenue, Asheville, NC 28801(or via email at PRAcomments@doc.gov).

Requests for additional information or copies of the information collection instrument and instructions please contact Laura Hansen at (978) 281-9225 or email at Laura.Hansen@noaa.gov.

Comment Period for the Tilefish Individual Fishing Quota (IFQ) Forms
NMFS published a notice in the *Federal Register* (84 FR 53111) on October 3, 2019, equesting comments for the Paperwork Reduction Act in effort to reduce paperwork and respondent burden for the IFQ Allocation permit application, IFQ holder cap form, and the IFQ transfer form. Comments are invited on the necessity of the collections, the accuracy of the agency's estimate of burden, ways to enhance the collection, and ways to minimize the burden on respondents. The comment period for the information collection is open through **December 3, 2019**. For additional details, please see the Greater Atlantic Region Status of Actions report.

Direct all written comments to Adrienne Thomas, PRA Officer, NOAA, Room 159, 151 Patton Avenue, Asheville, NC 28801(or via email at PRAcomments@doc.gov).

Requests for additional information or copies of the information collection instrument and instructions please contact Doug Potts at 978-281-9341 or Douglas.Potts@noaa.gov.

Jonah Crab

None at this time.

Industry Funded Monitoring Omnibus Amendment

None at the time.

Lobster

Advance Notice of Proposed Rulemaking to Establish a Control Date
On August 22, 2019, NMFS published an Advance Notice of Proposed Rulemaking in the *Federal Register* announcing a control date of April 29, 2019 for the lobster fishery. The intent of the control date is to inform American lobster permit holders and any potential new entrants that future participation and eligibility may be affected by past participation, documentation of landings, effort, and/or gear configuration prior to the control date. The Atlantic Large Whale Take Reduction Team (TRT) met in early April 2019. At the meeting, the New England states and the offshore lobster industry committed to reducing the risk of serious injury and mortality from lobster gear to North Atlantic right whales by 60 percent in all lobster management areas. The specific measures to achieve this goal are not yet finalized, but will focus on reducing the number, and lowering the breaking strength of, vertical lines used in the lobster trap fishery. Following the outcome of the TRT meeting, the Commission met and voted to establish a control date of April 29, 2019. NMFS will use April 29, 2019, as a control date for the same reasons outlined by the Commission. In the coming months, NMFS will be working with the states and the industry to develop more specific management measures to achieve the goals recommended by the TRT. Should the Commission take future action related to this control date, NMFS will consider complimentary regulations in Federal waters. For more information, please contact Laura Hansen at (978) 281-9225, or email at Laura.Hansen@noaa.gov.

Habitat Actions

Omnibus Deep-Sea Coral Amendment
On August 26, 2019, NMFS published a Notice of Availability (NOA) (84 FR 44596) in the Federal Register for the Omnibus Deep-Sea Coral Amendment. This action would implement measures that reduce impacts of fishing gear on deep-sea corals in the Gulf of Maine and on the outer continental shelf. In doing so, this action would prohibit the use of mobile bottom-tending gear in two areas in the Gulf of Maine (Mount Desert Rock and Outer Schoodic Ridge), and it would prohibit the use of all gear (with an exception for red crab pots) along the outer continental shelf in waters no shallower than 600 meters. The comment period for the NOA is open through October 25, 2019. NMFS will publish a proposed rule for this action in the near future. The decision date for this action is November 22, 2019. For additional information, please contact Travis Ford at (978) 281-9233, or email at Travis.Ford@noaa.gov.

Protected Resources Actions

None at this time.

Research Permits and Acknowledgments - Applications Under Review

Cornell University Cooperative Extension (CCE) submitted an application for a Letter of Acknowledgement (LOA) on June 14, 2019. This LOA would allow one federally permitted monkfish vessel to conduct approximately 30 research trips to test modified gillnet gear. The goal of the study is to examine the effect of increased mesh size and twine thickness on skate bycatch. The research trips will occur in statistical areas 539,537, and 613. Research trips will be accompanied by at least one CCE researcher. For additional information, please contact Laura Hansen at (978-) 281-9225, or email at Laura.Hansen@noaa.gov.

The Coonamessett Farm Foundadtion (CFF) submitted an Exempted Fishing Permit (EFP) application to conduct habitat research in the GSC HMA on June 10, 2019. CFF is proposing to use dredge-mounted cameras in sections of Rose and Crown and Davis Bank to conduct compensation fishing and to examine the interaction of the dredge with habitat. Compensation fishing would fund work using drift and stationary baited cameras to study the presence of juvenile cod in these areas. NMFS sent a response letter on August 7, 2019, outlining our concerns with the project as proposed. The main concerns were the scope and scale of the project, relating to the amount of on-bottom contact and the potential impact on sensitive habitat. The potential effort as proposed is significantly higher than historical levels before the HMA was established. NEPA staff noted that as proposed, the project would probably not qualify for a Categorical Exclusion and would likely require an Environmental Assessment or EIS. It was also unclear how the project objectives relate to and address the Council's objectives for the Great South Channel HMA. CFF sent a response letter on August 23, 2019, with some modifications to their swept area calculations, but otherwise argued for keeping the proposal as submitted. NMFS sent a follow up email to CFF on September 16, 2019, and suggested limiting the initial scope of the research, thereby reducing its potential adverse impacts. Regional Office staff had a call with CFF staff and potential EFP participants on October 3, 2019. NMFS and CFF came to a potential workable solution to reduce the scope and scale of the project by limiting the proposed dredging areas to smaller identified areas spread out within Rose and Crown. CFF will be refining their proposal after having a discussion with vessel captains. NMFS asked that CFF continue to have an open discussion regarding their new proposal before submission. For additional information, please contact Laura Hansen at (978) 281-9225, or email at Laura.Hansen@noaa.gov.

On August 29, 2019, NMFS received an application for an Exempted Fishing Permit (EFP) from DMF and SMAST. This EFP would authorize four party/charter vessels to retain sub-legal size Atlantic cod for biological samping purposes only. The data collected through this EFP would help scientists better characterize spawning seasons, sex ratios, demographics, genetics, and growth rate of cod around the Deepwater Wind Lease Area For additional information, please contact Maria Vasta at (978) 281-9196, or email at Maria.Vasta@noaa,.gov.

Research Permits and Acknowledgments - Application Review Completed

On September 24, 2019, NMFS issued an Exempted Fishing Permit to the Commercial Fisheries Research Foundation in support of a project titled, "Piloting a Novel Dredge Type to Reduce Bycatch and Improve Fuel Efficiency in the Southern New England Scallop Fishery." Participating vessels will conduct scallop dredging from September 24, 2019 to September 24, 2020. The study will test a relatively new gear type in the scallop fishery that could maintain target catch while reducing bycatch, minimizing habitat impacts by minimizing dredge penetration into and resistance along the seafloor, and improving fuel efficiency by towing at lower speeds. For addition information, please contact Travis Ford at (978) 281-9233 or email at Travis.Ford@noaa.gov.