November 2022 Briefing Materials

N.C. Marine Fisheries Commission

Business Meeting

Nov. 16-18, 2022

Emerald Isle, NC

NC Marine Fisheries Commission

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AGENDA

Islander Hotel
Emerald Isle, NC
November 16-18, 2022

N.C.G.S. 138A-15(e) mandates at the beginning of any meeting of a board, the chair shall remind all members of their duty to avoid conflicts of interest under Chapter 138. The chair also shall inquire as to whether there is any known conflict of interest with respect to any matters coming before the board at that time.

N.C.G.S. 143B-289.54.(g)(2) states a member of the Marine Fisheries Commission shall not vote on any issue before the Commission that would have a "significant and predictable effect" on the member's financial interest. For purposes of this subdivision, "significant and predictable effect" means there is or may be a close causal link between the decision of the Commission and an expected disproportionate financial benefit to the member that is shared only by a minority of persons within the same industry sector or gear group. A member of the Commission shall also abstain from voting on any petition submitted by an advocacy group of which the member is an officer or sits as a member of the advocacy group's board of directors. A member of the Commission shall not use the member's official position as a member of the Commission to secure any special privilege or exemption of substantial value for any person. No member of the Commission shall, by the member's conduct, create an appearance that any person could improperly influence the member in the performance of the member's official duties.

Commissioners having questions about a conflict of interest or appearance of conflict should consult with counsel to the Marine Fisheries Commission or the secretary's ethics liaison. Upon discovering a conflict, the commissioner should inform the chair of the commission in accordance with N.C.G.S. 138A-15(e).

Wednesday, November 16th

6:00 p.m. Public Comment Period

Thursday, November 17th

9:00 a.m. Preliminary Matters

- Commission Call to Order* - Rob Bizzell, Chairman
- Moment of Silence and Pledge of Allegiance
- Review Ethics Evaluations of New Commissioner
- Conflict of Interest Reminder
- Roll Call
- **Approval of Agenda ****
- **Approval of Meeting Minutes****

9:45 a.m. Public Comment Period

10:15 a.m. Chairman's Report

- Letters and Online Comments
- Ethics Training and Statement of Economic Interest Reminder
- 2023 Meeting Schedule
- Commission Committee Assignments
- **Delineation of Inland and Coastal Fishing Water Boundaries****

11:00 a.m. Committee Reports

- Nominating Committee – Chris Batsavage
  - **Vote on slate of nominees for the obligatory seat for the Mid-Atlantic Fishery Management Council****
- Regional Advisory Committees – Northern, Southern
- Standing Advisory Committees – Finfish, Shellfish/Crustacean, Habitat and Water Quality

11:30 a.m. Director's Report – Director Kathy Rawls

Reports and updates on recent Division of Marine Fisheries activities

- Division of Marine Fisheries Quarterly Update – Director Rawls
- Atlantic States Marine Fisheries Commission – Chris Batsavage
  - Shad Sustainable Fishery Report Update
- Mid-Atlantic Fishery Management Council Update – Chris Batsavage
- South Atlantic Fishery Management Council Update – Director Rawls
- Shellfish Lease Program Update – Owen Mulvey-McFerron
- Coastal Habitat Protections Plan Update – Jacob Boyd
- Marine Patrol Update – Col. Carter Witten
- License and Statistics Annual Report ("The Big Book") Update – Brandi Salmon

- Informational Materials:
  - Highly Migratory Species
  - Protected Resources Update
    - Observer Program
    - Incidental Take Permit Updates
  - Landings Updates

12:30 p.m. Lunch Break

2:00 p.m. Fishery Management Plans

- Status of ongoing plans – Corrin Flora
- Spotted Seatrout Fishery Overview – David Behringer, Lucas Pensinger
- Spotted Seatrout Stock Assessment Update – Yan Li
- Amendment 2 to the Estuarine Striped Bass FMP (Draft) – Nathaniel Hancock, Todd Mathes, Charlton Godwin, Joe Facendola, Steve Poland
  - **Vote on final approval of Amendment 2 to the Estuarine Striped Bass FMP****

Friday, November 18th

9:00 a.m. Fishery Management Plans Continued

- Supplement A to Amendment 1 of the Striped Mullet FMP (Draft)– Dan Zapf, Jeff Dobbs
  - Overview of Supplement
  - **Vote on Supplement A to Amendment 1 of the Striped Mullet FMP****

- Amendment 2 to the Striped Mullet FMP (Draft) – Jeff Dobbs, Dan Zapf
    - Scoping Period Overview
    - **Vote on approval of Goal and Objectives****
    - Provide Input on Management Options

11:00 a.m. Rulemaking

- **Rule Suspensions – Steve Poland****
- Rulemaking Cycle Updates – Catherine Blum
    - 2021-2022 Rulemaking Cycle Update
    - 2022-2023 Rulemaking Cycle Update
    - 2023-2024 Rulemaking Cycle Preview

11:40 a.m. Issues from Commissioners

12:10 p.m. Review of MFC Workplan and Meeting Assignments – Lara Klibansky

12:30 p.m. Adjourn

Marine Fisheries Commission Business Meeting Minutes
Courtyard Marriott
Jacksonville, North Carolina
Aug. 17-18, 2022

The commission held a business meeting Feb. 23-25 at the DoubleTree Hotel in New Bern, North Carolina. In addition to the public comment session, members of the public submitted public comment online or via U.S. mail. To view the public comment, go to: https://deq.nc.gov/media/31006/open

The briefing materials, presentations, and full audio from this meeting are available at: https://deq.nc.gov/about/divisions/marine-fisheries/marine-fisheries-commission/marine-fisheries-commission-meetings#quarterly-business-meeting---august-17-18-2022

Actions and motions from the meeting are listed in **bolded** type.

BUSINESS MEETING - MOTIONS AND ACTIONS

On Aug. 17, a public comment session was held beginning at 6 p.m. Chairman Rob Bizzell called the meeting to order. The following individuals spoke:

Jerry Schill, Director of Government Affairs for the N.C. Fisheries Association, spoke about striped bass management and the MFC's decision about closing gill nets above the ferry lines that ignored the science. Then-DMF director Steve Murphey and then-DEQ Secretary Regan commented to that effect. The Fisheries Reform Act was signed into law by Governor Hunt 25 years ago and is what put the MFC in existence; it exists because of that statute. Just like they put in statute the make-up of the MFC and its powers and duties, they also put in oversight of the MFC. He reminded the MFC there is a spotlight on the commission about whether you are abiding by your duties and responsibilities, especially when it comes to the area of science.

Captain Josiah Irwin is in the U.S. Marine Corps and transferred PCS (permanent change of station) here from California. He said N.C. fisheries was a big reason he decided to PCS here. Capt. Irwin said he has been fishing since he was 10 years old, and it has been a big part of his life. He has traveled the world, both in the Marine Corps and during his five years in college as an oil field worker in Qatar, Dubai, Saudi Arabia, Texas, Oklahoma, and North and South Dakota, and fisheries laws here seem to be a little "out-of-whack" and could be practiced a little better. He said this is especially true for flounder and red snapper seasons; they seem to be mismanaged, not like in Hawaii and Guam where there are no regulations, but a better way would be like in Texas. There, for red fish, you get a tag to go with that red fish that you pay for beforehand. If something like this was implemented for red snapper or flounder, the commission could reduce the numbers of fishermen, increase profits, and implement the tags for about three dollars. This would be an easier way to measure the number of fish coming in and the commission could avoid going over what is allowed to be caught.

Thomas E. Newman IV, a full-time commercial fisherman, member of the MFC Northern Regional Advisory Committee, and N.C. Fisheries Association part-time employee, spoke to urge the commission to reopen the gill nets above the ferry lines for all user groups, particularly commercial fishermen. During the March 2019 MFC emergency meeting, the rationale commissioners used to close the Neuse and Pamlico rivers to the use of gill nets was to protect a breeding-age class of striped bass. He said the March 2019 river closure was unjustified and deemed unnecessary by then-DMF Director Murphey and then-DEQ Secretary Regan. Mr. Newman said this was not about protecting striped bass but was a means to an end to remove a legal harvest method that some people do not like. Gill nets produce the least amount of striped bass discards in these areas. Recreational discards were two and half times higher than commercial discards in these two river systems alone from 2012 to 2020. This does not include the hundreds of thousands of discards from the Albemarle-Roanoke stock. The commissioners also said that reopening the rivers to gill nets would be looked at in two years at the next striped bass FMP amendment. The division and the FMP advisory committee did just that for draft Amendment 2 for the February 2022 MFC meeting. The draft included an option to reopen the rivers to the use of gill nets. But during that meeting, the commission voted to remove the option before it was reviewed by the advisory committees and the public. At the May 2022 MFC meeting, the hastiness, bad judgement, and unfairness used by the commission in 2019 was discussed. This discussion was not about protecting a breeding-age class of striped bass, it was anecdotal about how recreational fishermen are catching more and bigger fish because there are no gill nets in the water. The MFC had no scientific evidence to justify continuing this closure, but they voted gill nets as "guilty" once again. But this time they said they would look for evidence that gill nets are affecting the striped bass stock: condemned as guilty first, then look for evidence three years later, which is not the way this commission should operate. Commercial fishermen deserve equal access to have the opportunity to harvest fish from these areas. For many citizens of the State, the only way to get fresh seafood and bait is to buy commercially harvested fish. Keeping these areas closed limits consumer access to fresh seafood and bait.

Senator Norman Sanderson, Senate Vice-Chair of the N.C. General Assembly Joint Standing Committee for Appropriations on Agriculture, Natural, and Economic Resources, said he commends the commission on the role they play, as it is very important to the citizens of North Carolina. He gave a "shout out" to the staff of the DMF, especially officers who put their lives on the line to protect natural resources for all of us. He said he appreciates the efforts of the DMF and the MFC on preparing the latest amendment to the N.C. Estuarine Striped Bass FMP. The number one goal for any new or revised FMP should always be to provide sustainable fisheries and populations across all our endangered species. He said he commends the effort put into the plan but has significant concerns about extending the ban on gill nets in the upper Neuse and Pamlico rivers above the ferry lines; this action does not appear to be based on science and is not part of the original DMF proposal. It was added by this commission at its February 2022 meeting. He said the current exclusions were put in place in 2019 at an emergency meeting of the MFC. That decision led to then-DEQ Secretary Michael Regan to issue a news release saying the MFC had used bad judgement and directing the DMF to include the gear exclusions contradicts science and the recommendations of the DMF scientists. Then-Director Murphey sent a five-page letter to current MFC Chair Rob Bizzell after the MFC decided to close the areas. His letter documented the DMF concerns on instituting a gill net ban in light of the evidence. He stated that such a measure is not supported by the data as the primary or even the most significant source of discard mortality.

Senator Sanderson said he is concerned that during the MFC advisory committee review process that is required by the Fisheries Reform Act of 1997 that there was no public comment accepted on extending the closure or reopening the areas to gill nets. The current recommended action to ban the use of gill nets despite the fact an advisory committee voted for the upper river areas to be opened to gill netting has him wondering where is the right and where is the wrong. He said it is his understanding that no new data has been collected since 2019 that sheds additional light on this issue and the concerns expressed by the DMF, regional advisory committees, and Secretary Regan in 2019 are still valid. Senator Sanderson said the lack of new data, the fact that existing science does not appear to support such action, the fact that DMF did not propose such action in its original plan, and given that the advisory committees advised to reject the proposal should cause the commission to be concerned about including this management measure at this time. Actions taken this week must provide for fair regulation of both commercial and recreational fishing groups and all citizens of North Carolina as we move towards fish populations' sustainability.

Hodge Jordan spoke about the Incidental Take Permits (ITPs) that are up for renewal in 2023. He said the ITPs are for endangered species and asked for confirmation that we must have that to have gill nets. He also asked how many reported kills of turtles by fishermen and netters have been received, how many for sturgeon, and how much bycatch there has been. He said there is 48 percent bycatch in gill nets and 100 percent mortality of the bycatch. He said if these numbers are not reported by the netters themselves, then the monitoring we have does not seem to be working. He asked if a fisherman has a turtle or any endangered species caught in a net, how the fisherman is supposed to release it because it is illegal to touch it. All the fisherman can do is report it. He said the ITPs need more of a public forum so people are informed of what they can and cannot do, exactly what the ITPs mean to the public, and not just read about it. This is about a public resource, so there should be public information in a forum they can understand without bias. He said he realizes there is a difference between commercial and recreational fishermen. There is a balance we need to maintain. He said science is science and without good data, there will not be good results.

David Sneed, Coastal Conservation Association of N.C. Executive Director, said he grew up in eastern North Carolina, so conservation of N.C. resources is important to him personally, not just professionally. The house next to his has a family with a father and two grown sons that he watched fish off their pier all night long. The father said their boys were excited to move here because they love to fish. Mr. Sneed also saw commercial crab boats come by the same piers each morning to check their pots. He said it gave him an idyllic vision of how the fishing public and commercial fishermen can coexist in the same environment when a healthy fishery is present. He said he grilled fresh local mahi for dinner one night and fried farm-raised oysters from Commissioner Cross's Pamlico Packing Company that he mentions, not to curry favor, but because one of his wife's favorite Sunday night dinners is fried oysters. He said CCA would like to encourage the commission to work with stakeholders not as adversaries, but as partners, toward a future that produces a truly sustainable and abundant coastal fishery as anglers, commercial fishermen, and consumers, and the public that may never wet a line or eat seafood at all, but maybe they just enjoy an the environment where they can watch dolphin and sea turtles swim freely along the State's coast; a future where our children can grow up with a love for fishing off the end of the pier and the commercial fishermen can supply us with sustainable local seafood. He said the commission has a light agenda this week, but there is plenty of work ahead if we want to restore our fisheries where it should be and reverse the effect decades of overfishing have had on fish stocks like striped bass, spot, croaker, weakfish, blue crab, and southern flounder. He said Amendment 3 to the Southern Flounder FMP spelled it out very clearly: "overfished means there are not enough mature females to produce enough young. Overfishing means that fish are being removed faster than they can be replaced. Reducing the number of fish removed annually is needed to increase the southern flounder stock to sustainable levels." He said to him, the message is clear: stop managing for maximum harvest and start managing with the conservation thresholds so we are putting away some fish for the future. That is the true path to a sustainable fishery. With the commission's help, we can leave a healthy coastal fishery for our children and grandchildren.

Mike Brady, a recreational fisherman, spoke about what he has personally seen in North Carolina. He said he is from North Carolina, served in the U.S. Navy, and obtained degrees from North Carolina state universities. He fished starting when he was in elementary school and has fished at piers, inshore, near shore, and offshore. He has seen the fisheries flourish, diminish, and now he sees struggling fisheries. He said two or three times per week in the marsh he watched boats go by, but last year he saw about as many net boats as he has seen in his life. Mr. Brady said it is a small area and he said he wondered what in the world they could be doing because the fish were not around. He has seen trout fisheries shut down in the White Oak River on the first day that netting season started. Before that, he said he was catching nice slot, keeper-size trout, releasing 15-17 trout per trip, but as soon as the net season started, that stopped. Now, he is lucky to catch undersize trout. He said the fishery cannot be sustained when there are these events. He said gill nets are not a friend to fish, turtles, or anything in the waters, including divers too; it is destructive. Whether fish are caught in the nets or stay in the nets, fish are damaged and probably will not survive if they do get out. He said there has got to be a better way: hook and line fishing. He said he releases fish in good health and takes the effort; he has a rubberized net so he does not damage the fish. With these efforts, everyday fishermen are trying to sustain and keep the fisheries going. He said part of the netting problem he saw last year was no one was accounting for it; he said he did not see fishery officers. Mr. Brady said he knows the State is undermanned. There have been very few people taking surveys at ramps on recreational numbers. He asked how the recreational catch numbers are determined. He asked the commission to start looking at harvest and release numbers and stop using "catch", to be more accurate.

Donald Willis said he has made his money on recreational fishing for four decades and has attended fisheries meetings for 30 years. He said he has seen "maximum extraction" voted in, with status quo after that on fish that have been overfished for years; he watched four major fisheries crash and burn. He has seen the commission go from being inactive on taking care of the resource to being reactive. He hopes the new commission composition will be proactive. He said if we protect the resources, we take care of everybody, including commercial and recreational fishermen, and we cannot do it if we take too many fish due to greed. He has watched what has happened in his lifetime and is looking for good things from this commission. He said in the upper Neuse River and the upper Tar-Pamlico River it is amazing what is going on now that the gill nets are out of the rivers. He said he understands why commercial fishermen want the rivers reopened to gill nets; the fish are up there. Mr. Willis said if you get past the ferry lines, there is hardly anything because everything is upriver. He said we must look at other states that have done the same things on a larger scale and they still have a commercial fishery, and it is better than North Carolina's. If there is more resource, more fish, then everybody benefits. He reminded the commission their number one job is to take care of the resource. Take care of it and it will take care of all of us and that is all he asks.

Rocky Carter said he is not from eastern North Carolina, he is from Western North Carolina and was born in Asheville, 365 miles from this area. He said he came here to fish when he was young, fell in love with coast of North Carolina, and 17 years ago chose to make his life here, and to die here. He said when he came here there was great and abundant fishing, but he has seen and experienced the decline with his friends and neighbors and with their entire fishing community in Swansboro. He is concerned about the process to obtain an ITP (Incidental Take Permit) in North Carolina. He has questions about who fills out the application, perhaps someone with a regular job at the DMF or maybe contractors hired to complete the paperwork. He asked what the cost to North Carolina is to have an ITP and who pays the bills, like maybe taxpayers. He also asked if the commission is involved in the approval of the application for an ITP; as the governing body who makes the rules, he asked how involved the commission is with the ITPs. He said he has not heard it in any public forum and asked if it is brought up in any of the advisory committee meetings and if so, what committee meetings, who chairs those, and what data is available from those meetings saying this was adequately discussed and seemed to be necessary for the citizens of the State. He said with approximately 800 gill net fishermen in the State, each allotted with 800 yards of gill nets, coincidentally that makes about 365 miles of gill nets in North Carolina, the same distance from here to where he was born in Asheville. He asked with that many miles of nets in the water, how many interactions with turtles are self-reported by commercial fishermen and if it matches the expectation with that many miles.

Bruce Mclaughlin said after doing everything he could for 26 years to avoid coming to North Carolina in the U.S. Marine Corps, they dropped him off in North Carolina in 2004 where he retired after serving 30 years. Among the many reasons he said he stayed here is that this is a beautiful place and a wonderful community with great people. He stayed here primarily because of fishing opportunities that he observed and participated in when he came here in 2004. Since then, he has watched a steady decline of just about every inshore species of fish that he has pursued and fished for. He said every single one has gone downhill. There have been many opportunities to take a proactive management stance, but it has eluded commissions prior to this one. He urged the commission to take a very good look at where the fisheries are and were, and where they need to go, and stop the excessive take, especially of species like southern flounder; the commission had an opportunity 10 years ago to fix that and did not take it and here we are today.

<u>Aug. 18</u>

Chairman Rob Bizzell convened the Marine Fisheries Commission business meeting at 9 a.m. on Aug 18. and reminded commissioners of their conflict of interest and ethics requirements.

The following commission members were in attendance: Rob Bizzell-Chairman, Mike Blanton, Doug Cross, Donald Huggins, Robert McNeill, Dr. Doug Rader, Tom Roller, and Ana Shellem.

Motion by Mike Blanton to approve the agenda.

Second by Robert McNeill.

Motion passes unanimously.

Motion by Tom Roller to approve the minutes of the May 25-26, 2022 and the June 23, 2022 meetings.

Second by Doug Cross.

Motion passes unanimously.

__Public Comment Period__

A public comment session was held beginning at 9:05 a.m. The following individuals spoke:

Glenn Skinner, Executive Director of the N.C. Fisheries Association (NCFA) and a commercial fisherman, spoke about the Estuarine Striped Bass FMP Amendment 2 and he noted that the new commissioners were not involved in the process that led to the gill net ban in the Neuse and Pamlico rivers. He said they should be proud of that because the process that led to this has been disgraceful. He explained that there was no public comment allowed at the emergency MFC meeting and there was no advice from the MFC advisory committees. Then-director of the DMF, Steve Murphey, declined the initial request to issue a proclamation banning the gill nets because it was not supported by science; however, he was forced to issue it by the commission. Mr. Skinner reminded the commission that shortly afterward, then-DEQ Secretary Michael Regan issued a press release about the gill net ban, and this was the first time he is aware of a DEQ Secretary publicly condemning the commission's actions; this was a strong statement. He said the fact that there are new commissioners does not prevent the commission from doing the right thing. Mr. Skinner said approving Amendment 2 to the striped bass plan with this language means the commission approves of the process that led to it. He urged the commission to step up and do the right thing to try to restore some integrity to the commission and the fisheries management process. He said he hopes that is as important to the commission as it is to him and the over 2,000 members he represents. He said this is an opportunity to get the commission on the right track and show they intend to do what they were tasked with in the Fisheries Reform Act, which is to fairly manage both sectors. Mr. Skinner said the NCFA understands that management measures have to be implemented for the species. But he said the gill net ban was not supported by science and still is not supported by science. It is absurd to still have the gill net ban in the amendment; it is more absurd to ask the DMF to look for data to justify the net ban. He said the commission is supposed to look at all the data before implementing management measures. He asked the commission to please take all of this into consideration as they deliberate. He suggested the commission ask the DMF staff questions and get up to speed on this situation before voting. He said this is the last administrative step before it is final and if it is adopted, the gill net ban cannot be lifted without reopening the FMP. He implored the commission to not let that happen.

Stuart Creighton spoke about the final vote on the Estuarine Striped Bass FMP Amendment 2, which contains a continuation of the gill net ban above the ferry lines in the Neuse and Tar/Pamlico rivers. He reminded the commission they voted twice by a supermajority to maintain the gill net ban and urged the commission to maintain that in the final vote. He distributed a handout with a graphic showing that commercial fishermen have not been hurt at all by the ban. He said the division data show there are more spotted seatrout and striped mullet harvested commercially than before the ban was put in place in 2019 and said southern flounder harvest is only down because of Amendment 2. He said red drum harvest remains low but fairly consistent in each system. He further explained that the ban is working, striped bass are larger and more numerous, and the net ban is having a beneficial effect to other fisheries upriver, like red drum, spotted seatrout, and white perch. He has heard the arguments about no science; however, the initial stock assessment itself called for significant action to rebuild the striped bass population, which ought to be science enough. He said it is often downplayed that the Rachels and Ricks study showed gill net mortality is the primary source of cryptic mortality experienced by striped bass in those river systems. He then noted that based on the public opinion shared in the survey for the commission's last meeting, 60 percent wanted the net ban maintained and only 10 percent of the public wanted it lifted. Regarding observations, he said over nine years there were only 119 striped bass interactions, which over those three major river systems averages about six observations per year; he said that is not much of a snapshot. He said he wanted to discuss more on the ITPs and shrimp trawl bycatch as it relates to southern flounder, but he was not able to because of the time limitation.

Jess Hawkins, former MFC liaison for the division and a former commissioner, said he is a lifelong resident of North Carolina and grew up on the water. He said he is a recreational fisherman that runs a small business providing nature tours. He spoke about the Estuarine Striped Bass FMP Amendment 2 and noted that the gill net ban in the rivers was not based on science and was not necessary. He further explained that prior to the net ban, there were numerous measures put in place by the division to reduce bycatch from gill nets in those areas. He said the net ban was not part of the FMP; statutorily the FMP is prepared by the division, the scientific experts, then the commission has input, and then decides to approve the plan or not approve the plan. He said both the commission's experts and the MFC advisers did not support this measure. He reminded the commission our state leaders admonished this body in 2019 when the commission took this action, due to the lack of science and the way the issue was addressed. He said this management measure does not address the major source of bycatch mortality for striped bass in these areas, which is recreational bycatch. Mr. Hawkins said that legislators have taken a rare opportunity to express their concerns about this plan and noted that has only happened two other times in his 40 years of dealing with fisheries issues. He acknowledged that the decisions the commission makes are difficult sometimes and the science is uncertain sometimes, but he said the main test for the commissioners to use is to ask themselves if the management measures are fair. He said this gill net ban was not fair and possibly violates the commission's statutory responsibility for fair regulation of commercial and recreational fishermen. He said that provision was included so that in cases when science is not strong, the commission can use a fair moral compass in its decisions.

<u>Chairman's Report</u>.

Mike Blanton nominated Doug Cross for vice chairman.
Tom Roller nominated Robert McNeil for vice chairman.

Votes for Commissioner Cross: 5
Votes for Commissioner McNeil: 1
The commission elected Doug Cross to another term as vice chairman.

Director’s Report

Director Kathy Rawls gave a verbal update on recent Division of Marine Fisheries activities. Director Rawls provided an update on the 200th Anniversary events that will begin December 1st, 2022. Director Rawls also reviewed her intention to focus on Division outreach to the public and highlighted recent events and activities staff have participated in. Director Rawls reviewed the upcoming implementation of Southern Flounder FMP Amendment 3, including an overview of the various season openings and closings. Regarding striped mullet, the Director stated her intention to pursue a supplement for management based on the recent outcome of the benchmark stock assessment.

Director Rawls announced the upcoming retirement of Deputy Director Dee Lupton.

Deputy Director Dee Lupton gave a verbal update on the Federal Economics Assistance Programs.

Chris Batsavage gave verbal updates on the Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council.

Trish Murphey gave a verbal update on South Atlantic Fishery Management Council.

Motion by Tom Roller that the NC Marine Fisheries Commission write a letter to the South Atlantic Fisheries Management Council stating that we are supportive of the current management measures under the Amendment 10, as we do not believe that the proposed management measures are equitable to North Carolina. Additionally, we support further assessment of climate and other impacts to these stocks.
Second by Robert McNeil

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill	x			
Doug Rader	x			
Tom Roller	x			
Ana Shellem	x			
Chairman Rob Bizzell	x			

Motion passes unanimously

Motion by Tom Roller to update the 2017 false albacore white paper and to frame potential management options for future consideration.
Second by Doug Rader

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross	**x**			
Mike Blanton	**x**			
Donald Huggins	**x**			
Robert McNeill	**x**			
Doug Rader	**x**			

Tom Roller	**x**			
Ana Shellem	**x**			
Chairman Rob Bizzell	**x**			

Motion passes unanimously

Lara Klibansky provided an overview of the Climate Change Scenario Planning Workshop she attended in June 2022.

Owen Mulvey-McFerron provided an update on the Shellfish Lease Program.

Anne Deaton provided an update on the Coastal Habitat Protection Plan, specifically regarding implementation of the recently approved plan.

To view the presentation, go to:
https://deq.nc.gov/media/31025/open

Barbie Byrd provided an overview of Incidental Take Permits and briefly covered the two permits currently held by the state.

To view the presentation, go to:
https://deq.nc.gov/media/31026/open

Standard Commercial Fishing License Eligibility Report/Set Eligibility Pool Cap

Captain Garland Yopp presented to the SCFL Eligibility Report to the commission.

To view the presentation, go to:
https://deq.nc.gov/media/31029/open

Motion by Mike Blanton to set the temporary cap on the number of licenses in the Eligibility Pool at 500.
Second by Doug Cross

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill	x			
Doug Rader	x			
Tom Roller	x			
Ana Shellem	x			
Chairman Rob Bizzell	x			

Motion passes unanimously

Annual Fisheries Management Plan Review

Brandi Salmon, Lee Paramore, and Steve Poland provided an overview of the annual Fisheries Management Plan Review.

To view the presentation, go to:
https://deq.nc.gov/media/31027/open

Fishery Management Plans

Corrin Flora, the Division's Fishery Management Plan Coordinator provided a status update for ongoing Fishery Management Plans.

To view the presentation, go to:
https://deq.nc.gov/media/31028/open

River Herring FMP

Corrin Flora reviewed the status of the River Herring FMP during her FMP status update.

Motion by Tom Roller to adopt the North Carolina River Herring 2022 Annual Review to serve as the 5-year review as an information update
Second by Doug Rader

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill	x			
Doug Rader	x			
Tom Roller	x			
Ana Shellem	x			
Chairman Rob Bizzell	x			

Motion passes unanimously

Estuarine Striped Bass FMP

Charlton Godwin, one of the Division's striped bass biologists, presented an overview of Amendment 2 and reviewed the feedback the Secretary received from state legislators on the MFC preferred management options that were selected during the May business meeting.

To view the presentation, go to:
https://deq.nc.gov/media/31030/open

Motion by Doug Cross to remove the temporary closure to gill nets above the ferry lines in Amendment 2 to the Striped Bass Fishery Management Plan, and that the rest of the plan be passed as presented.
Second by Mike Blanton

Substitute motion by Tom Roller to approve the Striped Bass Fishery Management Plan Amendment 2 as passed at the May 2022 meeting, and that DMF will collect data sufficient to analyze the gill net closure by the next amendment.
Second by Robert McNeill

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross		x		
Mike Blanton		x		
Donald Huggins		x		
Robert McNeill	x			
Doug Rader		x		
Tom Roller	x			
Ana Shellem		x		
Chairman Rob Bizzell	x			

Motion fails 3-5

Motion by Doug Cross to remove the temporary closure to gill nets above the ferry lines in Amendment 2 to the Striped Bass Fishery Management Plan, and that the rest of the plan be passed as presented.
Second by Mike Blanton

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill		x		
Doug Rader	x			
Tom Roller		x		
Ana Shellem		x		
Chairman Rob Bizzell		x		

Motion fails 4-4

Motion by Mike Blanton to not approve the Estuarine Striped Bass Amendment 2.
Second by Doug Cross

Substitute Motion by Ana Shellem to table the discussion until the November meeting.
Seconded by Donald Huggins

ROLL CALL VOTE				
Commissioner	Aye	Nay	Abstain	Absent
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill	x			
Doug Rader	x			
Tom Roller		x		
Ana Shellem	x			
Chairman Rob Bizzell	x			

Motion passes 7-1

<u>Rulemaking Update</u>

Catherine Blum, the Rulemaking Coordinator, provided updates on two rule packages from the 2020-2021 rulemaking cycle and one from the 2021-2022 rulemaking cycle. Ms. Blum then provided an overview of the Mutilated Finfish rule and associated fiscal analysis.

Motion by Mike Blanton to approve Notice of Text for Rulemaking for the proposed amended "Mutilated Finfish" Rule 15A NCAC 03M .0101 and associated fiscal analysis. Second by Doug Cross

ROLL CALL VOTE				
Commissioner	Aye	Nay	Abstain	Absent
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill	x			
Doug Rader	x			
Tom Roller	x			
Ana Shellem	x			
Chairman Rob Bizzell	x			

Motion passes unanimously

Catherine Blum and Shannon Jenkins, the Recreational Water Quality and Shellfish Sanitation Section Chief, gave an overview of the Marinas, Docking Facilities, and Other Mooring Areas rule.

Motion by Mike Blanton to approve Notice of Text for Rulemaking for the proposed readopted "Marinas, Docking Facilities, and Other Mooring Areas" Rule 15A NCAC 18A .0911 per G.S. 150B-21.3A, and associated fiscal analysis.
Second by Tom Roller

ROLL CALL VOTE				
Commissioner	**Aye**	**Nay**	**Abstain**	**Absent**
Doug Cross	x			
Mike Blanton	x			
Donald Huggins	x			
Robert McNeill	x			
Doug Rader	x			
Tom Roller	x			
Ana Shellem	x			
Chairman Rob Bizzell	x			

Motion passes unanimously

Issues from Commissioners

Commissioner Roller requests discussions regarding South Atlantic permits, possible enforcement of those permits or outreach.

Commissioner Cross thanks the prior members of the Commission whose terms recently were completed, especially regarding the recent action related to the Shrimp FMP Amendment 2.

Chairman Bizzell welcomed the new Commissioners and congratulated them on their first meeting.

Meeting Assignments and Preview of Agenda Items for Next Meeting

Lara Klibansky reviewed meeting assignments and provided an overview of the November meeting items.

Having no further business to conduct, the meeting adjourned at approximately 5:00 p.m.

NC Marine Fisheries Commission

Chairman's Report

November 2022 Business Meeting

From: Bizzell, Rob
To: Klibansky, Lara
Subject: Fwd: [External] Rulemaking 15A NCAC 18A .0911
Date: Saturday, October 8, 2022 10:21:41 PM

Get Outlook for iOS

From: Christopher Elkins [redacted]
Sent: Saturday, October 8, 2022 11:59 AM
To: Bizzell, Rob <r.bizzell.mfc@ncdenr.gov>; Rader, Doug <d.rader.mfc@ncdenr.gov>
Cc: Biser, Elizabeth <Elizabeth.Biser@ncdenr.gov>; Rawls, Kathy <kathy.rawls@ncdenr.gov>; Cooper, Roy A <Roy.Cooper@nc.gov>; Blum, Catherine <catherine.blum@ncdenr.gov>
Subject: [External] Rulemaking 15A NCAC 18A .0911

To: Rob Bizzell,
Chairman, Marine Fisheries Commission

Re: Inadequacy of Rulemaking 15A NCAC 18A .0911

Background.
Rule 15A NCAC 18A .0911 is proposed for amendment to help ensure that North Carolina remains in full compliance with national requirements so that N.C. shellfish can continue to be sold through interstate commerce; allow the Division of Marine Fisheries to determine necessary buffer closures for shellfish growing waters in and around marinas based on a more scientific and public health-based rationale; and make implementation and enforceability of requirements clearer.

The Division of Marine Fisheries (the Division) has done a very good job in the last decade bringing the shellfish sanitation lab up to speed and updating procedures for detection of the proxies for fecal pathogens. They should be commended for it. The new rule to establish detection of fecal contamination near or around the perimeter of marinas is also just fine but is woefully inadequate to protect the public's health.

I say this because the State continues to ignore the plethora of chemicals and endocrine disruptors that have been described by the Division at Habitat Advisory Committee and MFC meetings. To test for all of these toxins would be impossible, but testing a *subset of these, originating from marinas* (or previously dumped into marinas and contaminating the bottom) is both possible and prudent.

I have spoken to this subject this in previous meetings where persons sought to place upwellers for clam seed to grow. When these shellfish are moved to open waters, the coliforms are removed in just a few days, as indicated by the lack coliforms (proxies). However, we never test for toxic chemicals that shellfish were exposed to when in the marina. Toxic chemicals are well documented in marina waters. Moreover, unlike coliform proxies (and the enteric pathogens they represent), these chemicals are not usually rendered harmless by cooking.

Perhaps the most disturbing is the fact that many of these chemicals are "Forever Chemicals", such as the PFAS family of toxins, and the FDA limits can be very minute.

Finally, the geographic boundaries of many marinas are contiguous with shellfish harvesting areas and some Outstanding Resource Waters. For example, Marshallberg Harbor is abutted up against Sleepy Creek, an important source of NC "salty" oysters. Marshallberg Harbor is infamous for its sinking and abandoned boats and subsequent fuel leaks. There are many such harbors bordering shellfish waters in Harkers Island and Downeast NC.

If the Division and the State are serious about protection of public health, it is time to start a program to address chemical contamination by marinas of the public trust waters.

Thank you for your service,

Christopher Elkins PhD
University of NC Departments of Medicine, Microbiology and Immunology, Retired.
Former Member, Marine Fisheries Commission, NC Shellfish Advisory Committee, Chair, NC Habitat Advisory Committee, SAFMC Habitat and Ecosystem Advisory Panel, Chair, NC Sea Grant Citizens Advisory Panel

Current Address:
[redacted]

cc. Elizabeth Bizer, Kathy Rawls, Catherine Blum, Roy Cooper

From: Bizzell, Rob
To: Klibansky, Lara
Subject: Re: [External] More bycatch
Date: Monday, October 31, 2022 4:55:34 PM

Get Outlook for iOS

From: Bizzell, Rob <r.bizzell.mfc@ncdenr.gov>
Sent: Monday, October 31, 2022 4:55:30 PM
To: Klibansky, Lara <Lara.Klibansky@ncdenr.gov>
Subject: Fwd: [External] More bycatch

Get Outlook for iOS

From: Stuart Creighton [redacted]
Sent: Sunday, October 30, 2022 1:26 PM
To: Bizzell, Rob <r.bizzell.mfc@ncdenr.gov>; Huggins, Donald <d.huggins.mfc@ncdenr.gov>; Rader, Doug <d.rader.mfc@ncdenr.gov>; McNeill, Robert <Robert.B.McNeill.mfc@ncdenr.gov>; Rawls, Kathy <kathy.rawls@ncdenr.gov>; Shellem, Ana <a.shellem.mfc@ncdenr.gov>; Roller, Thomas N <Tom.Roller.mfc@ncdenr.gov>
Subject: [External] More bycatch

Good afternoon all,
I am attaching a video of more striper bycatch. This is from last Saturday, in the ICW. While not as telling as the last pictures I sent, it furthers the point that gill net interactions with stripers remain significant.
While not visible in the video, the person who took it noted that net marks were all over the fish.
I am sure that the local business just upstream of the fish will be obvious. I want to be clear that I am in no way trying to implicate them in any wrongdoing. The fish are in the water, just "regulatory discards".
The point I want to emphasize with this is that when small mesh nets go in the water, striper bycatch goes way up.
We have areas upstream of the ferry lines where at least some protection of stripers can be assured. Though what I have sent may be a few snapshots of what is happening on the water now, it should resonate with all of you.
How many thousands of gill net trips occur each year in our rivers and their creeks? How many thousands of striped bass are we wasting with the use of this gear?

Realistically, we should expand the gill net closure. But what we certainly SHOULD NOT do is return them to the areas above the ferry lines on the Neuse and Tar/Pamlico Rivers.
PLEASE keep the closures intact!!

Sincerely,

Stuart Creighton
Oriental, NC

2022 Meeting Planning Calendar

January

Su	Mo	Tu	We	Th	Fr	Sa
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2	3	4	5	6	7	8
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February

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August

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September

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October

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November

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December

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- MFC
- ASMFC
- SAFMC
- MAFMC
- ASMFC/MAFMC Joint Meeting
- State Holiday
- Southern Regional AC
- Northern Regional AC
- Joint Regional AC
- Finfish AC
- Habitat and Water Quality AC
- Shellfish/Crustacean AC
- Finfish/Shellfish/Crustacean AC

September 1, 2021

Marine Fisheries Commission 2023 Annual Calendar

Dates are subject to change.

January

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June

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July

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August

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September

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October

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November

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December

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2023 MFC Meeting Dates

MFC Business Meetings	Northern Regional AC	Southern Regional AC
February 22-24	January 10	January 11
May 24-26	April 11	April 12
August 23-25	July 11	July 12
November 15-17	October 10	October 11

Finfish Standing AC	Shellfish/Crustacean Standing AC	Habitat and Water Quality Standing AC
January 12	January 17	January 18
April 13	April 18	April 19
July 13	July 18	July 19
October 12	October 17	October 18

Calendar Key

- MFC
- ASMFC
- SAFMC
- MAFMC
- State Holiday
- Northern Regional AC
- Southern Regional AC
- Finfish Standing AC
- Habitat and Water Quality Standing AC
- Shellfish/Crustacean Standing AC

2022 Committee Assignments for Marine Fisheries Commissioners

09/1/2022

FINFISH ADVISORY COMMITTEE

Statutorily required standing committee comprised of commissioners and advisers that considers matters related to finfish.

Commissioners: Tom Roller – co-chair, Sarah Gardner – co-chair, Mike Blanton – vice chair

DMF Staff Lead: Lee Paramore - lee.paramore@ncdenr.gov

Meeting Frequency: Can meet quarterly, depending on assignments from MFC

HABITAT AND WATER QUALITY ADVISORY COMMITTEE & COASTAL HABITAT PROTECTION PLAN STEERING COMMITTEE

Statutorily required standing committee comprised of commissioners and advisers that considers matters concerning habitat and water quality that may affect coastal fisheries resources.

Commissioners: Doug Rader – chair, Ana Shellem– vice chair

DMF Staff Lead: Anne Deaton - anne.deaton@ncdenr.gov

Meeting Frequency: Committee can meet quarterly, depending on assignments from MFC. CHPP Steering Committee can meet a couple of times a year.

SHELLFISH/CRUSTACEAN ADVISORY COMMITTEE

Statutorily required standing committee comprised of commissioners and advisers that considers matters concerning oysters, clams, scallops and other molluscan shellfish, shrimp and crabs.

Commissioners: Ana Shellem – co-chair, Mike Blanton – co-chair, Doug Cross – vice chair

DMF Staff Lead: Tina Moore - tina.moore@ncdenr.gov

Meeting Frequency: Can meet quarterly, depending on assignments from MFC

CONSERVATION FUND COMMITTEE

Committee comprised of commissioners that makes recommendations to the MFC for administering funds to be used for marine and estuarine resources management, including education about the importance of conservation.

Commissioners: Doug Rader - chair, and Robert McNeill

DMF Staff Lead: Steve Poland – steve.poland@ncdenr.gov

Meeting Frequency: Meets as needed

LAW ENFORCEMENT AND CIVIL PENALTY COMMITTEE

Statutorily required committee comprised of commissioners that makes final agency decisions on civil penalty remission requests.

Commissioners: Rob Bizzell - chair, Doug Cross

DMF Staff Lead: Col. Carter Witten – carter.witten@ncdenr.gov

Meeting Frequency: Meets as needed

COASTAL RECREATIONAL FISHING LICENSE ADVISORY COMMITTEE

Committee consisting of the three recreational seats and the science seat to provide the DMF advice on the projects and grants issued using Coastal Recreational Fishing License trust funds.

Commissioners: Sarah Gardner– chair, Rob Bizzell, Tom Roller, and Robert McNeill

DMF Staff Lead: Jamie Botinovch - jamie.botinovch@ncdenr.gov

Meeting Frequency: Meets as needed

NOMINATING COMMITTEE

Committee comprised of commissioners that makes recommendations to the MFC on at-large and obligatory nominees for the Mid- and South Atlantic Fishery Management Councils.

Commissioners: Robert McNeill – chair, Ana Shellem, Tom Roller and Mike Blanton
DMF Staff Lead: Chris Batsavage - chris.batsavage@ncdenr.gov
Meeting Frequency: Typically meets once a year

STANDARD COMMERCIAL FISHING LICENSE ELIGIBILITY BOARD

Statutorily required three-person board consisting of DEQ, DMF and MFC designees who apply eligibility criteria to determine whether an applicant is eligible for a SCFL.

Commission Designee: Mike Blanton
DMF Staff Lead: Marine Patrol Capt. Garland Yopp – garland.yopp@ncdenr.gov
Meeting Frequency: Meets two to three times a year, could need to meet more often depending on volume of applications

N.C. COMMERCIAL FISHING RESOURCE FUND COMMITTEE

Committee comprised of commissioners that the commission has given authority to make funding decisions on projects to develop and support sustainable commercial fishing in the state.

Commissioners: Doug Cross – chair, Mike Blanton, Ana Shellem
DMF Staff Lead: William Brantley – william.brantley@ncdenr.gov
Meeting Frequency: Meets two to three times a year

WRC/MFC JOINT COMMITTEE ON DELINEATION OF FISHING WATERS

Committee formed to help integrate the work of the two commissions as they fulfill their statutory responsibilities to jointly determine the boundaries that define North Carolina's Inland, Coastal and Joint Fishing Waters as the agencies go through a statutorily defined periodic review of existing rules.

MFC Commissioners: Rob Bizzell, Donald Huggins, Sarah Gardner
DMF Staff Lead: Anne Deaton - anne.deaton@ncdenr.gov
Meeting Frequency: Meets as needed

SHELLFISH CULTIVATION LEASE REVIEW COMMITTEE

Three-member committee formed to hear appeals of decisions of the Secretary regarding shellfish cultivation leases issued under G.S. 113-202.

MFC Commissioners: Rob Bizzell
DMF Staff Lead: Jacob Boyd – jacob.boyd@ncdenr.gov
Meeting Frequency: Meets as needed

COASTAL HABITAT PROTECTION PLAN STEERING COMMITTEE

The CHPP Steering Committee, which consists of two commissioners from the Marine Fisheries, Coastal Management and Environmental Management commissions reviews and approves the plan, recommendations, and implementation actions.

MFC Commissioners: Doug Rader, Donald Huggins
DMF Staff Lead: Anne Deaton – anne.deaton@ncdenr.gov
Meeting Frequency: Meets as needed

EDUCATION REQUIREMENTS FOR PUBLIC SERVANTS

Public Servants must complete the Ethics and Lobbying Education program provided by the N.C. State Ethics Commission within **six months** of their election, appointment, or employment. We recommend that this be completed as soon as possible, but the training must be repeated every two years after the initial session.

Since Adobe Flash was terminated on December 31, 2020, our online program is not available. A new and shorter online program will be available in the near future. The new program will be compatible with portable devices such as phones and tablets.

Live webinar presentations are being offered monthly and registration information for the live presentations can be found here. These presentations are about 90 minutes long and give you the opportunity to ask questions of the speaker.

For questions or additional information concerning the Ethics Education requirements, please contact Dottie Benz at (919) 389-1383.

Memorandum of Agreement between

The North Carolina Wildlife Resources Commission

And

The North Carolina Marine Fisheries Commission

To facilitate cooperation and collaboration between the Wildlife Resources Commission (WRC), and the Marine Fisheries Commission (MFC) regarding delineation of Inland Fishing Waters and Coastal Fishing Waters and subsequent management and regulation of resources in and around those fishing waters, the Chairmen of the WRC and the MFC, have reached an agreement in principle on modifications to inland-coastal boundary lines. In addition, the Chairmen have identified a list of necessary, though not exhaustive, issues to address before adopting rules for and related to these boundary lines. While this agreement in principle has reached by the Chairmen, execution of this document requires approval of both Commissions.

WITNESSETH:

WHEREAS, the Chairmen agreed to the attached inland-coastal fishing water boundary lines as modifications to the current inland-joint-coastal fishing water boundary lines to improve regulatory clarity and consistency for stakeholders and the public, and to address conflict and confusion that has arisen based on the current joint rules pertaining to joint fishing waters;

WHEREAS, the Chairmen have agreed to these modified inland-coastal fishing water boundaries, and acknowledge that the joint rulemaking necessary to amend the current boundary lines will have implications beyond their Commission's authority and that their respective Commissioners and constituents may have concerns beyond what they have initially agreed to;

WHEREAS, the Chairmen acknowledge the mutual advantages likely to result from this agreement and the communication and collaboration that ensues between the Commissions and Division of Marine Fisheries (DMF) and WRC staffs;

WHEREAS, the Chairmen commit to prioritizing the codification of changes to the delineation of inland-coastal fishing waters and the adoption of joint rules resulting from those modifications by December 2024;

NOW, THEREFORE, the Commissions do hereby commit to a transparent joint rulemaking process resulting in updated inland fishing water and coastal fishing water boundary lines, without joint fishing waters, based on the attached maps. The process will include public input and a combined regulatory impact analysis/fiscal note where the following issues are considered prior to beginning any rulemaking necessary to modify boundary lines or the regulations associated with those lines:

- Clarification of regulations, authority, and management including:
    - Cooperative management of species across inland-coastal fishing water boundaries
    - Striped Bass Management Areas

- Protection of rare, endangered, threatened, and special concern species
  - Statutory definitions applying to fishing waters, and inland, migratory, and coastal fisheries
  - Recreational limits and season consistency
  - Fishery Management Plan coordination
  - Commercial fishing activities in newly designated inland fishing waters, to include licensing, monitoring, and reporting
  - Management through proclamations and rulemaking
  - Dual agency enforcement
- Coordination with other divisions of the NC Department of Environmental Quality, local governments, and other agencies, to identify regulatory solutions for conflicts associated with policies and regulations referencing boundary lines.

**(REMAINDER OF PAGE INTENTIONALLY LEFT BLANK;
SIGNATURE PAGE TO FOLLOW.)**

In witness whereof, the Commissions hereto have caused this Agreement to be executed, to be effective as of the date of the last signature below.

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

By: ____________________________________

____
Printed Name

Title: ____________________________________

Date: ____________________________________

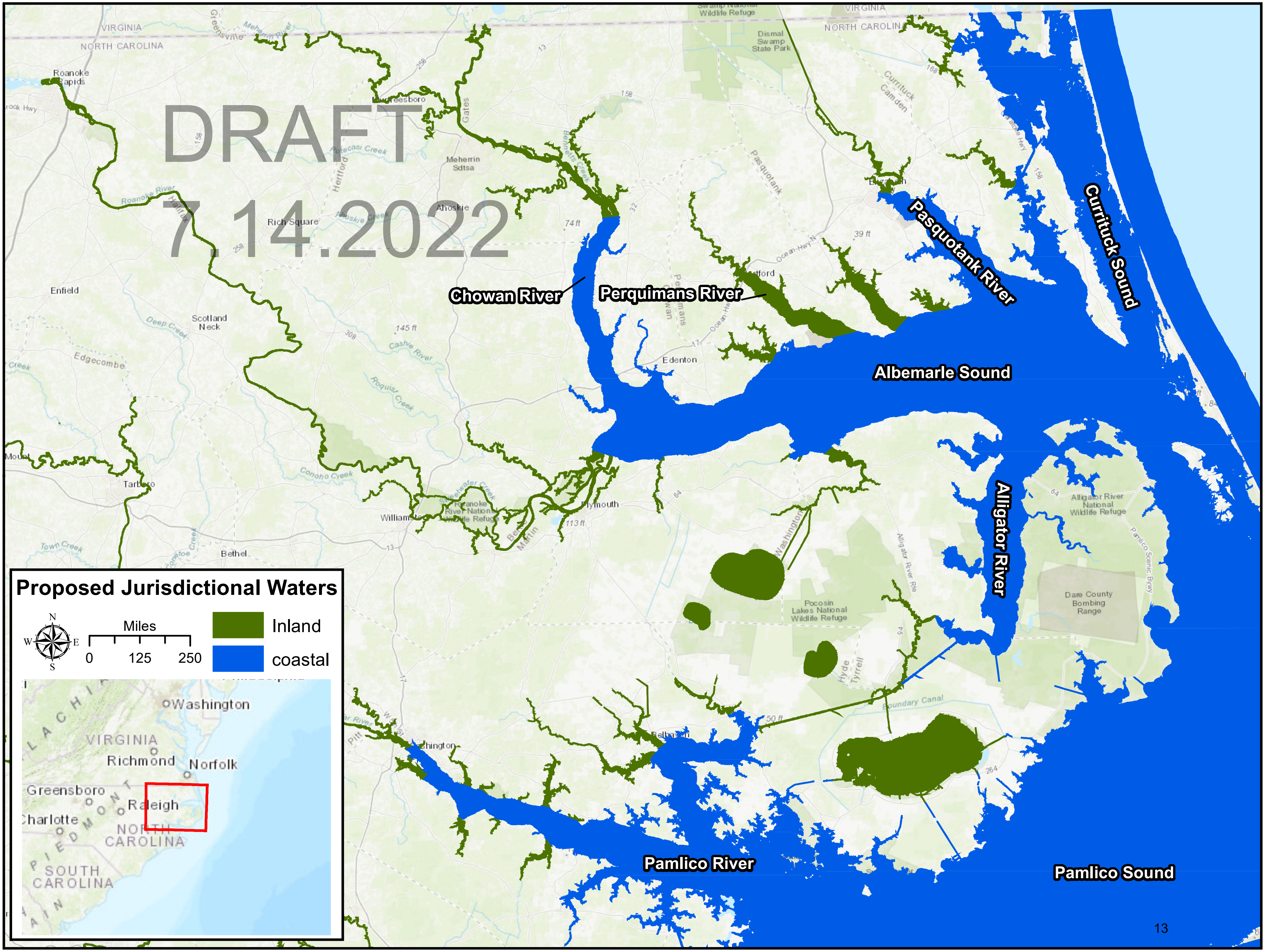
NORTH CAROLINA MARINE FISHERIES COMMISSION

By: ____________________________________

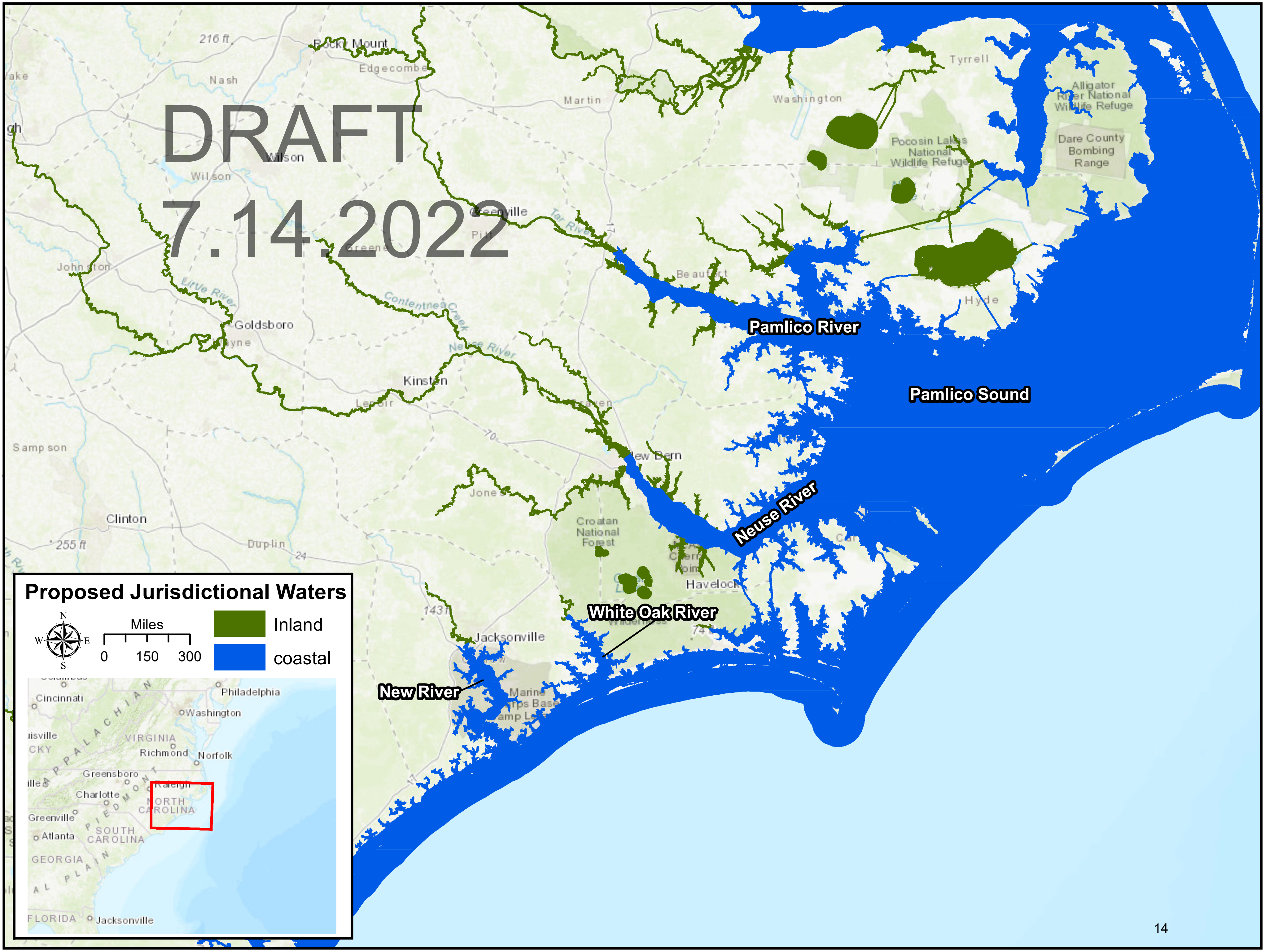
____
Printed Name

Title: ____________________________________

Date: ____________________________________



DRAFT
7.14.2022
Chowan River
Perquimans River
Pasquotank River
Currituck Sound
Albemarle Sound
Alligator River
Pamlico River
Pamlico Sound
Proposed Jurisdictional Waters
Miles
0
125
250
Inland
coastal
Washington
VIRGINIA
Richmond
Norfolk
Greensboro
Raleigh
Charlotte
NORTH CAROLINA
SOUTH CAROLINA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7.14.2022
Proposed Jurisdictional Waters
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coastal
Pamlico River
Pamlico Sound
Neuse River
White Oak River
New River
Rocky Mount
Edgecombe
Nash
Martin
Washington
Tyrrell
Alligator River National Wildlife Refuge
Dare County Bombing Range
Pocosin Lakes National Wildlife Refuge
Wilson
Greenville
Pitt
Greene
Johnston
Goldsboro
Wayne
Beaufort
Hyde
Kinston
Lenoir
Sampson
Clinton
Duplin
Jones
Croatan National Forest
Havelock
Jacksonville
Marine Corps Base Camp Lejeune
Cincinnati
Philadelphia
Washington
Richmond
Norfolk
Greensboro
Raleigh
Charlotte
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SOUTH CAROLINA
Greenville
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GEORGIA
FLORIDA
Jacksonville


DRAFT
7.14.2022
Proposed Jurisdictional Waters
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NC Marine Fisheries Commission

Committee Reports

November 2022 Business Meeting

MEMORANDUM

TO: N.C. Marine Fisheries Commission
MFC Nominating Committee

FROM: Chris Batsavage and Catherine Blum
Division of Marine Fisheries, DEQ

DATE: Oct. 25, 2022

SUBJECT: Marine Fisheries Commission Nominating Committee Meeting Minutes

The N.C. Marine Fisheries Commission Nominating Committee met on Tuesday, Oct. 11, 2022 at 1:00 p.m. via webinar.

The following were in attendance:

Committee members: Robert McNeill, Ana Shellem, Mike Blanton, Tom Roller
Staff: Chris Batsavage, Lara Klibansky, Catherine Blum, Hope Wade,

Chairman McNeill called the meeting to order. The agenda was approved without modification.

Motion by Tom Roller to approve the October 11, 2022, meeting agenda as presented. Seconded by Ana Shellem.

Roll Call

Mike Blanton	**Aye**
Robert McNeill	**Aye**
Ana Shellem	**Aye**
Tom Roller	**Aye**

Motion carries.

Motion by Mike Blanton to approve the September 29, 2021, meeting minutes as presented. Seconded by Ana Shellem.

Roll Call

Mike Blanton	**Aye**
Robert McNeill	**Aye**
Ana Shellem	**Aye**
Tom Roller	**Aye**

Motion carries.

Mike Blanton recuses himself from any further discussion.

Public comment
No public comment given at the meeting or received via email.

Review of N.C. General Statutes and federal Magnuson-Stevens Act requirements
Batsavage briefly reviewed the N.C. General Statutes pertaining to the selection of nominees for federal fishery management council seats. He stated that the N.C. Marine Fisheries Commission must approve a slate of candidates for the governor's consideration, and that the statutes allow the governor to consult with the commission regarding additions to the list of candidates. Batsavage also described the federal statutes and regulations pertaining to qualification of candidates and noted that the governor must submit a list of no less than three nominees for an appointment. The commission will review the list of candidates approved by the committee at its business meeting on Nov. 17-18, 2022.

Review and selection of candidates for the Mid-Atlantic Fishery Management Council obligatory appointment
Batsavage reviewed the bios of the candidates for the Mid-Atlantic Fishery Management Council obligatory seat, briefly describing the background and qualifications of each: Mike Blanton, Jess Hawkins, Thomas Newman, and Robert Ruhle. Batsavage noted that Dewey Hemilright, the current N.C. Obligatory Member on the Mid-Atlantic Fishery Management Council is completing his third consecutive three-year term and is not eligible for reappointment.

After a brief discussion of the candidates, the committee made the following motion:

Motion by Tom Roller to forward the names of Michael C. Blanton, Jess Harold Hawkins III, Thomas Newman, and Robert L. Ruhle to the Marine Fisheries Commission for consideration for the Mid-Atlantic Fishery Management Council obligatory seat. Seconded by Ana Shellem.

Roll Call

Mike Blanton	**Recused**
Robert McNeill	**Aye**
Ana Shellem	**Aye**
Tom Roller	**Aye**

Motion carries.

Tom Roller motion to adjourn. Seconded by Ana Shellem.

Meeting adjourned.

Michael C. Blanton, Elizabeth City, NC

Mr. Blanton is a sole proprietor, small boat (<25ft) commercial fisherman primarily participating in North Carolina's (NC) state-managed fisheries within the Albemarle Sound and surrounding waters. He grew up in Elizabeth City, NC, where he currently resides, participating in both recreational and commercial fisheries, since his early childhood days. Taking a keen interest in North Carolina's commercial industry, he spent his teenage years, working alongside lifelong fishermen, learning the commercial waterman trades of the area on multiple vessels and at a local fish/crab wholesale dealer. Mr. Blanton has now been an active full time commercial fisherman for over 8 years with the majority of his participation being in the blue crab industry as a crab potter, utilizing multiple finfish gillnet/hook-and-line fisheries as seasonal alternatives, including Menhaden, flounder, American Shad, Striped mullet, White Perch, and catfishes, respectively. Additional experience and involvement includes the Federal Longline/Hook-and-line Tuna Fishery, Ocean Gillnet Fisheries for Spiny Dogfish, Bluefish, Weakfish, Atlantic Croaker, Spot, and Sea Mullet, along with Shrimp Trawl Fisheries.

Mr. Blanton is currently serving his second term as a commercial representative on the NC Marine Fisheries Commission (NCMFC). He was originally appointed to his first term in August of 2019. Additional NCMFC responsibilities include: committee and board assignments to the NCMFC Nominating Committee, Standard Commercial Fishing License Eligibility Board, and NC Commercial Fishing Resource Fund Committee, along with, Shellfish/Crustacean Advisory Committee (co-chair) and Finfish Advisory Committee (vice chair). He also served as a permanent proxy for the NC Legislative Appointee to the Atlantic States Marine Fisheries Commission (ASMFC) from 2018-2020, at times working collaboratively with the Mid Atlantic Fisheries Management Council (MAFMC) on jointly managed species.

Prior to his appointments on the state and interstate management bodies, Mr. Blanton served on the NCMFC Northern Regional Advisory Committee and the ASMFC Striped Bass Advisory Panel. He has also served as a board member for the NC Fisheries Association and OBX Catch - a local seafood advocacy group that promotes and educates consumers on the economic importance of fresh, local seafood. He participated Fish Camp 2018- a fisheries workshop hosted by NC Sea Grant which created an opportunity to educate and inform young and upcoming fishermen of the fisheries management processes. Mr. Blanton also attended and completed three formal fisheries science and management education workshops in 2016, which include the MREP Greater Atlantic Fisheries Science 100 (Norfolk, VA), MREP Greater Atlantic Fisheries Management 100 (Norfolk, VA), and MREP Greater Atlantic Fisheries Science 200 (Woods Hole, MA).

Above all, Mr. Blanton is a strong advocate for sustainable seafood harvest, consumer access to fresh, local seafood, and habitat and water quality restoration. He has spent countless hours in policy discussions with federal, state and local leaders concerning the complexities of fisheries management. Volunteered at numerous public events promoting outreach that include: Day at the Docks, in Hatteras, NC and the NC Seafood Festival in Morehead City, NC. Mr. Blanton also connected with multiple young fishermen, offering in depth mentorship to help insure the future of NC's commercial fishing industry, with plans to continue to be an advocate for sustainability, along with fair and equitable access for all user groups.

Jess Hawkins, Morehead City, NC

North Carolina Marine Fisheries Commission Nominating Committee:

I would be honored to be considered by the North Carolina Marine Fisheries Commission (MFC) to serve on the Mid Atlantic Fishery Management Council (MAFMC) in the upcoming obligatory seat vacancy. I believe with my background and experience that I could serve effectively in that role representing North Carolina.

I have a Master of Science degree in biology and retired as a fisheries scientist with the NC Division of Marine Fisheries (DMF) in 2006 after 30 years of service. I have served as Chief of Fisheries Management (the main research/management section of DMF), studying and conserving both state and federally managed species. The last 12 years of my career I was the Executive Assistant to the Director, working as the liaison with the MFC, developing rules and policies for North Carolina with extensive stakeholder input (approximately 100 meetings per year with advisors and MFC members.) I became quite familiar with fisheries issues facing North Carolina, including management of species occurring in federal jurisdiction. I represented the state in numerous meetings during controversial and difficult circumstances and at all times tried to conduct myself professionally. I have also worked with many of the leading fisheries scientists in our state.

After retiring from DMF, I was honored by an appointment to the MFC from 2007-2009, serving in an at-large seat. I thoroughly enjoyed my tenure and am excited to potentially serve our state on another body dealing with fisheries governance. I also received the Governor's Award of the Order of the Long Leaf Pine in 2006 and the Governor's Award as Wildlife Conservationist of the Year in 1994.

Since my retirement I have served as an educator at the NC Aquarium, teaching the public about ecology and conservation. I also was privileged to be hired as an instructor of marine fisheries ecology at Duke Marine Laboratory for three years. I also co-taught marine fisheries ecology at NC State CMAST facility for six years, recently retiring from that endeavor. These opportunities have allowed me to track conservation policies and actions of many fisheries issues impacting North Carolina. I have also consulted on scientifically based issues involving fisheries conservation for stakeholder groups. I continue to monitor both state and federal fisheries management issues

Recreational fishing is my main hobby and something I am passionate about. I grew up on the coast of North Carolina and have recreationally fished all of my life, fishing from Dare to New Hanover counties, both inshore and offshore.

I also am president and owner of Crystal Coast Ecotours, where I provide people the opportunity to experience the wonderful natural resources of North Carolina. I have successfully operated this business for the last 12years and we are ranked as the top outdoor activity in Morehead City by reviewers. I know how regulations and circumstances can affect aquatic associated businesses. I hold a Master's Captain License from the US Coast Guard.

I would be honored to be considered for this opening. I have attached a resume with additional information.

Jess H. Hawkins lll

Thomas Newman, Williamston, NC

Mr. Newman is the owner/operator of the 40-ft. F/V Gotta Go with his homeport in Hatteras, NC. He has been commercial fishing for 25 years mostly in North Carolina but ranging as far north as scalloping in New York and has fished many seasons in Virginia gill netting for monkfish. He is currently serving on the Mackerel Cobia Advisory Panel (South Atlantic Fishery Management Council), the Northern Regional Advisory Panel (North Carolina Division of Marine Fisheries), and the Weakfish and Coastal Sharks Advisory Panels (Atlantic States Marine Fisheries Commission). Mr. Newman holds permits and fishes for Spanish mackerel, bluefish, spiny dogfish, smooth dogfish, king mackerel, croakers, large and small coastal sharks and monkfish, species which are mainly managed by the Mid-Atlantic Fishery Management Council, the South Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission. He also works part-time for the North Carolina Fisheries Association, is a member of the Coastal Carolina River Watch, serves on the Citizen Science Projects Advisory Team (SAFMC), and is involved in state and federal fisheries management issues working directly with fisheries managers and industry groups.

Mr. Newman received a B.S. in biology from Furman University in 2008. His focus was towards wildlife management but he also did a study abroad marine biology program in the Florida Keys and Belize directly observing habitats and multiple aquatic species. For his senior project he traveled to New Mexico to study an isolated population of desert bighorn sheep in the Fra Cristobal Range. The results of this study was published in The Southwestern Naturalist:

Evaluation of Methods Used to Estimate Size of a Population of Desert Bighorn Sheep (*Ovis canadensis mexicana*) in New Mexico

Author(s): Travis W. Perry, Thomas Newman, and Katherine M. Thibault

Source: The Southwestern Naturalist, 55(4):517-524. 2010.

Mr. Newman is also involved in climate change scenario planning and is looking forward to continue working with recreational, commercial, and ecosystem stakeholders to get ahead of these issues we are already seeing while planning for the future. He believes that flexibility, adaptation, and all user groups working together are going to be imperative for the future of our oceans.

Robert L. Ruhle

Wanchese NC

Robert Ruhle owns and operates the F/V DARANA R along with his father James Ruhle, who served 3 consecutive terms as a Mid Atlantic Council member for NC. His Uncle Phillip Ruhle also served on the New England council. His proximity to the council was highly educational to both the process and function of the councils, as well as provided insight to the innerworkings of Fisheries Management.

Robert is a member of Commercial Fisherman of America and NCFA.

He has been fishing commercially since 1994 and a Captain since 2001 although his fishing career began in 1983 when he first went to sea with his father aboard the family's 90' trawler. He has held an NC commercial fishing license since 1988.

Over the course of his career he has been active in numerous Mid Atlantic and New England fisheries and has fished from Hatteras to Canada. Primarily focusing on Illex squid, Longfin squid, Atlantic Mackerel, Sea herring, Atlantic Croaker and Butterfish.

He also participates in the Fluke, Black Sea Bass, Scup fisheries, Landing in both North Carolina and Virginia.

Mr. Ruhle has served multiple terms and currently is an Advisor for the Mid Atlantic Council serving on Atlantic Mackerel/Squid/Butterfish, Summer Flounder/Scup/Black Sea Bass, River herring/Shad, Ecosystems and Ocean Planning, and Sturgeon. Mr. Ruhle has been very active in his capacity as an advisor and always made himself available to attend meetings as well as work with the council staff on many different issues. Robert is also an ASMFC advisor for the Northeast Trawl Advisory Panel (NTAP) and a member of the NTAP working group.

Robert has participated all 3 MREP modules, (Management, Science 1 and Science 2) and has had over 20 yrs experience in co-operative research. He has worked on projects ranging from Gear selectivity to bycatch reduction with academic partners from, URI, Cornell, Manament, Scimfish , Rutgers, NOAA and VIMS. He has been a participant in the NOAA Study Fleet program since 2008.

Mr. Ruhle has been very active and a primary component in the Northeast Area Monitoring and Assessment Program (NEAMAP) trawl survey since 2006. Alongside VIMS, NEAMAP is conducted onboard the F/V DARANA R biannually during the spring and fall of each year. During his association with the survey, Mr. Ruhle has gained in depth knowledge of Fisheries/Scientific data collection methods as well as its use in Fisheries management practices. Over the course of NEAMAP, Mr. Ruhle has been a party to a multitude of outreach programs associated with the trawl survey.

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Oct. 27, 2022

MEMORANDUM

TO: Marine Fisheries Commission
Northern Regional Advisory Committee

FROM: David Behringer, Fisheries Biologist
Lee Paramore, Northern District Manager
Fisheries Management Section

SUBJECT: Meeting of the Marine Fisheries Commission's Northern Regional Advisory Committee, Oct. 18, 2022 for 2023 Meetings Planning and Updates.

The Marine Fisheries Commission's (MFC) Northern Regional Advisory Committee (AC) held a meeting on Oct. 18, 2022. The meeting was a hybrid meeting; some members of the AC and Division of Marine Fisheries (DMF) staff were in person at the Dare County Municipal Building in Manteo, North Carolina, while others attended virtually through Webex. The meeting was also streamed on Youtube for the public. AC members could attend in either setting and communicate with other committee members, whereas public comment could only occur via the in-person setting.

The following Advisory Committee members were in attendance: Sara Winslow, Missy Clark, Raymond Pugh, Herman Dunbar, Keith Bruno, Carl Hacker, and Thomas Newman attended in person. Everett Blake, Jim Rice, Jamie Winslow, and Roger Rulifson attended virtually.

DMF Staff: Lee Paramore, David Behringer, Charlton Godwin, Dan Zapf, Mike Loeffler, Corrin Flora, Lara Klibansky, Deborah Manley, Hope Wade, and Edward Mann attended in person and Steve Poland, Casey Knight, Daniel Ipock, Lorena de la Garza, and Shelby White attended virtually.

Public: None in attendance, 19 viewers watched on YouTube.

Northern Regional AC Chair Sara Winslow called the meeting to order at 6:02 p.m. All eleven Northern Regional AC advisors were present and a quorum was met.

APPROVAL OF THE AGENDA AND APPROVAL OF THE MINUTES

A motion was made to approve the agenda by Jim Rice. Second by Thomas Newman. The motion passed without objection.

A motion was made to approve the minutes from the Northern Regional AC meeting held on March 15, 2022. Motion by Missy Clark to approve the minutes. Second by Raymond Pugh. The motion passed without objection.

MARINE FISHERIES COMMISSION UPDATE

Lara Klibansky, MFC Liaison, gave an update on the newly appointed MFC commissioners and who they replaced. Pete Kornegay (science seat) left due to personal reasons and Dr. Doug Rader will continue his term until 2023. Ana Shellem is replacing Sam Romano (commercial seat) and Donald Huggins is replacing Tom Hendrickson (at-large seat). At the November business meeting Sarah Gardner will fill an at-large seat and she will be sworn in at the Finfish AC meeting on Oct. 20, 2022. Klibansky reminded everyone the AC solicitation period is open through Nov. 1. The DMF is looking for applicants for all ACs and encouraged current AC members to reapply. The MFC chair will select AC members and staff will notify applicants by Dec. 1.

Next the committee was provided an overview of the May and August 2022 MFC business meetings. At the May meeting, the review of the N.C. River Herring Fishery Management Plan (FMP) was approved as an information update (not an amendment) because the Atlantic States Marine Fisheries Commission is currently conducting a stock assessment and it will be prudent to wait until the results of the assessment are finalized before making management changes. Amendment 3 to the Southern Flounder FMP was approved at the May meeting, completing the cycle for this plan. Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the MFC at its May business meeting. The peer reviewed stock assessment indicates the N.C. striped mullet stock is overfished, and overfishing is occurring in the terminal year of the assessment (2019). At its November meeting, the MFC will be given the results of the scoping period for the review of the Striped Mullet FMP and vote to approve the goal and objectives of draft Amendment 2.

At the August meeting, the MFC tabled the final vote on the selected management measures for estuarine striped bass to give the new commissioners time to fully review the draft Amendment 2 to the FMP; the preferred management measures were approved at the May meeting. The DMF held two meetings in October to review the amendment with the newly appointed commissioners. The MFC is scheduled to select management measures for and give final approval of the Estuarine Striped Bass FMP Amendment 2 at its November business meeting. Dolphin (mahi mahi) was also discussed at the August meeting and the MFC asked the DMF to draft a letter opposing any new regulations (bag limits). Lastly, the MFC asked that a white paper be developed for false albacore; concerns were raised because it is a highly migratory species with no regulations.

The November meeting will be held at the Islander Hotel & Resort in Emerald Isle from Nov. 16th to the 18th. The results of the 2022 stock assessment for spotted seatrout and outcome of the peer review will be presented as an informational update.

Blue catfish continues to be a topic brought up by commissioners as a major concern due to their potential for impacts to other species and their population expansion, particularly in the Albemarle Sound. The DMF recently provided a presentation to the MFC on blue catfish and continues to actively collect data (diet, etc.) on blue catfish and has investigated available literature as well as management on blue catfish by other states such as Virginia. This will continue to be a topic of interest to the MFC moving forward.

Questions and comments from AC

The AC discussed the DMF's plans regarding false albacore. This was based on the motion that passed during the MFC's business meeting in August to update the 2017 false albacore informational document and to frame potential management options for future consideration. AC members asked for clarification about what this motion and white paper involves and what it means for management. Staff explained that the DMF will update the information in the 2017 white paper so that the most up to date information is available in the event that management is deemed necessary in the future. An AC member, who is also on the SAFMC Mackerel Cobia Advisory Panel (AP), brought up the fact that false albacore was discussed at their last meeting. He stated that there is general concern from both the commercial and recreational industries. The AC member stated that the general consensus of the SAFMC Mackerel Cobia AP was that false albacore do not meet the Magnuson Stevens Act criteria for a stock in need of conservation and management at this time and they voted to recommend to not create an FMP. It was also noted that false albacore are classified as "little tunny" in the NEFSC database and "false albacore" in the SEFSC database, which could cause confusion when compiling data for the white paper.

Many members of the AC were very vocal and supportive of meeting on a more regular basis. AC meetings could also serve as a good opportunity for the public to get involved and learn more about the process, as well as ask questions and express concerns. It was stated that there is a public perception that DMF/MFC does not listen to the public but that having more regular meetings and opportunities for public involvement would help to mitigate these negative perceptions. The AC meetings also provide a lower stress environment compared to the MFC meetings. Members of the AC also mentioned that Director Rawls and Colonel Witten's visit/outreach in Hatteras during a recent surf fishing tournament was well received by the fishermen and they encouraged more outreach. Staff also provided an overview of the ways the DMF notifies the public about upcoming meetings and asked for any suggestions on how to more effectively reach the public. AC members also brought up the idea of having some sort of event where all of the AC members and the MFC commissioners could meet and get to know each other. They feel that doing so would help to build relationships and promote better communication between the two groups.

FISHERY MANAGEMENT PLANS UPDATE

Flora gave an update on Amendment 3 to the Southern Flounder FMP, noting the 2022 season was based on management from the amendment and it may be a few months before the data are finalized. The commercial season is wrapping up and there have been some positive signs.

For the 2022-2023 FMP Review Schedule, river herring, hard clam, oyster, striped mullet, estuarine striped bass, and spotted seatrout are under review; the review of river herring has concluded. The blue crab stock assessment will also be updated and will include data through 2022; this will be a stock assessment update. The assessment update will add six years of data through 2022 with two to three years of management having occurred under the current FMP amendment. The DMF is also working with UNCW to evaluate new bycatch reduction devices to reduce diamondback terrapin interactions. The Shellfish/Crustacean AC will review this in early in 2023 and it will eventually come back to the Northern Regional AC too.

No management changes were deemed necessary for river herring; the information update is summarized in the 2022 FMP review. Staff are currently reviewing data and existing management for the Hard Clam and Oyster FMPs. Staff will bring information to the ACs in late 2023; a scoping period will likely begin around that same time. The MFC will review the preferred management measures for estuarine striped bass in November. Due to low juvenile abundance in the Albemarle-Roanoke stock, the DMF conducted a stock assessment update. The DMF and Wildlife Resources Commission staff are continuing to work on this update and based on the initial review of the results, the DMF director did not open the fishery in Albemarle Sound and continues to assess the subject.

For spotted seatrout, the peer review panel agreed that the stock assessment was the best available data to manage the fishery. The assessment contains data up to 2019 and indicated that biomass exceeded the target, but overfishing is occurring. In early 2023 the DMF will have scoping meetings for this plan.

Next, Flora discussed striped mullet and said that the stock is overfished, and overfishing is occurring in 2019. Because of stock concern the DEQ Secretary asked the MFC to work with the DMF to implement a supplement. If approved, this would be in place until the next amendment is adopted. At the November meeting, the MFC will review the scoping input and vote to approve the goal and objectives. The proposed management strategies for Amendment 2 include: Sustainable Harvest, Recreational Fishery Management, Small Mesh Gill net Management, Stop Net Fishery Management, and Migration Corridors. The DMF had three scoping meetings and an online questionnaire. Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest. The MFC will review the supplement in November and vote to approve it to go out for public comment. If all goes as planned, the next amendment could be in place as early as 2024 or 2025.

Questions and comments from AC

The AC asked about why hook and line is an approved commercial mobile gear for flounder. AC members stated that people who are not active in the commercial fishery but who hold a SCFL are using this as a loophole to land flounder for personal consumption without reporting or selling their catch. They felt that this is a loophole and people are taking advantage of the system. The AC member also noted the discrepancy between hook and line rules for flounder compared to other species such as striped bass, red drum, and spotted seatrout; for those species, commercial fishermen can use hook and line to catch and sell those species but they are limited to the recreational bag limit, not the commercial bag limit. Staff explained that hook and line has always been a commercial gear for flounder but that minimal landings have come from that gear. When the flounder season reopened for mobile gears, hook and line was listed as a viable gear. Another AC member commented that hook and line is a relatively clean gear and could be a good option, but if those landings are not being recorded on trip tickets, it should not be allowed. Staff also noted that people who hold a SCFL can also use gigs to harvest the commercial limit but not sell their catch. Discussions around personal consumption and reporting requirements have and are occurring within the DMF and by the MFC.

Discussion then moved to the striped mullet supplement. The reduction needed to end overfishing would be approximately 10% to reach the threshold and approximately 20-30% to reach the target. Staff noted that the DMF director requested the supplement to be straightforward, and a season closure is the most likely option. Season closures under consideration are November 1st or 15th through December 31st. The AC discussed the possibility of having a small bycatch quota after the roe season to allow fishermen to land a small amount of mullet and prevent regulatory discards while fishing for trout or other species. AC members also explained that there is one roe buyer that buys almost all the roe mullet. The buyer is only looking to buy in bulk, so setting a trip limit during roe season could cause the buyer to stop purchasing. Large quantities are necessary for it to be worthwhile for the buyer. There was consensus that a trip limit during roe season is not a good idea. They also noted that moving forward, if a closure is necessary, it would be better to close the fishery during the first half of roe season rather than the latter half. This is because the roe ratio is better later in the season (12% at the beginning of the season and 18% at the end). An AC member also noted that mullet is one of the species allowed as a bycatch-equivalent for red drum and asked if there would be other species that could be added to that list. Staff stated that the DMF director has the authority to change the species designated as “targeted species” in regards to being able to land red drum.

AC members provided the following additional comments: yardage limits would not be a good idea based on the style of fishing. Mesh size regulations could be an option. We could look at DMF data to examine what size mesh catches what sized fish. Regional management would be ideal. The bait fishery has become more popular with the increase in targeting big red drum. The bait fishery is an important option for many commercial fishermen. Recreational fishermen like the smaller "cobb" mullet, which are targeted using 2.5" stretched mesh.

PUBLIC COMMENT

There was no public in attendance.

PLAN AGENDA ITEMS FOR THE NEXT MEETING

No action items are planned at this time. Klibansky said the MFC ACs will meet again at their scheduled quarterly meeting in January 2023 when she will give an update on the outcome of the November MFC business meeting and the ACs will receive a presentation on stock assessments.

At the end of the meeting, AC member Jim Rice announced that he will not reapply when his term is up in January 2023. The meeting adjourned at 8:00 p.m.

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Oct. 20, 2022

MEMORANDUM

TO: Marine Fisheries Commission
Southern Regional Advisory Committee

FROM: Tina Moore, Southern District Manager
Chris Stewart, Biologist Supervisor
Fisheries Management Section

SUBJECT: Meeting of the Marine Fisheries Commission's Southern Regional Advisory Committee, Oct. 19, 2022 for 2023 Meetings Planning and Updates.

The Marine Fisheries Commission's (MFC) Southern Regional Advisory Committee (AC) held a hybrid meeting on Oct. 19, 2022, via webinar and in-person at the Department of Environmental Quality Regional Office, Wilmington, North Carolina. Advisory Committee members could attend in either setting and communicate with other committee members, whereas public comment could only occur via the in-person setting.

The following Advisory Committee members were in attendance: Fred Scharf, Samuel Boyce, Cane Faircloth, Jason Fowler, Tom Smith, Pam Morris, Jeffrey Harrell (Absent – Jerry James, James Rochelle, Adam Tyler, and Tim Wilson).

Division of Marine Fisheries (DMF) Staff: Lara Klibansky, Hope Wade, Debbie Manley, Corrin Flora, Tina Moore, Chris Stewart, Garland Yopp, Jason Parker, Mike Loeffler, Jeff Dobbs

Public: None in attendance, eight viewers watched on YouTube.

Southern Regional AC Chair Fred Scharf called the meeting to order at 6:06 p.m.

A call for attendance was performed and attendance recorded. The Southern Regional AC had six members present at the start of the meeting and a quorum was met. Cane Faircloth joined the meeting online at 7:52 p.m. Jeff Harrell was online at the beginning of the meeting and left about 6:40 p.m.

APPROVAL OF THE AGENDA AND APPROVAL OF THE MINUTES

A motion was made to approve the agenda by Pam Morris. Second by Tom Smith. The motion passed without objection.

Fred Scharf noted that staff corrected a misspelling of Samuel Boyce's name in the second paragraph of page eight of the minutes. A motion was made to approve the minutes from the Southern Regional AC meeting held on March 16, 2022. Motion by Sam Boyce to approve the minutes. Second by Pam Morris. The motion passed without objection.

MARINE FISHERIES COMMISSION UPDATE

Lara Klibansky gave an update on the newly appointed MFC commissioners and who they replaced. Pete Kornegay (science seat) left due to personal reasons and Dr. Doug Rader will continue his term until 2023. Ana Shellem is replacing Sam Romano (commercial seat) and Donald Huggins is replacing Tom Hendrickson (at-large seat). At the November business meeting Sarah Gardner will fill an at-large seat and she will be sworn in at the Finfish AC meeting on Oct. 20, 2022.

Klibansky reminded everyone the AC solicitation period is open through Nov. 1. The DMF is looking for applicants for all ACs and encouraged current AC members to reapply. The MFC chair will select AC members and staff will notify applicants by Dec. 1.

Next the committee was provided an overview of the May and August 2022 MFC business meetings. At the May meeting, the review of the N.C. River Herring Fishery Management Plan (FMP) was approved as an information update (not an amendment) because the Atlantic States Marine Fisheries Commission is currently conducting a stock assessment and it will be prudent to wait until the results of the assessment are finalized before making management changes. Amendment 3 to the Southern Flounder FMP was approved at the May meeting, completing the cycle for this plan. Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the MFC at its May business meeting. The peer reviewed stock assessment indicates the N.C. striped mullet stock is overfished, and overfishing is occurring in the terminal year of the assessment (2019). At its November meeting, the MFC will be given the results of the scoping period for the review of the Striped Mullet FMP and vote to approve the goal and objectives of draft Amendment 2.

At the August meeting, the MFC tabled the final vote on the selected management measures for estuarine striped bass to give the new commissioners time to fully review the draft Amendment 2 to the FMP; the preferred management measures were approved at the May meeting. The DMF held two meetings in October to review the amendment with the newly appointed commissioners. The MFC is scheduled to select management measures for and give final approval of the Estuarine Striped Bass FMP Amendment 2 at its November business meeting.

The November meeting will be held at the Islander Hotel & Resort in Emerald Isle from Nov. 16th to the 18th. The results of the 2022 stock assessment for spotted sea trout and outcome of the peer review will be presented as an informational update. Dr. Scharf asked who was conducting the assessment. Staff indicated that it is a DMF assessment, and that the DMF is working with researchers at NCSU. The new model incorporates cold stun events and assesses stocks within North Carolina (north of Cape Fear River only, due to genetic differences in the stock) and Virginia.

Blue catfish continues to be a topic brought up by commissioners as a major concern due to their impact to other species, particularly in the Albemarle Sound. The DMF continues to actively collect data (diet, etc.) on blue catfish and has participated in blue catfish workshops in Virginia. Dr. Scharf noted that he and a researcher at ECU have submitted a proposal to do genetic, diet, and trophic analyses on blue catfish in western Albemarle Sound. If the proposal is funded, they would work with commercial gill netters and explore using electrofishing gear as a means of removal.

Dolphin (mahi mahi) was also discussed at the August meeting and the MFC asked the DMF to draft a letter opposing any new regulations (bag limits). Lastly, the MFC asked that a white paper be developed for false albacore; concerns were raised because it is a highly migratory species with no regulations.

2023 ANNUAL MFC ADVISORY COMMITTEE MEETINGS PLANNING

Klibansky reviewed the 2023 calendar and noted that in past years the AC did not meet unless there was something the MFC needed input on; however, moving forward we would like to meet on a regular basis to give updates and talk about less contentious topics. The next meeting with an action item will be October 2023 for the management of striped mullet. In January, there will be new AC members and the ACs will receive a presentation from one of the DMF stock assessment biologists to orient the new members. It will likely be a Webex meeting. In the future we will alternate between Webex and in-person meetings; however, staff will set up listening stations for the public at various locations when the meetings are virtual. The AC agreed they liked in person meetings, but also liked the convenience of having hybrid meetings and said it was nice not to have to travel. Dr. Scharf said that he especially liked talking with the other AC members before and after the meetings. Morris commented that she would like to see more fishermen attend the meetings and would prefer going back to having Northern, Central, and Southern ACs. Morris further noted that the fisheries and gear are so different between regions it can be difficult to make informed decision. Morris also suggested the existing regional AC lines could be moved down to better suit areas that use similar gears and fishing methods. Dr. Scharf also commented that prior to going to two regional ACs, there was more participation from Sneads Ferry and Brunswick County fishermen. Klibansky noted that it has been hard to fill the seats in the past with three regional ACs and budget and staffing constraints are an ongoing issue. There was agreement that meeting more frequently was beneficial.

Tom Smith said at the next AC meeting he would like an update on the fish passage work being done on the Cape Fear River. Corrin Flora noted that the data is still preliminary; however, both the modified rock archway and the pulses appear to have increased passage of striped bass. It may be several months before the results are ready to share. Smith noted that there are so many dynamic things going on with that fishery any update would be appreciated.

FISHERY MANAGEMENT PLANS UPDATE

Flora gave an update on Amendment 3 to the Southern Flounder FMP, noting the 2022 season was based on management from the amendment and it may be a few months before the data is finalized. The commercial season is wrapping up and there have been some positive signs. Dr. Scharf noted both sectors had indicated more and bigger fish are available and asked if the DMF was seeing that in their surveys. Mike Loeffler said staff is seeing some sign in the DMF trawl survey with large numbers of juveniles in the northern part of the state, as well as good catch in our gill net program. So far, staff has also seen more age-3 fish and even an age-7 fish this year.

For the 2022-2023 FMP Review Schedule, hard clam, oyster, striped mullet, estuarine striped bass, and spotted seatrout are under review; the review of river herring has concluded. The 2018 benchmark blue crab stock assessment will also be updated and will include data through 2022; this will be a stock assessment update. The assessment update will add six years of data through 2022 with two to three years of management having occurred under the current FMP amendment. The DMF is also working with UNCW to evaluate new bycatch reduction devices to reduce diamondback terrapin interactions. The Shellfish/Crustacean AC will review this in early in 2023 and it will eventually come back to the Southern Regional AC too.

No management changes were deemed necessary for river herring; the information update is summarized in the 2022 FMP review. Staff are currently reviewing data and existing management for the Hard Clam and Oyster FMPs. Staff will bring information to the ACs in late 2023; a scoping period will likely begin around that same time. The MFC will review the preferred management measures for estuarine striped bass in November. Due to low juvenile abundance in the Albemarle-Roanoke stock the DMF conducted a stock assessment update. DMF and Wildlife Resources Commission staff are continuing to work on this update and based on the initial review of the results, the director did not open the fishery in Albemarle Sound and continues to assess the subject.

For spotted seatrout, the peer review panel agreed that the stock assessment was the best available data to manage the fishery. The assessment contains data up to 2019 and indicated that biomass was up to the target, but overfishing is occurring. In early 2023 DMF will have scoping meetings for this plan. Morris asked who the reviewers were and if it was the same method used as last time. Staff said the reviewers are people outside of the DMF who are familiar with the species and are experts in the field. The new model now accounts for cold stuns based on data collected in North Carolina; the assessment can be found online. Dr. Scharf noted how you could see similar trends in the landings data and the independent data, but it was nice to see how they could bounce back so quickly.

Next, Flora discussed striped mullet and said the stock is overfished, and overfishing is occurring in 2019. Because of stock concern the DEQ Secretary asked the MFC to work with DMF to implement a supplement. If approved, this would be in place until the next amendment is adopted. At the November meeting the MFC will review the scoping input and vote to approve the goal and objectives. The proposed management strategies for Amendment 2 include: Sustainable Harvest, Recreational Fishery Management, Small Mesh Gill net Management, Stop Net Fishery Management, and Migration Corridors. The DMF had three scoping meetings and an online questionnaire. Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest. At the scoping meeting held in Wilmington there were concerns expressed about the number of finger mullet harvested and how the model incorporated landings data. Participants also expressed interest in serving on the Striped Mullet FMP AC. Dr. Scharf asked for more information on the development of the supplement. Flora said management is temporary, needs to be simple and effective, and is meant to end overfishing within one year. The MFC will review the supplement in November and vote to approve it to go out for public comment. The supplement could be implemented as early as 2023. If all goes as planned the Amendment 2 could be in place as early as 2024 or 2025.

Jeff Dobbs asked the AC if they had any management ideas for Amendment 2 to the striped mullet FMP. Staff noted the seasonal closures were the only option being evaluated for the supplement, but other options could be explored in the amendment. Morris said she felt the biological reference points changed and the impact of hurricanes has a lot to do with the fishery; she did not believe the stock was overfished. Dobbs noted that only reference point that changed was for the target SPR and not for the threshold; thus, not impacting the overfished status. He further noted that the same model was used, and the new inputs made the model more stable. While the old model was good for management, it could not determine the overfished status. The old model indicated that we were on the verge of overfishing in the terminal year Smith agreed and noted that we were told we were fishing on the edge of the threshold, and we took the minimum reduction the last go round, so this is not unexpected. The AC discussed how the terms overfished can be misleading. Morris felt that the commercial fishery bears the brunt of the blame and regulations while water quality issues, development, etc. all contribute to the status of the fishery, further noting that this was not conveyed at the last meeting. Staff indicated that this was the input staff was looking for from the ACs by meeting more frequently.

Dr. Scharf asked what harvest reductions needed for stiped mullet; staff indicated between 9% (threshold) and 20-30% (target) for the supplement. Dobbs further noted that this was just a stop gap measure and additional ideas were needed for the amendment. Staff noted that at the scoping meetings the need for adaptive management was brought up frequently and that it would be a good option as this species, as they tend to bounce back quickly. Adaptive management would likely be based off some type of abundance index and not landings data such as our recently expanded electrofishing and gill net surveys. Staff indicated that a 20-30% reduction was needed. Morris said that she could not go for that or end of the season closures and expressed the need to keep historic fisheries such as the stop net fishery going. Smith indicated that escapement was needed. Dobbs said that most of the harvest occurs Oct. 15-Nov. 15 and if opened later in the year recoupment is an issue. Morris again expressed her concern about the importance of the roe fishery and the stop net fishery; further noting that regional differences in the gears should be considered. Staff noted there are some concerning trends in the data and that they are seeing age truncation in the fishery. Morris expressed concern about how the landings data was used. Dobbs noted that it just informs the DMF about removals and the fishery-independent data tracks well with the landings; both of which show a decline in recent years.

Dobbs asked if maximum mesh size restrictions would work. Staff heard comments about cast net mesh sizes at the Wilmington scoping meeting. Morris commented that the markets are not what they once were and the desire to have larger fish has diminished. She further noted the expense of rehanging gill nets. Smith asked about the life expectancy of a gill net and if fishermen used different mesh sizes throughout the year. Morris said they did about every year or two, and they often cut out bad webbing; she later noted mesh size restrictions could be an option. Dobbs next asked if migration or area and season closures were viable options. Smith felt we need to allow the fish to spawn, and to limit harvest in the ocean when they are spawning. Dobbs added there were other fisheries in the ocean that may also be impacted. There was some concern that if one fishery was to close, effort may shift to another area or gear. Morris highlighted the need to continue the stop net fishery.

PUBLIC COMMENT

There was no public in attendance.

PLAN AGENDA ITEMS FOR THE NEXT MEETING

No items are planned at this time. Klibansky said the MFC ACs will not likely need to meet again until January 2023 when she will give an update on the outcome of the November MFC business meeting and the ACs will receive a presentation on stock assessments. Dr. Scharf also asked for an update on the outcome of the 2022 flounder season.

Samuel Boyce motioned to adjourn; it was seconded by Pam Morris. The meeting adjourned at 8:15 p.m.

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Oct. 28, 2022

MEMORANDUM

TO: Marine Fisheries Commission
Finfish Advisory Committee

FROM: Lee Paramore, Northern District Manager
Jason Rock, Biologist Supervisor
Fisheries Management Section

SUBJECT: Meeting of the Marine Fisheries Commission's Finfish Advisory Committee, October 20, 2022 for 2023 Meetings Planning and Updates.

The Marine Fisheries Commission's (MFC) Finfish Advisory Committee (AC) held a meeting on Oct. 20, 2022. The meeting was a hybrid meeting; some members of the AC were in person at the Morehead City Central District Office while others attended and participated virtually. Members of the public were able to attend and comment in person or had the option to attend the meeting online without an option to comment.

The following AC members were in attendance: Thomas Brewer, Jeff Buckel, Sarah Gardner, David Mense, Allyn Powell, Ken Siegler, William Tarplee, Tom Roller (Absent – Mike Blanton, Brent Fulcher, Randy Proctor, Scott Whitley)

Division of Marine Fisheries (DMF) Staff: Jason Rock, Tina Moore, Corrin Flora, Debbie Manley, Hope Wade, Carter Witten, Lee Paramore, Charlton Godwin, Steve Poland, Jeff Dobbs, Dan Zapf, Ashely Bishop, Lucas Pensinger, and Shelby White.

Public: None in attendance, 36 viewers watched on YouTube.

Finfish AC Chair Tom Roller called the meeting to order at 6:06 p.m. A call for attendance was performed and attendance was recorded. The Finfish AC had eight members present and a quorum was met.

APPROVAL OF THE AGENDA AND APPROVAL OF THE MINUTES

A motion was made to approve the agenda by Ken Siegler. Second by Allyn Powell. The motion passed without objection.

State of North Carolina | Division of Marine Fisheries
3441 Arendell Street | P.O. Box 769 | Morehead City, North Carolina 28557
252-726-7021

A motion was made to approve the minutes from the Finfish AC meeting held on March 17, 2022 by Doug Mense. Second by Allyn Powell. The motion passed without objection.

MARINE FISHERIES COMMISSION UPDATE

Lee Paramore gave an update on the newly appointed MFC members and who they replaced. Pete Kornegay (science seat) left due to personal reasons and Doug Rader will continue his term until 2023. Ana Shellem is replacing Sam Romano (commercial seat), Donald Huggins is replacing Tom Hendrickson (at-large seat), and Sarah Gardner is replacing Martin Posey (at-large seat).

Paramore reminded everyone we are in the AC solicitation period through Nov. 1. The division is looking for applicants for all ACs and encouraged current members to reapply. The MFC Chair will select AC members and staff will notify applicants by Dec. 1. The AC asked if it would be possible to provide brief resumes for all MFC and AC members so they could be familiar with one another's background and expertise when having discussions. Staff indicated they would investigate this.

Next the committee was provided an overview of the May and August 2022 MFC business meetings. At the May meeting, the review of the N.C. River Herring Fishery Management Plan (FMP) was approved as an information update (not an amendment) because the Atlantic States Marine Fisheries Commission is currently conducting a stock assessment and it will be prudent to wait until the results of the assessment are finalized before making management changes. Amendment 3 to the Southern Flounder FMP was approved at the May meeting, completing the cycle for this plan. Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the MFC at its May business meeting. The peer reviewed stock assessment indicates the N.C. striped mullet stock is overfished, and overfishing is occurring in the terminal year of the assessment (2019). At its November meeting, the MFC will be given the results of the scoping period for the review of the Striped Mullet FMP and vote to approve the goal and objectives of draft Amendment 2.

At the August meeting, the MFC tabled the final vote on the selected management measures for estuarine striped bass to give the new commissioners time to fully review the draft Amendment 2 to the FMP; the preferred management measures were approved at the May meeting. The DMF held two meetings in October to review the amendment with the newly appointed commissioners. The MFC is scheduled to select management measures for and give final approval of the Estuarine Striped Bass FMP Amendment 2 at its November business meeting.

The results of the 2022 stock assessment for spotted seatrout and outcome of the peer review workshop will be presented as an informational update. The AC asked what reduction is needed for spotted seatrout to end overfishing. Staff indicated the assessment was just finalized and those calculations have yet to be completed.

Blue catfish continues to be a topic brought up by commissioners as a major concern due to their impact to other species, particularly in the Albemarle Sound. The DMF continues to actively collect data (diet, etc.) on blue catfish and has participated in blue catfish workshops in Virginia.

Dolphin (mahi mahi) was also discussed at the August meeting and the MFC asked the DMF to draft a letter opposing any new regulations (bag limits). Lastly, the MFC asked that a white paper be developed for false albacore; concerns were raised because it is a highly migratory species with no regulations.

The November MFC meeting will be held at the Islander Hotel & Resort in Emerald Isle from Nov. 16th to the 18th.

2023 ANNUAL AC MEETINGS PLANNING OVERVIEW

Paramore reviewed the 2023 calendar and noted that in past years the AC did not meet unless there was something the MFC needed input on; however, moving forward the AC will meet on a regular basis to receive updates and talk about less contentious topics. The next meeting with an action item will be October 2023 for striped mullet. In January 2023, there will be new AC members and the ACs will receive a presentation from one of our stock assessment biologists to orient the new members. It will likely be a WebEx (virtual) meeting. In the upcoming year, meetings will alternate between virtual and in-person meetings; however, there will be listening stations for the public at various locations when the meetings are virtual. AC members will continue to also have the option to attend virtually when meetings are in person.

FISHERY MANAGEMENT PLANS UPDATE

Corrin Flora gave an update on Amendment 3 to the southern flounder FMP, noting the 2022 season was based on management from the amendment and it will be a few months before the data is finalized. The commercial season is wrapping up and there have been some positive signs in the fishery. The AC was interested in which portions of the commercial fishery were still open and how that was being communicated to the public. Staff noted that proclamations have been going out with changes and those have also been accompanied by news releases. The AC noted they have been seeing larger numbers of juvenile southern flounder in shallow water areas and were interested to know if the division was seeing this in their own sampling. Staff indicated they have been seeing this as well as some sign of some older fish in the population. The committee also asked if the annual sampling data was available publicly and staff indicated that data for all managed species, including survey data, is available through the annual FMP Updates and those are readily available on the DMF website.

For the 2022-2023 FMP Review Schedule, river herring, hard clam, oyster, striped mullet, estuarine stiped bass, and spotted seatrout are under review. The blue crab stock assessment is also scheduled to be updated beginning in 2023 and will include data through 2022; this will be a stock assessment update of the prior benchmark assessment. The assessment update will add six years of data through 2022 with three years of management under the current FMP amendment. The DMF is also working with UNCW to evaluate new bycatch reduction devices to reduce diamondback terrapin interactions. The Shellfish/Crustacean AC will review this in early 2023. The AC asked which surveys are used in the blue crab stock assessment and staff provided details. The AC also asked if the division has made progress on implementing a pot survey for blue crabs. Staff informed the AC that progress was stalled during the COVID-19 pandemic but plans remain to reinitiate discussions. The AC also noted that blue crab landings are down, coastwide, not just in North Carolina.

No management changes were deemed necessary during the review of the River Herring FMP; the plan was approved as an information update and is summarized in the 2022 FMP review. Staff are currently reviewing data and existing management for the Hard Clam and Oyster FMPs. The scoping period for these plans will likely begin in late 2023.

The MFC will review the recommended management measures of Estuarine Striped Bass FMP Amendment 2 in November 2022. Due to continued low juvenile abundance in the Albemarle-Roanoke stock the DMF conducted a stock assessment update in 2022. DMF and Wildlife Resources Commission (WRC) staff are continuing to work on this assessment update. Based on the initial review of the results the director did not open the fall recreational fishery in Albemarle Sound and continues to assess the matter. The AC asked about the recruitment sampling results for 2022. Staff indicated that sampling showed another very low recruitment year for the Albemarle/Roanoke stock.

For spotted seatrout, an independent peer review panel agreed the division's stock assessment was the best available science to manage the stock. The assessment contains data through 2019 and indicated spawning stock biomass is above the target, but overfishing is occurring. The DMF is moving forward with FMP development. In early 2023, DMF will have scoping meetings for this plan.

Next, Flora discussed striped mullet and said the stock is overfished, and overfishing is occurring in 2019. Due to concern about the stock, the Department of Environmental Quality Secretary asked the MFC to work with DMF to implement a supplement to address overfishing. If passed, the supplement will be in place until a next amendment is adopted. Amendment 2 to the Striped Mullet FMP is currently underway. At the November meeting the MFC will review the scoping input and vote to approve the goal and objectives of Amendment 2. The proposed management strategies for Amendment 2 include: sustainable harvest, recreational fishery management, small mesh gill net management, stop net fishery management, and migration corridors. For the scoping period, DMF held three public meetings and provided an online questionnaire to allow for public input. Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest. The AC asked several questions about the benchmark stock assessment that were discussed and answered by staff. There was discussion and questions on prior model results and how it would be helpful to more fully understand any factors that were driving differences between the assessments.

Next, staff discussed the scoping input that was received and asked the AC for management ideas for Amendment 2 to the Striped Mullet FMP. Staff clarified further that a season closure is the only option being considered for the supplement, but other more broad and comprehensive options are available to be explored during the development of the amendment. Staff heard concerns about the proposed closure period in the supplement and some on the AC stressed that anything that could be done to add fishing days in November would be a benefit to the roe fishery. Some AC members preferred to see gear restrictions (specifically gill net mesh size restrictions) to limit roe harvest in lieu of a season closure and to allow the bait fishery to operate unimpeded. The AC also mentioned that if a season closure is considered, the division will need data on the roe weight and roe to body weight ratio across the fall season for the different regions of the state because it is regionally variable and season closures for a given date may impact areas differently. This will be important to understanding the regional differences and economic impacts of a season closure for the striped mullet roe fishery. An AC member noted that in southern region of state, November has always been a very important month for the roe fishery, and this may differ from more northern areas. There were questions and discussion on the movement of mullet by season and prior tagging study work. There were also discussions on the market conditions for striped mullet roe and if it has rebounded since the first year of the COVID-19 pandemic.

PUBLIC COMMENT
None in attendance.

PLAN AGENDA ITEMS FOR NEXT MEETING

In January the AC will receive educational information on stock assessments. The meeting is scheduled to be a virtual meeting. AC meetings are an avenue to bring up issues, concerns, and discuss new information.

The meeting adjourned at 7:52 p.m.

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Oct. 26, 2022

MEMORANDUM

TO: Marine Fisheries Commission
Shellfish/Crustacean Advisory Committee

FROM: Tina Moore, Southern District Manager, Fisheries Management Section
Anne Deaton, Habitat Program Manager, Habitat and Enhancement Section

SUBJECT: Meeting of the Marine Fisheries Commission's Shellfish Crustacean Advisory Committee, October 25, 2022. 2023 Meetings Planning and Updates**.**

The Marine Fisheries Commission's Shellfish/Crustacean advisory committee (AC) held a meeting on Oct. 25, 2022, via webinar and in-person at the Division of Marine Fisheries, Central District Office, Morehead City, NC. Advisory Committee members could attend in either setting and communicate with other committee members whereas public comment could only occur via the in-person setting.

The following AC members were in attendance: Mike Blanton, Ana Shellem, Mary Sue Hamann, Doug Cross, Mike Marshall, Bruce Morris, Brian Shepard, Ted Wilgis, Tim Willis (Absent: Adam Tyler, Jim Hardin)

Division of Marine Fisheries (DMF) Staff: Lara Klibansky, Hope Wade, Debbie Manley, Corrin Flora, Tina Moore, Anne Deaton, Chris Stewart, Daniel Ipock, Steve Poland, Carter Witten, Jeff Dobbs

Public: None in attendance, six viewers watched on You Tube.

Shellfish/Crustacean Chair Mike Blanton called the meeting to order at 6:03 p.m.

Chair Blanton provided some general guidance for order of the meeting and noted the conflict of interest statement for Commissioners serving on the AC. Blanton asked the AC members to give an brief introduction.

A call for attendance was performed. The Shellfish/Crustacean AC had nine members present and quorum was met.

APPROVAL OF AGENDA AND APPROVAL OF THE MINUTES

A motion was made to approve the agenda by Mike Marshall. Second by Bruce Morris. The motion passed without objection.

A motion was made to approve the minutes from the Shellfish/Crustacean AC meeting held on October 19, 2021 by Ana Shellem. Second by Mike Marshall. The motion passed without objection.

MARINE FISHERIES COMMISSION UPDATE

Lara Klibansky gave an update on the newly appointed MFC commissioners and who they replaced. Pete Kornegay (science seat) left due to personal reasons and Dr. Doug Rader will continue his term until 2023. Ana Shellem is replacing Sam Romano (commercial seat) and Donald Huggins is replacing Tom Hendrickson (at-large seat). At the Finfish AC meeting on Oct. 20, 2022, Sarah Gardner was sworn in and will fill an at-large seat at the November business meeting.

Klibansky reminded everyone the AC solicitation period is open through Nov. 1. The DMF is looking for applicants for all five ACs and encouraged current AC members to reapply. The MFC chair will select AC members and staff will notify applicants by Dec. 1.

The Coastal Habitat Protection Plan (CHPP) was the last item this committee reviewed and approved. It was approved by all three commissions, and all recommended the development of a public/private partnership to help with research and outreach to implement CHPP actions. Several meetings since adoption of the CHPP have occurred and implementation of this plan is underway.

Next the committee was provided an overview of the May and August 2022 MFC business meetings. At the May meeting, the review of the N.C. River Herring Fishery Management Plan (FMP) was approved as an information update (not an amendment) because the Atlantic States Marine Fisheries Commission is currently conducting a stock assessment and it will be prudent to wait until the results of the assessment are finalized before making management changes. Amendment 3 to the Southern Flounder FMP was approved at the May meeting, completing the cycle for this plan. Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the MFC at its May business meeting. The peer reviewed stock assessment indicates the N.C. striped mullet stock is overfished, and overfishing is occurring in the terminal year of the assessment (2019). At its November meeting, the MFC will be given the results of the scoping period for the review of the Striped Mullet FMP and vote to approve the goal and objectives of draft Amendment 2.

At the August meeting, the MFC tabled the final vote on the selected management measures for estuarine striped bass was tabled to give the new commissioners time to fully review the draft Amendment 2 to the FMP; the preferred management measures were approved at the May meeting. The DMF held two meetings in October to review the amendment with the newly appointed commissioners. The MFC is scheduled to select management measures for and give final approval of the Estuarine Striped Bass FMP Amendment 2 at its November business meeting.

The results of the 2022 stock assessment for spotted sea trout and outcome of the peer review will be presented as an informational update at the November meeting.

In May, the MFC was given a presentation on blue catfish. This is an issue several commissioners have brought up as a major concern due to their impact to other species, particularly in the Albemarle Sound. The DMF continues to actively collect data (diet, etc.) to determine their impact.

Dolphin (mahi mahi) was also discussed at the August meeting and the MFC asked the DMF to draft a letter opposing any new regulations (bag limits). At the August business meeting, the MFC asked that a white paper be developed for false albacore; concerns were raised because it is a highly migratory species with no regulations.

The November MFC meeting will be held at the Islander Hotel & Resort in Emerald Isle from Nov. 16th to the 18th.

Tim Willis asked for an update on the Coastal Conservation Association (CCA) lawsuit vs. the state of NC. Klibansky indicated that she could not comment ongoing legal cases at this time. Willis said the outcome would impact several of the issues that were just discussed.

2023 ANNUAL MFC ADVISORY COMMITTEE MEETINGS PLANNING

Klibansky reviewed the 2023 calendar and noted that in past years the AC did not meet unless there was something the MFC needed input on; however, moving forward we would like to meet on a regular basis to give updates and talk about less contentious topics. The next meeting with an action item will be October 2023 for the management of striped mullet. In January, there will be new AC members and the ACs will receive a presentation from one of the DMF stock assessment biologists to orient the new members. In the future we will alternate between Webex and in-person meetings; the schedule will be finalized once we received input from the ACs. Marshall indicated that he like the idea of meeting more regularly and thought it was important to interact with the members more frequently. Sue Hamann asked if AC members were required to attend commission meetings. Staff indicated that it is not required but AC members can always attend online. MFC updates will be given at each of the four planned AC meetings. Additional AC meeting may be held if requested by the AC.

FISHERY MANAGEMENT PLANS UPDATE

Corrin Flora gave an update on Amendment 3 to the Southern Flounder FMP, noting the 2022 season was based on management from the amendment and it may be a few months before the data is finalized. She noted that the division will not have the Marine Recreational Information Program (MRIP) data until the end of November. Staff noted that the recreational season ended in September and the commercial season is wrapping up and there have been some positive signs. There has also been positive sign in the fishery-independent data as well. Willis asked for more information on MRIP. Flora explained that MRIP is a federal program that produces catch and effort estimates for recreational fisheries. NC is one of the largest contributors to this program. Outreach materials and data is available online. Hamann asked about how the recent management measures have impacted the for-hire fleet. Staff indicated that there is legislation in place that limits our ability to use logbooks to collect data; thus, the landings and discard data are lumped in with all recreational harvest. MRIP does have a charter headboat survey that allows us to look at some of this data. Recently the division received a grant to conduct an economic study on the charter headboat fleet. The last survey was done 10 years ago; Klibansky will send this out to the AC.

For the 2022-2023 FMP Review Schedule, hard clam, oyster, striped mullet, estuarine striped bass, and spotted seatrout are under review; the review of river herring has concluded. The 2018 benchmark blue crab stock assessment will also be updated as part of adaptive management and will include data through 2022. The terminal year of the last assessment was 2016 and indicated that the stock was overfished and overfishing was occurring. The assessment update will add six years of data through 2022 with two to three years of management having occurred under the current FMP amendment. The DMF is also working with UNCW to evaluate new bycatch reduction devices (BRD) to reduce diamondback terrapin interactions in crab pots. The Shellfish/Crustacean AC will review this in early in 2023. Blanton noted the Commercial Fisheries Resource Fund Committee approved giving money to support additional testing of the devices. Flora noted that there were positive results from the current study with hope to expand the study statewide. The new BRD design, narrows the funnel of the pot down and doesn't require the addition of new gear. Cross indicated the need for this came about because the Monterey Bay Aquarium Seafood Watch added blue crab to their red list which restricts sales to high end markets and has crippled the crab meat picking market. Willis asked for an update on the terrapin abundance numbers. Flora indicated that the NC Wildlife Resource Commission conducts a survey and was recently expanded to 12 areas. Colonel Carter Witten with Marine Patrol noted there are two areas where BRDs are required from

Mar. 1 to Oct. 31st with great compliance. Staff further noted that many pot builders are incorporating the new funnel design in pots and BRDs are more readily available. If you need any additional details on this work contact Joe Facendola, DMF. Blanton asked when the data for the stock assessment update would be available. Flora commented that it will likely be ready by April 2023; a summary could be available as early as the July or August. Willis asked if the blue crab landings were down, noting that he had heard from some crabbers up north landings were low. Flora indicated that we review the indices and landings annually with our FMP reviews which can be found online. Klibansky will send a copy out as well. Willis also asked if shrimp landings were down and when the data would be available. Flora commented that shrimp are an annual crop so no stock assessment is done, but landings data can be found in the FMP update.

No management changes were deemed necessary for river herring; the information update is summarized in the 2022 FMP review and will serve as the five-year review of the plan. Staff are reviewing data and existing management for the Hard Clam and Oyster FMPs. Staff will bring information to the ACs in late 2023; a scoping period will likely begin around that same time. The MFC will review the preferred management measures for estuarine striped bass in November. Due to low juvenile abundance in the Albemarle-Roanoke stock the DMF conducted a stock assessment update. DMF and Wildlife Resources Commission staff are continuing to work on this update and based on the initial review of the results, the Director did not open the fishery in Albemarle Sound and continues to assess the subject.

For spotted seatrout, the peer review panel agreed the stock assessment was the best available data to manage the fishery. The assessment contains data up to 2019 and showed biomass was high and therefore not overfished, but overfishing is occurring. Hamann asked staff to define for overfished and overfishing. In early 2023 DMF will have scoping meetings for this plan.

Ted Wilgis asked when the AC would receive an update on the oyster FMP. Flora indicated staff are currently reviewing data and current management. We would like to further develop potential management strategies before bringing them out for scoping in October 2023. Hamann asked if there has been research investigating bird interactions and shellfish aquaculture, specifically fecal contamination from birds roosting. Witten indicated that this has been an issue in NJ. Staff indicated the Interstate Shellfish Sanitation Conference (ISSC) and Federal Drug Administration (FDA) have not established guidelines for this yet; however, the ISSC is now requiring growers to have a bird mitigation plan in their Aquaculture Operation Plan (AOP). Growers must comply or will not be able to transport product out of state. Marine Patrol and the Habitat Enhancement Lease Program enforce and oversee AOPs in NC. In March 2023, the ISSC will discuss this further. Cross noted that this is more of an issue for surface cages and is not an issue for bottom leases. Flora further noted that the amendment would only focus on wild oysters.

Next, Flora discussed striped mullet and said the stock is overfished, and overfishing is occurring in 2019. Because of stock concern the DEQ Secretary asked the MFC to work with DMF to implement a supplement. This will be in place until the next amendment is adopted. At the November meeting the MFC will review the scoping input and vote to approve the goal and objectives. The proposed management strategies for Amendment 2 include: Sustainable Harvest, Recreational Fishery Management, Small Mesh Gill net Management, Stop Net Fishery Management, and Migration Corridors. The DMF had three scoping meetings and an online questionnaire. Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest. The MFC will review the supplement in November and vote to approve it to go out for public comment. The supplement could be implemented as early as 2023. If all goes as planned the Amendment 2 could be in place as early as 2024 or 2025. Flora indicated the division is looking for Striped Mullet AC members and the AC will come up with recommendations in a workshop setting. Hamann asked what the publics' concerns were. Staff indicated concerns with the terminal year of the assessment, lack of electrofishing data, inclusion of the gill net survey, and how the landings data is used. Dobbs noted inclusion of the new data made the model more stable; however, it did change the overall stock status. Flora noted that all assessments are taken out for peer review. Overall, all the concerns of the peer review panel were addressed and the assessment was deemed appropriate for management. We issue press releases for these workshops and the public is welcome to attend. Cross also expressed concerns that the electrofishing data was not included. Dobbs spoke on how data from the independent gill net survey was included which had better spatial coverage and statistical power than the electrofishing data, therefore including data from the electrofishing survey was redundant.

Dobbs gave an overview of the striped mullet scoping meetings. He noted people wanted adaptive management based on abundance indices, not landings as they are influenced by environmental conditions and market demands. Stakeholder expressed need for regional management, noting differences in migration patterns, gears, and markets across the state. Gill net minimum and maximum mesh size restriction as well as migration corridors have been suggested as potential management options. The MFC has not implemented any overarching gill net restrictions; however, will address these in species-specific plans. Dobbs asked the AC if they had any management ideas for Amendment 2 to the Striped Mullet FMP. Cross expressed the need to evaluate how other economic factors influence landings across all plans; further noting that fuel costs and other operating costs have recently reduced effort in the shrimp, scallop, and summer flounder trawl fisheries. Staff noted the division assesses landings and effort annually and the data can be found in the License and Statistic Big Book; commissioners will receive a copy at their November meeting. Klibansky noted she would provide the Big Book as well as the FMP updates to the AC at the January meeting. Blanton asked what options were included in the supplement. Staff noted the options are still being evaluated by the Director and we looking at an end of season closure in the supplement, but other options could be explored in the amendment. Blanton also asked if any tagging studies have been conducted recently. Dobbs gave a summary of study that was conducted in NC from 1998-2001 with returns into 2004; noting that over 14,000 were tagged with roughly 400 returns. There was high site fidelity and many of the fish tagged returned to where they were originally tagged after spawning in the ocean. While there were a few fish that migrated out of state, there is little evidence of long distance migration. Blanton expressed the need to conduct another tagging study to investigate escapement and improve the rate of recapture.

PUBLIC COMMENT

There was no public in attendance.

PLAN AGENDA ITEMS FOR THE NEXT MEETING

No items are planned at this time. Klibansky said the MFC ACs will not likely need to meet again until January 2023 when she will give an update on the outcome of the November MFC business meeting and the ACs will receive a presentation on stock assessments.

Blanton asked if at the January meeting, they could receive a presentation on adaptive management measures and how they have been incorporated into other plans, specifically how they may be applied to Amendment 3 to the Blue Crab FMP. Wilgis asked if the traffic light approach was still being used for the blue crab assessment. Flora indicated that it was a benchmark assessment. Additionally, Blanton asked for more information on Monterey Bay Aquarium Seafood Watch program, specifically how to be delisted. Klibansky said she would pull together some information for the January meeting. Cross indicated that what gets put on the list is highly influenced donor contributions.

Blanton asked Cross if he had any updates on the shellfish lease program. Cross indicated that AOPs have been streamlined and he would like to put off any updates until the January meeting. Klibansky noted there will be a shellfish lease program update under the Director's report at November MFC meeting and will be included as a part of the January commission update. Wilgis asked for more information from DMF and NCSU on the oyster assessment methodology and timeline. Staff noted the NCSU research was not an assessment, but is providing survey methodology to capture estimates of oyster abundance and the data could be used to inform an assessment after a data stream of at least 10-years is completed.

Mike Blanton motioned to adjourn; it was seconded by Ana Shellem. The meeting adjourned at 7:53 p.m.

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

October 28, 2022

MEMORANDUM

TO: Marine Fisheries Commission
Habitat and Water Quality Standing Advisory Committee

FROM: Anne Deaton, Habitat Program Supervisor, Habitat Enhancement Section
Jimmy Harrison, Fisheries Specialist, Habitat Enhancement Section

SUBJECT: Meeting of the Marine Fisheries Commission's Habitat and Water Quality Standing Advisory Committee, Oct. 26, 2022

The Marine Fisheries Commission's (MFC) Habitat and Water Quality Standing Advisory Committee (AC) held a hybrid meeting on Oct. 26, 2022, via webinar and in-person at the Division of Marine Fisheries (DMF) Central District Office, Morehead City, North Carolina. Advisory Committee members could attend in either setting and communicate with other committee members whereas public comment could only occur via the in-person setting.

The following AC members were in attendance: Doug Rader, Ana Shellem, Bob Christian, Nathan Hall, James (Stanley) Hall, Markham Parrish. The following AC members were absent: Joel Fodrie

DMF Staff: Anne Deaton, Tina Moore, James Harrison, Lara Klibansky, Hope Wade, Debbie Manley, Jason Parker, Jeff Dobbs, Steve Poland

Public: Lisa Rider; 14 on YouTube

Habitat and Water Quality AC chair Doug Rader called the meeting to order at 6:02 p.m.

Introductions were made and attendance recorded. The Habitat and Water Quality AC had six members present at the start of the meeting and a quorum was met.

APPROVAL OF THE AGENDA AND APPROVAL OF THE MINUTES

Doug Rader asked the committee to approve the agenda by consensus. All members agreed without objection.

A motion was made by Markham Parrish to approve the minutes from the Habitat and Water Quality AC meeting held on October 20, 2021 and was seconded by Ana Shellem. The motion passed without objection.

MARINE FISHERIES COMMISSION UPDATE

Lara Klibansky gave an update on the newly appointed MFC commissioners and who they replaced. Pete Kornegay (science seat) left due to personal reasons and Dr. Doug Rader will continue Kornegay's term until 2023. Ana Shellem is replacing Sam Romano (commercial seat) and Donald Huggins is replacing Tom Hendrickson (at-large seat). At the November business meeting Sarah Gardner will fill an at-large seat and she was sworn in at the Finfish AC meeting on Oct. 20, 2022.

Klibansky reminded everyone we are in the AC solicitation period which is open through Nov. 1. The DMF is looking for applicants for all ACs and encouraged current AC members to reapply. The MFC chair will select AC members and staff will notify applicants by Dec. 1. Rader asked if there is a certain number of members required for the ACs and if AC members can recruit members. Klibansky replied that 11 is the maximum and that the MFC appoints members with a goal of balance across different stakeholders. There are two openings on the AC and Klibansky agreed with Rader that members can recruit people.

Next the committee was provided an overview of the May and August 2022 MFC business meetings. Since the last Habitat and Water Quality AC meeting in October 2021, the Coastal Habitat Protection Plan (CHPP) 2021 Amendment was approved by the three environmental commissions unanimously, and implementation is underway. At the May MFC meeting, the review of the N.C. River Herring Fishery Management Plan (FMP) was approved as an information update (not an amendment) because the Atlantic States Marine Fisheries Commission is currently conducting a stock assessment and it will be prudent to wait until the results of the assessment are finalized before making management changes. Amendment 3 to the Southern Flounder FMP was approved at the May meeting, completing the cycle for this plan. Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the MFC at its May business meeting. The peer reviewed stock assessment indicates the N.C. striped mullet stock is overfished, and overfishing is occurring. The terminal year of the assessment is 2019. At its November meeting, the MFC will be given the results of the scoping period for the review of the Striped Mullet FMP and vote to approve the goal and objectives of draft Amendment 2.

At the August meeting, the MFC tabled the final vote on the selected management measures for estuarine striped bass to give the new commissioners time to fully review the draft Amendment 2 to the FMP; the preferred management measures were approved at the May meeting. The DMF held two meetings in October to review the amendment with the newly appointed commissioners. The MFC is scheduled to select management measures for and give final approval of the Estuarine Striped Bass FMP Amendment 2 at its November business meeting.

The results of the 2022 stock assessment for spotted sea trout and outcome of the peer review will be presented as an informational update at the MFC's November business meeting.

Blue catfish continues to be a topic brought up by commissioners as a major concern due to their impact to other species, particularly in the Albemarle Sound. The DMF continues to actively collect data (diet, etc.) on blue catfish and has participated in blue catfish workshops in Virginia.

Dolphin (mahi mahi) was also discussed at the August meeting and the MFC asked the DMF to draft a letter opposing any new regulations (bag limits). Lastly, the MFC asked that a white paper be developed (or the 2017 document updated) for false albacore and consider management options; concerns were raised because it is a highly migratory species with no regulations. Markham asked if there is a size limit for dolphin because there are dolphin in N.C. year-round. Steve Poland replied no, partially due to lower numbers of fish at that time and concern over dead discards. Studies have found that the size at maturity is 20 inches. Tagging studies indicate dolphin stocks are shifting north. In N.C. and waters further north, more dolphin are being seen. Rader commented that we will see this more with additional species due to warming temperatures and climate change. He suggested that fishery management may want to consider more comprehensive management rather than species by species.

The November MFC meeting will be held at the Islander Hotel & Resort in Emerald Isle from Nov. 16th to the 18th.

2023 ANNUAL MFC ADVISORY COMMITTEE MEETINGS PLANNING

Klibansky reviewed the 2023 MFC calendar and noted that in past years the AC did not meet unless there was something the MFC needed input on; however, moving forward we would like to meet on a regular basis to give updates and talk about less contentious topics, even when there are no action items from the MFC. In January, there will be new AC members and the ACs will receive a presentation from one of the DMF stock assessment biologists to orient the new members. It will be a virtual meeting. In the future we will alternate between Webex and in-person meetings; however, staff will set up listening stations for the public at various locations when the meetings are virtual. The next AC meeting in January will be virtual.

Markham asked if the AC will get materials in advance and was told yes. Rader noted that he would like them to consider their role, discuss priority habitat and water quality issues that cross multiple species, and make sure the AC agenda aligns with MFC business. Rader asked if there were topics they can take a leadership role in, getting ahead for habitat and water quality issues in FMPs or CHPP. Anne Deaton said that the staff could compile all the Habitat and Water Quality recommended management actions from FMPs for the AC to review. Rader said that would be a good information for the AC to review so that they can consider actions needed. Markham noted there are some common problems such as loss of submerged aquatic vegetation, decline in water quality, but they are difficult for the AC to address (eg. agriculture impacts) because they cannot do anything. Rader explained that they can, with one example being writing letters to appropriate commissions. It is the AC’s responsibility to advise the MFC. Rader suggested discussing more specific issues at the January meeting.

FISHERY MANAGEMENT PLANS UPDATE

Poland gave an update on Amendment 3 to the Southern Flounder FMP, noting the 2022 season was based on management from the amendment and it may be a few months before the data is finalized. He noted that the division will not have the Marine Recreational Information Program (MRIP) data until the end of November. There have been reports that fishermen are seeing more and larger flounder, indicating that the fishery is heading in the right direction.

Poland, when asked about any new updates on southern flounder regionally, said there are no reports from other states. Discussions will likely occur in 2024 with other states to inform the stock assessment since southern flounder in the South Atlantic region is considered one stock. N.C. is waiting on the other states to implement management measures. There will be an update by the end of 2024. Stanley Hall noted that new gear restrictions on shrimp trawls (2” bar spacing) are greatly reducing bycatch of flounder.

For the 2022-2023 FMP Review Schedule, hard clam, oyster, striped mullet, estuarine striped bass, and spotted seatrout are under review; the review of river herring has concluded. The 2018 benchmark blue crab stock assessment will also be updated as part of adaptive management and will include data through 2022. The terminal year of the last assessment was 2016 and indicated that the stock was overfished and overfishing was occurring. The assessment update will add six years of data through 2022 with two to three years of management having occurred under the current FMP amendment. The DMF is also working with UNC-W to evaluate new bycatch reduction devices to reduce diamondback terrapin interactions in crab pots.

No management changes were deemed necessary for river herring; the information update is summarized in the 2022 FMP review and will serve as the five-year review of the plan. Staff are reviewing data and existing management for the Hard Clam and Oyster FMPs. Focus will be on cultch planting efforts and new management strategies. Staff will bring information to the ACs in late 2023; a scoping period will likely begin around that same time. Rader asked if anything novel regarding oyster and clams was expected to be brought to committee. Deaton replied that shellfish harvest closures have not been increasing greatly, but there is a trend of temporary areas are closing more frequently or staying closed longer. There are increasing efforts to develop management plans to address runoff. For example, the N.C. legislature allocated funds for developing a Newport River Watershed Restoration Plan. There is a CRFL study finishing up that is examining the rate and effect of sedimentation at multiple tidal creeks by Joel Fodrie. Rader asked if there were any updates on status/trends for nursery areas. Rader expects the AC to have questions about habitat and water quality and productivity trends in nursery areas and the effects of that on FMP species. Rader asked if there was any new information or studies on the extent of heavy metal concentration. Deaton responded that there have been some studies and sampling, but not to the extent of previous efforts. Rader would like staff to present any new information on shellfish and water quality trends so the AC can begin discussing actions needed. Deaton noted there have been some recent relevant studies. One study looked at the impact of sedimentation on oyster reefs, other habitat, and primary nursery function. Another assessed Primary Nursery Area function and current monitoring protocol.

The MFC will review the preferred management measures for estuarine striped bass in November. Due to low juvenile abundance in the Albemarle-Roanoke stock the DMF conducted a stock assessment update. DMF and Wildlife Resources Commission staff are continuing to work on this update and based on the initial review of the results, the Director did not open the fishery in Albemarle Sound and continues to assess the subject. Doug commented that the AC should be aware that one sticking point in the amendment was whether there would be a potential to establish spawning populations in the different systems to jumpstart stock increases. The South Atlantic Fishery Management Council (SAFMC) had a policy related to establishment of flows that allowed the federal agencies to provide input on flow measures to maintain fisheries resources. After this FMP process, Rader said there is a need to assess spawning in the upper Neuse, Tar-Pamlico, and other areas, and the effect of altered flow on spawning.

For spotted seatrout, the peer review panel agreed the stock assessment was the best available data to manage the fishery. The assessment contains data up to 2019 and showed biomass was high and therefore not overfished, but overfishing is occurring. In early 2023 DMF will have scoping meetings for this plan.

Poland discussed striped mullet and said the stock is overfished, and overfishing is occurring in 2019. Because of stock concerns, the Department of Environmental Quality (DEQ) Secretary asked the MFC to work with DMF to implement a supplement. This will be in place until the next amendment is adopted. At the November meeting the MFC will review the scoping input and vote to approve the goal and objectives. The proposed management strategies for Amendment 2 include: Sustainable Harvest, Recreational Fishery Management, Small Mesh Gill net Management, Stop Net Fishery Management, and Migration Corridors. The DMF had three scoping meetings and an online questionnaire. Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest. The MFC will review the supplement in November and vote to approve it to go out for public comment. The supplement could be implemented as early as 2023. If all goes as planned the Amendment 2 could be in place as early as 2024 or 2025. Jeff Dobbs noted inclusion of the new data made the model more stable; however, it did change the overall stock status. The DMF issues press releases for these workshops and the public is welcome to attend.

Dobbs gave an overview of the striped mullet scoping meetings. He noted people wanted adaptive management based on abundance indices, not landings as they are influenced by environmental conditions and market demands. Stakeholders expressed need for regional management, noting differences in migration patterns, gears, and markets across the state. Gill net minimum and maximum mesh size restriction as well as migration corridors have been suggested as potential management options. The MFC has not implemented any overarching gill net restrictions; however, will address these in species-specific plans. Dobbs asked the AC if they had any management ideas for Amendment 2 to the Striped Mullet FMP. Markham explained that mullet migrate along the east coast, and are in Maryland waters earlier, and in N.C. waters in August and September. He has concerns that people are cast netting for mullet and bringing the fish to large tractor trailers, where they are then transported and sold elsewhere. Staff noted that the fishermen would have to be licensed, but there were questions on whether the sales are getting recorded on trip tickets. Jason Parker, Marine Patrol officer that attended virtually, stated later to Deaton that the fish would be required to go through a fish dealer if they were landed here and transported out of state.

Rader asked about striped mullet spawning and nursery area locations and whether there would be habitat or water quality concerns. Dobbs explained they are mature in one to two years, they go out of the estuary to spawn in the ocean, not very far offshore. Currents carry larvae to the small estuarine creeks where they live through the summer, and cooling water triggers spawning migrations. During “mullet blows” they move from the rivers to the ocean by December. A tagging study found limited movement in the ocean. Rader asked Dobbs to bring back any habitat and water quality issues related to striped mullet in January. Bob Christian asked if mullet were common in fish kills. Staff did not think so but can look at fish kill data that Division of Water Resources collects. Rader asked if there were new trends with hypoxia in N.C. Nathan Hall, who studies water quality in the Neuse River and other waters extensively, stated it was about the same over the last 20 years, with the Neuse River having hypoxic bottom waters most of the summer. He said that high amounts of organic sediment can cause hypoxia without an algal bloom and that hypoxia does not always result in fish kills. Markham mentioned that a study by Tar-Pamlico Foundation found that hypoxia triggered algal blooms. N. Hall said it’s possible but complex. After further discussion, Rader asked staff to synthesize what is known currently regarding hypoxia, patterns and trends, correlation with fish kills and algal blooms.

Poland said the supplement is intended to be simple, effective, and end overfishing within one year. The MFC will review the supplement in November and vote to approve it to go out for public comment. If all goes as planned the next amendment could be in place as early as 2024 or 2025.

PUBLIC COMMENT

There was no public comment.

PLAN AGENDA ITEMS FOR THE NEXT MEETING

No items are planned at this time. Klibansky said the MFC ACs will not likely need to meet again until January 2023 when she will give an update on the outcome of the November MFC business meeting and the ACs will receive a presentation on the stock assessment process. There will also be an AC orientation. Klibansky mentioned the MFC will be given an update on the lease program changes in November.

Bob Christian noted that CHPP Water Quality Summit occurred last week and asked if Deaton could provide some initial outcomes from that at the January AC meeting. Deaton said we could and noted that they expect multiple water quality initiatives coming from that meeting, including forming an active Stakeholder Engagement for Collaborative Coastal Habitats Initiative (SECCHI). Rader noted wanting updates on other habitat initiative. Examples included APNEP activities, water clarity and nutrient criteria development, Mid and South Atlantic Council activities, and Council work on climate vulnerability assessments. Staff will compile a list of requested habitat and water quality topics to present to the AC in the future.

Rader adjourned the meeting by consensus at 7:47 p.m.

October 27, 2022

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: William Brantley, Grants Program Manager, Administrative and Maintenance Services Section

SUBJECT: September 29, 2022, Commercial Fishing Resource Fund Committee Meeting

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Issue
The N.C. Commercial Fishing Resource Funding Committee met jointly with the N.C. Marine Fisheries Commission Commercial Resource Fund Committee at 6:00 p.m. on Thursday, September 29, 2022, through Webex to consider funding for their 2023 funding cycle.

Findings
The joint committees approved extending a public relations project, as well as three proposals that were submitted as a result of the Commercial Fishing Resource Fund Request for Proposals. Three proposals were tabled, and four proposals were not approved for funding.

Action Needed
For informational purposes only, **no action is needed at this time.**

Attachments
1) Draft meeting minutes from the September 29, 2022 joint meeting

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

MEMORANDUM

TO: N.C. Marine Fisheries Commission Commercial Resource Fund Committee and the Funding Committee for the N.C. Commercial Fishing Resource Fund

FROM: William Brantley, Grants Program Manager
Division of Marine Fisheries, NCDEQ

DATE: October 24, 2022

SUBJECT: MFC Commercial Resource Fund Committee and Funding Committee for the N.C. Commercial Fishing Resource Fund Meeting Minutes

The MFC Commercial Resource Fund Committee and the Funding Committee for the N.C. Commercial Fishing Resource Fund met at 6:00 p.m. on Thursday, September 29, 2022, through Webex. The following members attended:

MFC Commercial Resource Fund Committee: Chairman Doug Cross, Mike Blanton, Ana Shellem

Funding Committee for the N.C. Commercial Fishing Resource Fund Members: Chairman Ernest Doshier, Glenn Skinner, Steve Weeks, Britton Shackleford, and Doug Todd.

Absent: Gilbert Baccus

Public Comment: Public comment was received through webpage and US mail

Approval of Agenda and Minutes

Chairman Ernest Doshier and Chairman Doug Cross called the meeting to order for the Funding Committee for the N.C. Commercial Fishing Resource Fund and the MFC Commercial Resource Fund Committee. William Brantley read the conflict-of-interest reminder, and no conflicts were noted by the Chairmen. Brantley conducted a roll call for both committees. All members were present from the MFC Commercial Resource Fund Committee. One member was absent from the Funding Committee for the N.C. Commercial Fishing Resource Fund.

The meeting agenda and minutes were reviewed.

Motion by Glenn Skinner to approve the agenda. Second by Steve Weeks. Motion passed unanimously through a roll call vote of present members.

Motion by Ana Shellem to approve the agenda. Second by Mike Blanton. Motion passed unanimously through a roll call vote.

Motion by Glenn Skinner to approve the minutes from the March 3, 2022 meeting. Second by Britton Shackleford. Motion passed unanimously through a roll call vote of present members.

Motion by Mike Blanton to approve the minutes from the March 3, 2022 meeting. Second by Ana Shellem. Motion passed unanimously through a roll call vote.

The committees were briefed on points from Session Law 2020-3 since the meeting was occurring during a state of emergency and provided a brief overview of the agenda.

Financial Report

Brantley briefed the Committees that the fiscal year 2022 transfer into the Commercial Fishing Resource Fund was $714,273. After obligations for on-going projects from the Fund, this leaves $1,824,663.80 available for the Committees to spend on projects allowed for in NCGS 113-173.1.

DMF Southern Flounder Satellite Tagging Update

DMF biologists Shelby White and Mike Loeffler gave updates on the program funded by the Committees. This is a collaborative project with UNC-Wilmington's Coastal Recreational Fishing License funded satellite flounder tagging program. In 2020, 130 tags were placed in southern flounder. In 2021, 94 tags were placed in southern flounder. Thus far, 63 tag releases occurred inshore, 68 were on the inner shelf, and 14 were on the outer shelf. 27 mrPAT tags will be used in 2022, mostly focused on the Core Sound area. Chairman Cross inquired about the sex of the tagged fish. White noted that field testing the sex of the flounder could not occur with the current sampling equipment available to staff. Shackleford asked about information obtained from the use of traditional tags of southern flounder and a future presentation on conventional tagging efforts. Loeffler noted the Division's multispecies tagging program began in 2014 and has tagged over 5,000 southern flounder. A future presentation on conventional tagging could be prepared for a future meeting.

Public Relations Project Extension

Chairman Cross noted the quality of the PR project, and a one-year extension was an option for the Committees to consider for extending the project at a similar cost and budget. Skinner spoke on the outreach impacts the project is having, and the organization has proven their stewardship of the funding they have received. Blanton agreed with the extension and noted that the content was excellent.

Motion by Britton Shackleford to approve extending the SA Cherokee project one year with a similar scope and budget. Second by Glenn Skinner. Motion passed unanimously through a roll call vote of present members.

Motion by Mike Blanton to approve extending the SA Cherokee project one year with a similar scope and budget. Second by Ana Shellem. Motion passed unanimously through a roll call vote.

CFRF REQUEST FOR PROPOSALS (RFP) REVIEW

Elevating consumer awareness of domestic shark fisheries: Promoting the sustainability of the US shark fishery with MSC certification: Skinner and Chairman Cross noted the importance of MSC certification but acknowledged the limited number of coastal and pelagic species that were listed in the proposal. Members considered future maintenance of the certification once it was received. Weeks stated concerns over the ownership of the MSC certification: the state, Commercial Fishing Resource Funding committees, or the applicant? Skinner also mentioned MSC pre-assessments as an option in the future to see where the fishery stands with the MSC, prior to full certification. Blanton issued concerns on assurances of certification.

Motion by Glenn Skinner to not approve the project titled *Elevating consumer awareness of domestic shark fisheries: Promoting the sustainability of the US shark fishery with MSC certification*. Second by Steve Weeks. Motion passed unanimously through a roll call vote of present members.

Motion by Mike Blanton to not approve the project titled *Elevating consumer awareness of domestic shark fisheries: Promoting the sustainability of the US shark fishery with MSC certification*. Second by Ana Shellem. Motion passed unanimously through a roll call vote.

Water quality for fisheries: Addressing marine debris impacts to costal commercial fisheries in NC: Skinner noted that this was a continuation of a prior project from the Fund and questioned what the direct action was to improve water quality. Chairman Cross concurred and inquired to any integration into the Coastal Habitat Protection Plan. Chairman Cross asked to table this project until other projects had been reviewed. The joint Committees agreed to postpone the decision until the end of the meeting.

*The floor was re-opened for discussion after all proposals had been discussed.

Motion by Glenn Skinner to table the project titled *Water quality for fisheries: Addressing marine debris impacts to costal commercial fisheries in NC*. Second by Steve Weeks. Motion passed unanimously through a roll call vote of present members.

Motion by Ana Shellem to table the project titled *Water quality for fisheries: Addressing marine debris impacts to costal commercial fisheries in NC*. Second by Mike Blanton. Motion passed unanimously through a roll call vote.

<u>Trophic impacts of the invasive blue catfish in the Albemarle sound ecosystem:</u> Chairman Cross reiterated concerns over blue catfish in the Albemarle sound and that further research is needed. Blanton stated he agreed with Cross, but he had questions on the methodology of the project and sampling areas, and what would be gained from the project's conclusion. Blanton noted that before the projects are approved, he would like to hear from the research team, especially with concern to what is listed as the most commercially important species within the proposal. Chairman Cross asked if the proposal could be tabled, pending further clarification. Brantley stated that if the Committees felt they had met the objectives, and only needed clarification on the proposal, then that would be an option to consider. Shackleford noted the open-ended nature of the methodology. Skinner stated he had spoken with the research team, and there was flexibility in the sampling areas and predation species.

Motion by Glenn Skinner to table the vote on the project titled *Trophic impacts of the invasive blue catfish in the Albemarle sound ecosystem*. Second by Steve Weeks. Motion passed unanimously through a roll call vote of present members.

Motion by Mike Blanton to table the vote on the project titled *Trophic impacts of the invasive blue catfish in the Albemarle sound ecosystem*. Second by Ana Shellem. Motion passed unanimously through a roll call vote.

<u>Integrating multi-scaler indicators of management effectiveness to support sustainable and equitable development of the eastern oyster fishery in NC:</u> Chairman Cross stated he felt that market conditions heavily influenced the oyster fishery, and this proposal focused on competition among stakeholders. Weeks and Chairman Doshier stated concerns over the value to the fishery if it was funded. Shackleford brought forth discussion on market factors and how current stakeholders consider those conditions in their current business practices.

Motion by Glenn Skinner to not approve the project titled *Integrating multi-scaler indicators of management effectiveness to support sustainable and equitable development of the eastern oyster fishery in NC*. Second by Britton Shackleford. Motion passed unanimously through a roll call vote of present members.

Motion by Mike Blanton to not approve the project titled *Integrating multi-scaler indicators of management effectiveness to support sustainable and equitable development of the eastern oyster fishery in NC*. Second by Ana Shellem. Motion passed unanimously through a roll call vote.

<u>Rapid response alerts for consumer education:</u> Skinner noted his support of the project scope and the ability of the program to quickly inform consumers. Chairman Cross also noted that consumers were often overlooked on management decisions, and consumer involvement would be a positive for the industry. Shellem stated that she had formally sat on the NC Catch board and wanted to recuse herself from discussion on the proposal. Blanton asked for clarification on what the program would be rapidly responding to, inquired to the clarity of the overall intent of the proposal, and questioned the threshold for when to respond. Skinner stated one of the abilities of the proposal is that it would permit rapid consumer education on the impacts of impending management decisions. Cross concurred that this would allow consumers to hear fishery management plan considerations that were being discussed, that would impact the availability of certain species of consumers. Shackleford acknowledged the ambiguity of the proposal on who makes determinations for responses, but he wanted clarification on triggers and education of the consumers; and how that would occur (i.e. single-species, multi-species, regional impacts, etc). Brantley asked the Chairmen for clarity on what questions the Committees wanted further information on if the motion moved to table. Chairman Cross said clarification was needed on events that trigger the use of funds, decisions on how much is allocated on each event, and any other details to further understand how the project functions. Blanton acknowledged the milestone schedule in the proposal, and he would like to see how it targets audiences other than the methods they are already funding (Always NC Fresh) or already occurring (NC DMF press releases). He would prefer that applicants be available in the future for discussion on their proposals.

Motion by Mike Blanton to table the discussion on the project titled *Rapid response alerts for consumer education.* Second by Doug Cross. Motion passed with Cross and Blanton voting 'aye' and Shellem recused herself.

Motion by Glenn Skinner to table the discussion on the project titled *Rapid response alerts for consumer education*. Second by Britton Shackleford. Motion passed unanimously through a roll call vote of present members.

Lost fishing gear recovery project in NC coastal waters: Chairman Cross stated that this was a continuation of previous work that the Committees had funded. Cross inquired as to the funding amounts for the last project, Brantley referenced the budget report that reflects the Committees approving $115,599 in 2021 for a one-year project. Weeks asked about funds being released for approved projects, and Brantley stated that the recipients operated under reimbursable contracts with the DEQ. Shellem noted the importance of the program. Shackleford asked about the status of equipment that was recovered, and if it was destroyed once recovered. Blanton stated the pots were offered back to the fishermen.

Motion by Steve Weeks to approve the project titled *Lost fishing gear recovery project in NC coastal waters*. Second by Britton Shackleford. Motion passed unanimously through a roll call vote of present members.

Motion by Ana Shellem to approve the project titled *Lost fishing gear recovery project in NC coastal waters.* Second by Mike Blanton. Motion passed unanimously through a roll call vote.

Ecosystem based approach to determine predation impacts on commercially important species in NC: Chairman Cross stated that it was general knowledge that the species in the proposal impacted the ecosystem through predation. Shackleford summarized that the scope may be too broad. Weeks noted the importance of documenting and quantifying the impacts that this proposal sought to cover.

Motion by Britton Shackleford to not approve the project titled *Ecosystem based approach to determine predation impacts on commercially important species in NC*. Second by Doug Todd. Motion passed with Shackleford, Skinner, Todd, and Doshier voting 'aye' and Weeks voting 'nay.'

Motion by Mike Blanton to not approve the project titled *Ecosystem based approach to determine predation impacts on commercially important species in NC.* Second by Ana Shellem. Motion passed unanimously through a roll call vote.

<u>A comparison of commercial and recreational marine fisheries management and allocation approaches in NC: Dynamics related to efforts to rebuild depleted stocks:</u> Weeks stated the purpose of this project is to evaluate the trends of commercial and recreational fisheries to the contributions of harvest and to evaluate systemic biases resulting in the de facto reallocations between the sectors. Skinner stated he felt that cuts in the commercial sector from Fishery Manager Plans were occurring with unrealized cuts in the recreational sector, and it is essentially reallocating the resource; management measures need to be effective in both sectors. Chairman Cross stated that reallocation was concerning, and this project would be a move in the right direction for data-based decisions. Chairman Doshier discussed the impacts of the recreational sector in fisheries. Shackleford stated recreational mortality is impactful, but the proposal is broad.

Motion by Glenn Skinner to approve the project titled *A comparison of commercial and recreational marine fisheries management and allocation approaches in NC: Dynamics related to efforts to rebuild depleted stocks*. Second by Britton Shackleford. Motion passed unanimously through a roll call vote of present members.

Motion by Mike Blanton to approve the project titled *A comparison of commercial and recreational marine fisheries management and allocation approaches in NC: Dynamics related to efforts to rebuild depleted stocks.* Second by Ana Shellem. Motion passed unanimously through a roll call vote.

<u>Evaluating the impact of shrimp trawl industry on estuarine dependent fisheries:</u> Chairman Cross stated he had a high interest in shrimp trawl bycatch and the industry has questions they want answered; however, this proposal does not target the objectives in the RFP. Skinner stated he had spoken with the applicant, and while the proposal offers valuable data, it does not capture the intent of the RFP. Skinner also noted that the state needs to implement a program to annually capture effort in the shrimp trawl fishery. Shellem noted the impacts of climate change on the fishery. Shackleford stated that the proposal assumes a bycatch issue.

Motion by Steve Weeks to not approve the project titled *Evaluating the impact of shrimp trawl industry on estuarine dependent fisheries*. Second by Glenn Skinner. Motion passed unanimously through a roll call vote of present members.

Motion by Ana Shellem to not approve the project titled *Evaluating the impact of shrimp trawl industry on estuarine dependent fisheries.* Second by Mike Blanton. Motion passed unanimously through a roll call vote.

<u>Incorporation of bycatch technology in the NC blue crab commercial fishery:</u> Blanton opened discussion, and the provided some history on the project the Committees had funded that preceded this proposal. He also expressed concern about the Seafood Watch group and their opinion of fisheries throughout the nation. Blanton stated his concern about genetic analysis on the turtles captured in the study. Chairman Cross said this study would provide results that the Seafood Watch group had asked for in the fishery.

Motion by Mike Blanton to approve the project titled *Incorporation of bycatch technology in the NC blue crab commercial fishery.* Second by Ana Shellem. Motion passed unanimously through a roll call vote.

Motion by Doug Todd to approve the project *Incorporation of bycatch technology in the NC blue crab commercial fishery*. Second by Glen Skinner. Motion passed unanimously through a roll call vote of present members.

<u>Issues from Committee Members</u>

Glenn Skinner asked for time to discuss the Always NC Fresh campaign in connection with the NC Seafood Festival, considering the impending tropical storm expected to impact the area. The weather impacts are expected to affect the attendance, and the Committees could reallocate time and expenses for more a more impactful campaign. Chairman Cross and Shellem offered discussion in concurrence.

Blanton expressed the benefits that the Committees would have in asking applicants to be in attendance for proposal discussion during the next RFP review meeting. Skinner stated that the applicants are available outside of a meeting for discussion if members want to reach out for individual discussion.

The ‘Always NC Fresh’ logo was discussed, and Mike Blanton asked for clarification on ownership. Chairman Cross stated the need to consult with counsel. Skinner asked for guidance from the Committees to speaking on behalf of the Always NC Fresh campaign, or who can use the public relations material. The conversation moved to suggest that the committees need an answer on giving permissions to use the material along with putting a process in place for approval, and the MFC general counsel would be the first step.

<u>ADJOURNMENT</u>

Motion by Ana Shellem to adjourn. Second by Mike Blanton. Motion passed unanimously through a roll call vote.

Motion by Glen Skinner to adjourn. Second by Steve Weeks. Motion passed unanimously through roll call vote of present members.

Meeting adjourned.

WB

NC Marine Fisheries Commission

Director's Report

November 2022 Business Meeting

October 2022 Council Meeting Summary

The Mid-Atlantic Fishery Management Council met October 4-6, 2022, in Dewey Beach, Delaware. This was a hybrid meeting, with virtual and in-person participation options. Presentations, briefing materials, motions, and webinar recordings are available at http://www.mafmc.org/briefing/october-2022.

HIGHLIGHTS

During this meeting, the Council:

- Approved for public comment a draft amendment to modify the species separation requirements in the Atlantic surfclam and ocean quahog fisheries
- Initiated an Omnibus (all Council-managed species) Essential Fish Habitat (EFH) Amendment
- Set 2023 spiny dogfish specifications including a 55% reduction in the Acceptable Biological Catch and a 59% reduction in the commercial quota, compared to 2022
- Received an update on private recreational tilefish permitting and reporting and discussed additional outreach needed to improve angler awareness and compliance
- Received an update on the East Coast Scenario Planning Initiative
- Met jointly with the Scientific and Statistical Committee to discuss topics of mutual interest
- Received presentations on NOAA Fisheries Draft Ropeless Roadmap Report, NEFSC Fishery Monitoring and Research Division Update, and NOAA Saltwater Recreational Fisheries Policy
- Received a refresher on the Surfclam and Ocean Quahog Excessive Shares Amendment
- Provided input on proposed actions and deliverables for the 2023 Implementation Plan (Executive Committee)
- Agreed with the Protected Resource Committee's recommendation to send a comment letter on the Proposed North Atlantic Right Whale Vessel Strike Reduction Rule
- Presented the 2021 Ricks E Savage Award to Mr. Steve Heins

Atlantic Surfclam and Ocean Quahog Species Separation Requirements Amendment

The Council approved for public comment a draft amendment to modify the species separation requirements in the Atlantic surfclam and ocean quahog fisheries. Comments may be submitted at any of three public hearings to be held on November 10, 14, and 17. Written comments will also be accepted through November 23. A hearing schedule and public comment instructions are available here.

This action is intended to address the increased occurrence of mixed catches in the Atlantic surfclam and ocean quahog fisheries. Current regulations do not allow for surfclam and ocean quahog to be landed on the same trip or placed in the same cages. Industry has reported that it has become increasingly difficult to avoid mixed catches due to changes in the species' distributions. The draft amendment contains a range of management approaches ("alternatives") that would modify current regulations to allow for mixed catches onboard vessels. Details about these management alternatives can be found in the **Public Hearing Document**.

Following a review of comments received, the Council will choose a preferred alternative and submit the amendment to the Secretary of Commerce for approval and publication of proposed and final rules, both of which have additional comment periods. The Council may consider final action at its December 12-15, 2022 meeting.

Essential Fish Habitat Amendment

The Council initiated an Omnibus (all Council-managed species) Essential Fish Habitat (EFH) Amendment that will concurrently conduct the 5-year EFH review required under the Magnuson Stevens Act while amending fishery management plans for the Council, as needed. This action is an opportunity to utilize the best available fish habitat science to improve EFH designations and support the Council's fish habitat conservation efforts while supporting the EFH consultation process. The consultation process plays an important role in addressing the impacts of non-fishing projects (such as wind energy projects) on fish habitat.

Spiny Dogfish 2023 Specifications

Due to delays with the ongoing spiny dogfish research track assessment, the Council had to set 2023 spiny dogfish specifications without the benefit of a current assessment. The Council will consider the assessment results when they become available. The Council's Scientific and Statistical Committee (SSC) recommended an Acceptable Biological Catch (ABC) reduction from 17,498 metric tons (MT) to 7,788 MT, a 55.5% reduction. The SSC's rationale for the reduction included observations of declining trends in several indicators including survey abundance, catch per unit of effort (CPUE), pup production, and dogfish growth. After other sources of catches are accounted for (discards, recreational landings, and Canadian landings), the 2023 commercial quota (beginning May 1, 2023) would be 12.0 million pounds, a 59% reduction from 2022. The 2021 fishery landed about 10.4 million pounds, and the first half of the 2022 fishery has followed a similar weekly pattern as 2021. The Council discussed that these specifications involve a higher risk of overages due to the lack of a management uncertainty buffer and uncertainty about expected discards, but industry input indicated they were willing to risk future paybacks because a 2023 quota below 12 million pounds could lead to the closure of the last remaining spiny dogfish processing facility. The New England Fishery Management Council will consider its spiny dogfish recommendations in December 2022 for this jointly-managed stock.

Private Recreational Tilefish Permitting and Reporting

In August 2020, recreational permitting and reporting requirements were implemented for private tilefish anglers. During this meeting the Council received a presentation from the Greater Atlantic Regional Fisheries Office (GARFO) on the status of private recreational tilefish (golden and blueline) permitting and reporting. The update included information related to the number of permits issued, recreational trips, and landings reported since the requirements were initially implemented.

Council staff also gave a presentation on what outreach has been accomplished to date, provided a summary of the Joint Tilefish and Communication and Outreach Advisory Panel meeting, and a list of future outreach efforts. As a result of the presentations and subsequent discussion, the Council recommended additional outreach be conducted in Spring 2023 when offshore angler activity for golden and blueline tilefish recreational fishing increases. The goal of this outreach is to increase awareness of the tilefish permitting and reporting requirements, as well as to educate anglers on the reporting systems available to submit electronic vessel trip reports and the benefits of accurate reporting. Current outreach materials and other resources are available on the Council's Tilefish Permitting and Reporting Webpage.

Climate Change Scenario Planning

The Council received an update on the East Coast Scenario Planning Initiative. Since the August Council meeting, the core team has worked to refine the draft scenario narratives and begin the Applications Phase of the initiative. Three manager "brainstorming sessions" were recently held via webinar to generate ideas issues, ideas and options that should be discussed during the Applications Phase. At their respective upcoming November and December meetings, each East Coast Council and the ASMFC will develop ideas and recommendations from each management body. These ideas will feed into an in-person summit meeting to be held in February 2023. The summit meeting will serve as a venue to develop a final set of governance, management, and monitoring recommendations from the scenario planning process. Additional updates will be posted to the [Climate Change Scenario Planning website]() as they are available.

Joint Council-SSC Meeting

The Council and its Scientific and Statistical Committee (SSC) met jointly to discuss ongoing and planned SSC activities in support of Council priorities. The Council and SSC have been holding these joint meetings annually since 2019 to provide an opportunity to discuss pertinent issues and foster greater dialogue and build relationships between the Council and SSC given the limited interaction between the two groups. Three topics were discussed in detail: (1) the anticipated topics and issues the SSC will address in 2023, (2) an update of the ongoing work by the SSC Ecosystem Work Group in developing and utilizing integrated ecosystem-level indicators within existing or new Council processes, and (3) future engagement and activities of the SSC Economic Work Group. The Council also discussed potential changes to future joint meetings to ensure meetings remain productive and achieve the intended goals.

NOAA Fisheries Presentations

NOAA Fisheries Draft Ropeless Roadmap Report

Dr. Michael Asaro (NEFSC) provided an overview of the Draft Ropeless Roadmap which describes the current state of on-demand fishing and outlines a path for adoption of this technology in commercial fisheries. This roadmap is an important step towards reducing the risk of right whale entanglement in fishing gear. The technology involved in this on-demand or ropeless fishing is still in development, and public input is being sought at this time to help guide the future of the program. The Council discussed the capabilities of the current technology and where it is expected to progress in the future. They also discussed concerns over the current costs and the potential for gear conflicts.

NEFSC Fishery Monitoring and Research Division Update

KB McArdle (NEFSC) presented an update on activities at the Fishery Monitoring and Research Division. This Division focuses on the data collection and integration of information from Mid-Atlantic and New England commercial fisheries into the science and management process. They oversee programs such as the observer operations and training, dockside monitoring, the study fleet, and data modernization. The update included information on recent changes to the data review process to redistribute observer coverage, the planned 2022-2023 sea day coverage for the standardized bycatch reporting methodology, and current activities within the cooperative research program.

NOAA Saltwater Recreational Fisheries Policy

Russ Dunn (NOAA Fisheries) briefed the Council on plans to update NOAA's 2015 National Policy for Saltwater Recreational Fisheries. Goals of the current policy include supporting relevant natural resources, promoting saltwater fishing for the benefit of the nation, and enabling enduring participation through science-based conservation and management. NOAA Fisheries intends to update the Policy to ensure that it adapts with changing ocean and fishery conditions, scientific understanding, and the evolving needs of the fishing public. The public comment period is open through December 31, 2022. [Learn more here]().

Other Business

Excessive Shares Amendment Proposed Rule

The Council received a refresher on the history of the development of Amendment 20 to the Atlantic Surfclam and Ocean Quahog Fishery Management Plan. The Council initiated work on this action in 2004, and after many years of work and deliberations it approved the amendment for submission to NMFS in December 2019. The Council developed this action to limit the amount of surfclam or ocean quahog individual transferable quota share, or annual allocation in the form of cage tags, that an individual or their family members could hold. In addition, this action will adjust the maximum duration of multi-year specifications actions to match the stock assessment schedule. NMFS published a proposed rule to implement Amendment 20 on August 24, 2022.

2023 Implementation Plan

The Executive Committee met to discuss the 2023 Implementation Plan. The Council develops Implementation Plans each year to ensure progress toward achieving the goals and objectives of its 5-year strategic plan. First, the Committee received a progress update on the 2022 Implementation Plan. The Committee then reviewed and provided feedback on a draft list of deliverables that had been developed by staff for 2023. The Executive Committee agreed to move an action to address sturgeon bycatch from "possible additions" to the proposed deliverables for 2023.

Proposed North Atlantic Right Whale Vessel Strike Reduction Rule

The Council received a report from the Protected Resources Committee and agreed with the Committee's recommendation to send a comment letter on the Proposed North Atlantic Right Whale Vessel Strike Reduction Rule before the October 31 comment deadline. The comment letter will include the points discussed during the September 14 Protected Resources Committee meeting.

2021 Ricks E Savage Award

Mr. Stephen (Steve) Heins was named the 2021 recipient of the Ricks E Savage Award. The award is given each year to a person who has added value to the MAFMC process and management goals through significant scientific, legislative, enforcement, or management activities. Mr. Heins retired in 2017 following 29 years of employment with the New York Department of Environmental Conservation. Early in his career, he headed New York State's artificial reef and fishing access programs. During his last 11 years at DEC, he served as the Chief of Marine Fisheries and coordinator of finfish and crustacean programs. In this role, he also served as the department's designee to the Mid-Atlantic Council. After his retirement, Mr. Heins was appointed to New York's obligatory seat on the Council and served for one additional term. Throughout his 14-year tenure on the Council, Mr. Heins contributed a wealth of knowledge and experience for every MAFMC-managed species as well as NEFMC-managed species such as groundfish. Mr. Heins has a B.S. in Marine Science from Southampton College and an M.S. in Marine Environmental Science from the State University of New York. He proudly served in the U.S. Marine Corps. He is an avid recreational angler.

Next Meeting

The next Council meeting will be held **December 12-15, 2022 in Annapolis, Maryland.** A complete list of upcoming meetings can be found at https://www.mafmc.org/council-events.

South Atlantic Fishery Management Council

News Release

FOR IMMEDIATE RELEASE
September 21, 2022

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Council Fishery Managers Consider Options for Red Snapper Management

There were many agenda items affecting federal fisheries management for the September meeting of the South Atlantic Fishery Management Council, but a single issue dominated interest from the public – the potential use of time/area closures for the snapper grouper fishery. The Council received a total of 1,047 online written comments, with the majority opposing time and area closures to address release mortality in the Red Snapper fishery. The opposition continued as the Council received comments during the meeting in Charleston, SC from charter captains, recreational fishermen, regional business leaders, boat and fishing gear manufacturers, and Florida Congressman John Rutherford.

Managing Red Snapper as the stock continues to rebuild remains a challenge. As the number of Red Snapper increase, so do the number of fish released that die, driven primarily by the recreational sector targeting co-occurring snapper grouper species. Frustration levels also are also high because the stock remains listed as "undergoing overfishing" due to release mortality and its impacts on the larger breeding populations. As a result, harvest remains strictly limited.

During its June 2022 meeting, the Council requested a comprehensive list of data analyses to consider options for time/area closures to address release mortality as it develops Regulatory Amendment 35 to the Snapper Grouper Fishery Management Plan. The draft amendment currently includes an action to reduce the Acceptable Biological Catch (ABC) and Annual Catch Limits (ACL) for Red Snapper to address overfishing as required, and options to reduce release mortality by allowing only single hook rigs and prohibiting the use of automatic (electric) reels in the recreational snapper grouper fishery. "You still have year-round *access* to the Red Snapper fishery," said NOAA Fisheries Regional Administrator Andy Strelcheck during a presentation at the meeting. "While the Council is taking positive steps to reduce release mortality, more has to be done. There's a changing baseline – drivers 10-20 years ago are different than today," explained Strelchek, noting the increase in the numbers of offshore recreational fishermen, access to highly improved electronics, and other factors.

After considering public input, data concerns, and need for additional analyses, Council members were quick to oppose considering area closures in Regulatory Amendment 35, and discussed options for addressing management through short-term, mid-term, and long-term solutions. The Council agreed to move forward with the amendment, considered a "short-term" measure to immediately address the overfishing condition, until additional mid-term and long-term management measures could be considered and put into place. Regulatory Amendment 35 includes an outreach component, stressing the importance of best fishing practices in improving survivability of all snapper grouper species. "Recreational fishermen can certainly do their part in reducing release mortality," said Council Chair Mel Bell during discussions. "We've heard from business and industry leaders and will depend on their support as we move forward. If you educate fishermen, I think they will do the

(Continued)

right thing. I've watched this happen at the state level with amazing results." The Council's Snapper Grouper Advisory Panel will provide recommendations during its October 18-20 meeting in Charleston. Regulatory Amendment 35 is scheduled for approval during the Council's March 2023 meeting, with public hearings anticipated in early 2023.

Other Actions

Greater Amberjack (Snapper Grouper Amendment 49)
The Council approved Snapper Grouper Amendment 49 for submission to the Secretary of Commerce during their meeting. The amendment addresses changes in management for Greater Amberjack after the latest assessment, completed in 2020, indicated the stock is not overfished or undergoing overfishing. If approved by the Secretary of Commerce, the amendment would: increase the Annual Catch Limit (ACL); revise sector allocations with 65% of the total ACL recreational and 35% commercial; reduce the commercial minimum size limit from 36" fork length to 34" fork length (the recreational minimal size limit is 28" fork length); increase the commercial trip limit during Season 2 (September 1 through end of February) to 1,200 pounds gutted or whole weight; apply the current April spawning season closure to both commercial and recreational fishermen; and remove recreational annual catch targets from the Snapper Grouper Fishery Management Plan. The amendment would also adopt revised goals and objectives for the Snapper Grouper FMP.

Spanish Mackerel
The recent stock assessment for Spanish Mackerel was reviewed by the Council's Scientific and Statistical Committee in August 2022. The SSC had numerous concerns with the assessment and input data, such as the recent recreational estimates from NOAA Fisheries Marine Recreational Information Program (MRIP) and concluded that additional work was needed before the assessment could be accepted. New landings will be incorporated into the stock assessment model to address the uncertainty and the Council's Scientific and Statistical Committee will review the outcomes during its October 25-27, 2022, meeting. The Council's Mackerel Cobia Advisory Panel will also provide input on increased recreational shore-based landings and overall increase in recreational effort during the COVID-19 pandemic, effects of a lower commercial trip limit on market price, and other fishery issues during its October 5-6, 2022, meeting in Charleston.

Elections
The Council elected Dr. Carolyn Belcher to serve as its new Chair. Dr. Belcher is the Council representative for the GA Department of Natural Resources and is currently the Chief of Fisheries for the Coastal Resources Division. She was serving as Vice Chair when elected to replace Mel Bell with the SC Department of Natural Resources as Chair. Trish Murphey, the agency designee for the NC Division of Marine Fisheries was elected Vice Chair.

Information about the September Council meeting, including final committee reports, public comments, and meeting materials is available from the Council's website at: https://safmc.net/events/september-2022-council-meeting/. The next meeting of the Council is scheduled for December 5-9, 2022, in Wrightsville Beach, NC.

The online version of this news release is available at: https://safmc.net/posts/federal-fishery-managers-consider-options-for-red-snapper-management/.

The South Atlantic Fishery Management Council, one of eight regional councils, conserves and manages fish stocks from three to 200 miles offshore of North Carolina, South Carolina, Georgia and east Florida.

South Atlantic Fishery Management Council
Full Council and Committee Reports
SUMMARY MOTIONS
September 12-16, 2022

This is a summary of the motions approved by the Council. Motions addressing actions and alternatives for FMP amendments are followed by text showing the result of the approved motion. Complete details on motions and other committee recommendations are provided in the Committee Reports available on the SAFMC website.

Full Council Session I

Acceptable Biological Catch Control Rule Amendment

MOTION 1: APPROVE THE PURPOSE AND NEED STATEMENTS.

Purpose for Actions

The purpose of this amendment is to revise the acceptable biological catch control rule by clarifying the incorporation of scientific uncertainty and management risk, modifying the approach used to determine the acceptable risk of overfishing, and prioritizing the use of stock rebuilding plans for overfished stocks. Additionally, this amendment will specify conditions and procedures for using carry-overs and phase-ins in setting catch limits, including modification of framework procedures to accommodate implementation of carry-overs when applicable.

Need for Actions

The need for this amendment is to ensure catch level recommendations are based on the best scientific information available, prevent overfishing while achieving optimum yield, and include flexibility in setting catch limits as allowed by the Magnuson-Stevens Fishery Conservation and Management Act, and particularly in accordance with 2020 NMFS guidance on carry-over and phase-in provisions.

MOTION 2: CONFIRM ALTERNATIVE 2 UNDER ACTION 1 AS PREFERRED, WITH PREFERRED SUB-ALTERNATIVES 2B AND 2C.

Action 1. Modify the Acceptable Biological Catch Control Rule

****Refer to Full Council I Summary Report for language of preferred alternative(s)****

MOTION 3: SELECT ALTERNATIVE 2-SUB-ALTERNATIVE 2C UNDER SUB-ACTION 2.1 AND ALTERNATIVE 2 UNDER SUB-ACTION 2.2 AS PREFERRED.

Action 2. Allow phase-in of acceptable biological catch changes under the acceptable biological catch control rule

Sub-Action 2.1. Establish criteria specifying when phase-in is allowed.

****Refer to Full Council I Summary Report for language of preferred alternative(s)****

MOTION 4: UNDER SUB-ACTION 3.1, SELECT ALTERNATIVE 2 AS PREFERRED WITH SUB-ALTERNATIVES 2D AND 2E AS AMENDED.

Action 3. Allow carry-over of unharvested portion of the annual catch limit under the acceptable biological catch control rule

Sub-Action 3.1. Establish criteria specifying circumstances when an unharvested portion of the originally specified sector ACL can be carried over from one year to increase the available harvest in the immediate next year. Carry-overs may not be delayed, and only amounts from the originally specified sector ACL may be carried over.

****Refer to Full Council I Summary Report for language of preferred alternative(s)****

MOTION 5: UNDER SUB-ACTION 3.2, SELECT ALTERNATIVE 2 AS PREFERRED.

Sub-Action 3.2. Specify limits on how much of the unharvested portion of a sector annual catch limit may be carried over from one year to increase the sector annual catch limit in the next year.

****Refer to Full Council I Summary Report for language of preferred alternative(s)****

MOTION 6: SELECT ALTERNATIVE 2 UNDER SUB-ACTION 4.1, SUB-ACTION 4.2, AND SUB-ACTION 4.3 AS PREFERRED.

Action 4. Modify framework procedures for the Snapper Grouper, Dolphin Wahoo, and Golden Crab Fishery Management Plans

****Refer to Full Council I Summary Report for language of sub-actions and preferred alternative(s)****

MOTION 7: APPROVE ALL ACTIONS IN THE ABC CONTROL RULE AMENDMENT.

<u>Snapper Grouper Committee</u>

MOTION 8: RECOMMEND APPROVAL OF THE EFP.

Release Mortality Reduction & Red Snapper Catch Levels (Regulatory Amendment 35)

MOTION 9: CONTINUE WORK ON REGULATORY AMENDMENT 35 TO REDUCE SNAPPER GROUPER DISCARDS AND MODIFY THE RED SNAPPER ACL WITH THE GOAL OF TAKING FINAL ACTION NO LATER THAN MARCH 2023.

MOTION 10: ADD AN APPENDIX TO REGULATORY AMENDMENT 35 TO PROMOTE BEST FISHING PRACTICES THAT REDUCE RECREATIONAL DEAD RELEASES IN THE SNAPPER GROUPER FISHERY.

MOTION 11: TO REQUEST THE SEFSC PROVIDE THE FOLLOWING SOUTH ATLANTIC RED SNAPPER STOCK ASSESSMENT SENSITIVITY RUN AT THE DECEMBER 2022 COUNCIL MEETING:

- REDUCE ANNUAL DISCARD ESTIMATES BY 50% RELATIVE TO CURRENT ESTIMATES USED IN THE ASSESSMENT.
- ASSUME 100% COMPLIANCE WITH DESCENDING DEVICE REQUIREMENTS.

THIS SENSITIVITY RUN IS HYPOTHETICAL BUT INTENDED TO INFORM THE COUNCIL ON HOW REDUCED DISCARDS AND DISCARD MORTALITY ESTIMATES WOULD AFFECT STOCK STATUS AND MANAGEMENT BENCHMARKS.

MOTION 12: TO DIRECT STAFF TO BEGIN DEVELOPMENT A WHITE PAPER, FOR REVIEW AT THE MARCH 2023 COUNCIL MEETING, TO EVALUATE ADDITIONAL LONGER-TERM OPTIONS TO FURTHER AVOID/MINIMIZE, TO THE EXTENT PRACTICABLE, DISCARDS OF SNAPPER-GROUPER SPECIES IN ORDER TO ACHIEVE STOCK REBUILDING GOALS, REDUCE WASTE, PROTECT MARINE ECOSYSTEMS, INCREASE SOCIO-ECONOMIC BENEFITS, ENHANCE ANGLER OPPORTUNITIES, AND/OR PROMOTE MORE EFFECTIVE UTILIZATION OF THE RESOURCE (E.G, SHIFT DEAD DISCARDS TO LANDED CATCH).

Yellowtail Snapper (Amendment 44)

MOTION 13: REINITIATE SNAPPER GROUPER AMENDMENT 44.

Gag (Amendment 53)

MOTION 14: APPROVE THE PURPOSE AND NEED STATEMENT, AS REVISED

> The purpose of this fishery management plan amendment is to establish a rebuilding plan, set an acceptable biological catch, revise annual catch limits, and sector allocations, and make modifications to management measures and accountability measures for South Atlantic gag based on the results of the most recent stock assessment.
>
> The need for this fishery management plan amendment is to end overfishing of South Atlantic gag, rebuild the stock, and achieve optimum yield while minimizing, to the extent practicable, adverse social and economic effects.

MOTION 15: RETAIN ALTERNATIVE 1 AS PREFERRED UNDER SUB-ACTION 4B FOR PUBLIC HEARINGS.

Sub-Action 4b. Modify the commercial spawning season closure for gag.

> **Preferred Alternative 1 (No Action):** The annual commercial gag spawning season closure is from January 1 through April 30.

MOTION 16: INCLUDE ACTIONS THAT WOULD MODIFY THE BLACK GROUPER VESSEL LIMIT, SPAWNING SEASON CLOSURE, AND CAPTAIN AND CREW BAG LIMIT AND ALTER THE PURPOSE AND NEED ACCORDINGLY.

MOTION 17: REMOVE ALTERNATIVE 4 FROM SUB-ACTION 5A.

Action 5. Modify the recreational management measures for gag

Sub-Action 5a. Establish a recreational vessel limit for gag.

> **Alternative 4.** Retain the current bag limit. Establish a recreational gag vessel limit of 6 fish per vessel per day, not to exceed the daily bag limit, whichever is more restrictive, for the:
>
> > **Sub-Alternative 4a.** private recreational component.
> > **Sub-Alternative 4b.** for-hire component.

MOTION 18: ADD AN ALTERNATIVE UNDER SUB-ACTION 5A TO PROHIBIT THE RETENTION OF THE BAG LIMIT FOR CAPTAIN AND CREW

Sub-Action 5a. Establish a recreational vessel limit for gag

MOTION 19: RETAIN ALTERNATIVE 1 AS PREFERRED UNDER SUB-ACTION 5B FOR PUBLIC HEARINGS.

Sub-action 5b. Modify the recreational spawning season closure for gag.

> **Preferred Alternative 1 (No Action):** The annual recreational gag spawning season closure is from January 1 through April 30.

MOTION 20: APPROVE AMENDMENT 53 AND ALL ACTIONS, AS REVISED, FOR PUBLIC HEARINGS.

Wreckfish (Amendment 48)

MOTION 21: APPROVE THE PURPOSE AND NEED AS MODIFIED.

> Purpose: The purpose of this action is to modernize the wreckfish individual transferable quota (ITQ) program, revise management measures.
>
> Need: The need for this action is to improve program monitoring and enforcement, as well as data collection and management, provide more flexibility for fishers and increase profitability in the wreckfish ITQ program.

MOTION 22: SELECT ALTERNATIVE 2 AS PREFERRED UNDER ACTION 1.

Action 1. Revise sector allocations and sector annual catch limits for wreckfish.

> **Alternative 2.** Allocate 98% of the total annual catch limit for wreckfish to the commercial sector. Allocate 2% of the total annual catch limit for wreckfish to the recreational sector

MOTION 23: SELECT ALTERNATIVE 2 AS PREFERRED UNDER ACTION 2.

Action 2. Implement an electronic reporting system for the wreckfish individual transferable quota (ITQ) program

> **Alternative 2.** Implement an electronic system of reporting for the wreckfish ITQ program to electronically track ownership and transfers of quota shares, distribution, and transfers of annual allocation (quota pounds), and electronically record wreckfish landing information.

MOTION 24: SELECT ALTERNATIVE 3 AS PREFERRED UNDER ACTION 3.

Action 3. Modify the requirement to possess a commercial vessel permit for wreckfish.

> **Alternative 3.** To commercially harvest or sell wreckfish, a commercial permit for South Atlantic snapper grouper (unlimited) must have been issued to the vessel, the permit must be on board, and the permit holder must be a wreckfish shareholder.

MOTION 25: ADD AN ALTERNATIVE THAT ALLOWS FOR HARVEST OR SALE OF WRECKFISH WITH A PERMIT FOR SOUTH ATLANTIC SNAPPER GROUPER, REMOVING THE REQUIREMENT TO BE A WRECKFISH SHAREHOLDER.

MOTION 26: SELECT ALTERNATIVE 2 AS PREFERRED UNDER ACTION 4.
Action 4. Modify the commercial fishing year for wreckfish.

> **Alternative 2**. The commercial fishing year for wreckfish begins on January 1 and ends on December 31. From January 15 through April 15, each year, no person may harvest or possess wreckfish on a fishing vessel, in or from the exclusive economic zone.

MOTION 27: MOVE ACTION 5 TO THE CONSIDERED BUT REJECTED APPENDIX.
Action 5. Modify the spawning season closure for wreckfish.

MOTION 28: SELECT ALTERNATIVE 2 AS PREFFERED UNDER ACTION 8.1.
Sub-Action 8-1. Implement a cost recovery plan for the wreckfish individual transferable quota program.

> **Alternative 2.** Implement an individual transferable quota cost recovery plan. The transferable quota shareholder landing wreckfish would be responsible for collection and submission of the cost recovery fee to NMFS.

MOTION 29: SELECT ALTERNATIVE 3 AS PREFFERED UNDER ACTION 8.2.
Sub-Action 8-2. Collection of wreckfish individual transferable quota program cost recovery fees.

> **Alternative 3.** Fees will be collected upon the sale of such fish during a fishing season.

MOTION 30: SELECT ALTERNATIVE 4 AS PREFFERED UNDER ACTION 8.3.
Sub-Action 8-3. Frequency of wreckfish individual transferable quota program cost recovery fee collection.

> **Alternative 4.** Cost recovery fee will be submitted four times per year.

MOTION 31: SELECT ALTERNATIVE 3 AS PREFFERED UNDER ACTION 8.4.
Sub-Action 8-4. Determination of wreckfish individual transferable quota program cost recovery fees.

> **Alternative 3.** The cost recovery fee will be based on standard** ex-vessel value of the wreckfish landings as calculated by NMFS.

MOTION 32: APPROVE SNAPPER GROUPER AMENDMENT 48 FOR PUBLIC HEARINGS AT THE MARCH 2023 COUNCIL MEETING.

Golden Tilefish and Blueline Tilefish (Amendment 52)

MOTION 33: CHANGE THE PREFERRED ALTERNATIVE UNDER ACTION 6 TO ALTERNATIVE 1 (NO ACTION).
Action 6. Modify blueline tilefish recreational season.

> **Preferred Alternative 1 (No Action).** Do not modify the blueline tilefish recreational season. The current recreational season is May 1-August 31

MOTION 34: APPROVE ALL ACTIONS FOR SNAPPER GROUPER AMENDMENT 52.

Snowy Grouper (Amendment 51)

MOTION 35: APPROVE ALL ACTIONS AS MODIFIED IN SNAPPER GROUPER AMENDMENT 51.

Greater Amberjack (Amendment 49)

MOTION 36: APPROVE THE PURPOSE AND NEED STATEMENTS AS REVISED.

Purpose: The *purpose* of this amendment is to revise the acceptable biological catch and catch limits for greater amberjack in the South Atlantic based on the results of the latest stock assessment; revise sector allocations, the commercial minimum size limits, commercial trip limits, and the April spawning closure for greater amberjack; and remove recreational annual catch targets for the Snapper Grouper Fishery Management Plan.

Need: The *need* for this amendment is to ensure catch limits are based on the best scientific information available and to ensure overfishing does not occur for the South Atlantic greater amberjack stock, while increasing social and economic benefits through sustainable and profitable harvest of South Atlantic greater amberjack, consistent with the Magnuson-Stevens Fishery Conservation and Management Act and its National Standards. This amendment is also needed to make administrative efforts more efficient by removing recreational annual catch targets, which are not actively used in management, from the Snapper Grouper Fishery Management Plan.

MOTION 37: APPROVE MODIFIED ACTION AND ALTERNATIVE LANGUAGE IN ACTION 1.

Action 1. Revise the greater amberjack acceptable biological catch, total annual catch limit, and annual optimum yield

****Refer to Snapper Grouper Committee Summary Report for language of preferred alternative(s)****

MOTION 38: CHANGE PREFERRED ALTERNATIVE UNDER ACTION 3 TO ALTERNATIVE 2 (34 INCH COMMERCIAL MINIMUM SIZE LIMIT).

Action 3. Reduce the commercial minimum size limit for greater amberjack

Preferred Alternative 2. Reduce the commercial minimum size limit to 34 inches fork length.

MOTION 39: APPROVE AMENDMENT 49 TO THE FISHERY MANAGEMENT PLAN FOR THE SNAPPER GROUPER FISHERY OF THE SOUTH ATLANTIC REGION FOR FORMAL SECRETARIAL REVIEW AND DEEM THE CODIFIED TEXT AS NECESSARY AND APPROPRIATE. GIVE STAFF EDITORIAL LICENSE TO MAKE ANY NECESSARY EDITORIAL CHANGES TO THE DOCUMENT/CODIFIED TEXT AND GIVE THE COUNCIL CHAIR AUTHORITY TO APPROVE THE REVISIONS AND RE-DEEM THE CODIFIED TEXT.

MOTION 40: DIRECT STAFF TO DO THE FOLLOWING:

- Continue to develop actions for Regulatory Amendment 35 (Snapper Grouper Release Mortality Reduction and Red Snapper Catch Levels) for the Committee's consideration of approval for public hearings at the December 2022 meeting.
- Remove overfishing limits from purpose and need and action language in amendments considering revisions to catch levels, including Amendment 49 (Greater Amberjack), Amendment 51 (Snowy Grouper), Amendment 52 (Golden Tilefish and Blueline Tilefish), Amendment 53 (Gag Grouper), and Regulatory Amendment 35 (Red Snapper and Release Mortality Reduction).
- Conduct public comment for Amendment 53 (Gag Grouper) prior to the December 2022 Council meeting. Coordinate with states to conduct hearings via listening stations.
- Develop Amendment 48 (Wreckfish) in preparation for public hearings to be held at the March 2023 Council meeting.
- Prepare Amendment 51 (Snowy Grouper) and Amendment 52 (Golden Tilefish Blueline Tilefish) for consideration of final approval at the December 2022 Council meeting.
- Convene a meeting of the Snapper Grouper Advisory Panel in October.

Mackerel Cobia Committee

MOTION 41: ADD THE FOLLOWING LANGUAGE TO THE JOINT CMP FMP OBJECTIVES: TO ACHIEVE ROBUST FISHERY REPORTING AND DATA COLLECTION SYSTEMS ACROSS ALL SECTORS FOR MONITORING THE COASTAL MIGRATORY PELAGIC FISHERY WHICH MINIMIZES SCIENTIFIC, MANAGEMENT, AND RISK UNCERTAINTY.

MOTION 42: REMOVE CURRENT OBJECTIVE 3 FROM THE CMP FMP OBJECTIVES. Objective 3: To provide necessary information for effective management and establish a mandatory reporting system for monitoring catch.

MOTION 43: AMEND THE LANGUAGE OF OBJECTIVE 1 TO READ AS FOLLOWS: Objective 1 reads as follows: The primary objective of this FMP is to ACHIEVE AND MAINTAIN OPTIMUM yield at the maximum sustainable yield (MSY), TO allow recovery of overfished populations, and maintain population levels sufficient to ensure adequate recruitment.

MOTION 44: ADOPT THE FOLLOWING TIMING AND TASKS:

1. Work with Gulf Council staff, as needed, to continue work on Coastal Migratory Pelagics Amendment 33.
2. Add a review of the revised SEDAR 78 stock assessment to the SSC's October 2022 meeting agenda.
3. Convene a meeting of the Mackerel Cobia Advisory Panel to discuss the agenda items as listed above in October 2022.
4. Develop a white paper that examines false albacore relative to the ten criteria outlined in the Magnuson-Stevens act to determine if they may be in need of conservation and management.
5. Prepare the allocation decision tool for Atlantic Spanish mackerel to be reviewed at the December 2022 meeting.

SEDAR Committee

MOTION 45: THE COMMITTEE APPROVED SCOPES OF WORK FOR GAG, KING MACKEREL, AND RED PORGY AS MODIFIED.

Full Council Session II

MOTION 46: RESUBMIT CORAL AMENDMENT 10 AFTER MODIFICATIONS.

MP Quarterly Update Memo

Document Coming Soon

October 25, 2022

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Steve Poland, Fisheries Management Section Chief

SUBJECT: Highly Migratory Species Update

Issue

Highly Migratory Species activity update.

Action Needed

For informational purposes only, **no action is needed at this time.**

Overview

Bluefin Tuna

National Marine Fisheries Service (NMFS) has closed the Bluefin Tuna general category commercial fishery through November 30th, 2022 based off of projected landings. This closure prohibits the retention, possession, and landing of large-medium or giant Bluefin Tuna by commercial fisherman aboard vessels with a general category or charter/headboat permit. The general category fishery should re-open December 1st under the December sub-quota period.

The final rule was published for Amendment 13 to the Highly Migratory Species Fishery Management Plan which implemented various measures adopted trough the amendment to the FMP. Included in these measures is a significant modification to the Individual Bluefin Tuna Quota (IBQ) program and a reallocation of bluefin tuna quotas across categories with the phasing out of the Purse Seine category. Changes to the IBQ program include employing a dynamic system for determining IBQ shares where a shareholder's shares will be based on the proportion of their pelagic longline sets legally made in a calendar year to the total number of legal longline sets made by all IBQ shareholders. Additionally, there is a IBQ cap of 25% that can be held by any individual or entity. For the reallocation of quota across gear categories, the Purse Seine category (18.6% of total baseline Bluefin Tuna quota) was redistributed across the remaining categories with the majority going to the General, Angling, and Longline categories. More information on the specific measures implemented through Amendment 13 including a table of the current and new Bluefin quota category percentages can be found in the final rule published in the Federal Register here.

October 21, 2022

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Barbie Byrd, Biologist Supervisor
Protected Resources Program, Fisheries Management Section

SUBJECT: Protected Resources Program Update

Issue

Summary information is provided from the division's Protected Resources Program for observer program activities during summer (June-August) 2022. Seasonal reports to National Marine Fisheries Service are required for the Sea Turtle Incidental Take Permit (ITP) and monthly reports, if there is an observed take, are required for the Atlantic Sturgeon ITP. The summer seasonal report can be found in the briefing materials.

Action Needed

For informational purposes only; **no action is needed at this time**.

Overview

During summer 2022, estuarine waters were closed to anchored large-mesh gill nets statewide and closed to anchored small-mesh gill nets in Management Unit A due to Atlantic sturgeon interactions the previous spring. Observers and Marine Patrol officers conducted 30 observations of estuarine anchored gill nets (seven onboard observations and 27 alternative platform observations). Estimated observer coverage of the estuarine anchored small-mesh gill-net fishery exceeded 1% in all management units (Table 1). During summer, there were also 328 No-Contact trips, unsuccessful trips looking for estuarine anchored gill-net effort to observe (Table 2).

Observers logged 151 contacts or contact attempts during summer 2022. Observers spoke with a fisherman on 59 occasions to try to arrange a trip, but only arranged five trips in advance (8.5%). Out of 60 times observers left a message (either voicemail or with another person), observers received 17 returned calls from fishermen.

There were no sea turtle or Atlantic sturgeon interactions documented from observed trips during summer 2022.

Table 1. For estuarine anchored small-mesh gill nets, estimated percent observer coverage calculated from observer trips (<4 inch) and estimated fishing trips using Trip Ticket

Program data (<5 inch) by management unit during summer (June–August) 2022 for Incidental Take Permit Year 2022. Management Unit A was closed to anchored gill nets of all sizes during summer.

Management Unit	Estimated Fishing Trips	Observed Trips	Percent Observer Coverage
A	closed	closed	closed
B	896	15	1.7
C	66	2	3.0
D1	8	1	12.7
D2	22	2	9.3
E	189	10	5.3
Total	1,180	30	2.5

Table 2. Number of "No-Contact" trips by management unit completed by Marine Patrol and observers during summer (June–August) 2022 for Incidental Take Permit Year 2022. "No Contact" refers to unsuccessful attempts to find and observe estuarine anchored gill-net effort. Management Unit A was closed to anchored gill nets of all sizes during summer.

Management Unit	Marine Patrol No-Contact Trips	Observer No-Contact Trips	Total No-Contact Trips
A	closed	closed	closed
B	44	24	68
C	57	10	67
D1	13	1	14
D2	8	6	14
E	165	0	165
Overall	287	41	328

2022 Summer Seasonal Progress Report
for Activities under Endangered Species Act
Section 10 Incidental Take Permit No. 16230
June 1–August 31, 2022
ITP Year 2022

Barbie L. Byrd and Matthew Doster
North Carolina Department of Environmental Quality
North Carolina Division of Marine Fisheries
Protected Resources Program
3441 Arendell Street
Morehead City, NC 28557

September 2022

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SUMMARY

This report summarizes activities of the North Carolina Division of Marine Fisheries (NCDMF) Observer Program during summer (June–August) 2022 of the Incidental Take Permit (ITP) Year 2022 (September 1, 2021–August 31, 2022) for ITP No. 16230. Throughout this document, all references to gill nets are for estuarine anchored gill nets only unless stated otherwise. Data used in this seasonal report are preliminary and subject to change for the annual report to be submitted February 2023. See Figure 1 for a map of management units outlined in the ITP Conservation Plan.

During summer 2022, the estuarine anchored large-mesh gill-net fishery was closed state-wide. For the estuarine anchored small-mesh gill-net fishery, the projected number of observer trips needed to obtain 2% observer coverage was calculated from the average of reported estuarine anchored small-mesh gill-net trips by month and management unit from the previous five years. The exception was for Management Unit A where the estuarine anchored small-mesh gill-net fishery was closed due to estimated dead Atlantic sturgeon interactions approaching the authorized number in the management unit (Table 1). See Table 1 for other proclamations affecting anchored gill nets during summer 2022.

There were no sea turtle interactions documented from observed trips during summer 2002. Observers and Marine Patrol officers conducted 30 observations (seven onboard observations and 27 alternative platform observations). Estimated observer coverage of the estuarine anchored small-mesh gill-net fishery exceeded 1% in all management units (range: 1.7-12.7; Table 2).

Observers and Marine Patrol officers occasionally observed estuarine runaround (also called a drop/strike) gill net trips and documented unsuccessful trips looking for estuarine anchored gill-net effort to observe (referred to as No-Contact trips). During summer 2022, observers and Marine Patrol officers conducted observations of 20 runaround gill net trips: five trips in Management Unit B, 13 trips in Management Unit C, one trip in Management Unit, and one trip in Management Unit E. There were also 328 No-Contact trips (Table 3).

As part of their regular duties, Marine Patrol officers checked gill nets for compliance. Occasionally, citations and/or Notice of Violations (NOVs) were issued to fishermen when gear or fishing practices were out of compliance. A citation is an enforcement action taken by a Marine Patrol officer for person(s) found to be in violation of general statues, rules, or proclamations under the authority of the NCMFC and is considered a proceeding for district court. An NOV is the NCDMF's administrative process to suspend a permit and is initiated by an officer or division employee when a permit holder is found to be in violation of general or specific permit conditions. A citation and an NOV may both be initiated by the same permit condition violation; however, they are two separate actions. For this report, NOVs or citations associated with gill-net activities or the Estuarine Gill Net Permit (ENGP) (database codes "NETG" and "EGNP") were compiled. Marine Patrol issued three citations and one NOV for estuarine anchored gill nets during summer 2022 (Tables 4 & 5).

As per the ITP, the NCDMF established the EGNP in September 2014 to register all fishermen participating in anchored large- and small-mesh gill-net fisheries. Permits are renewed on an annual basis, based on the fiscal year for licenses. Contact information associated with the EGNPs

is used by observers to call fishermen to schedule trips. To help arrange trips, the Observer Program worked with the NCDMF License & Statistics Section to distill the list of fishermen with active EGNPs to those that have actually reported landings with anchored gear (by mesh-size category) during the last three years. Observers also attempted to talk with fishermen in person at boat ramps and on the water when possible. Observers logged contact attempts and returned phone calls from fishermen into a database with categories of the response: 1) Left message with someone else; 2) Not fishing general; 3) Fishing other gear; 4) Not fishing because of weather; 5) Not fishing because of boat issues; 6) Not fishing because of medical issues; 7) Booked trip; 8) Hung up, got angry, trip refused; 9) Call back later time/date; 10) Saw in person; 11) Disconnected; 12) Wrong number; 13) No answer; 14) No answer, left voicemail; 15) Not fishing because of natural disaster (e.g., hurricane) (Figure 2). During summer 2022, observers logged 151 contacts or contact attempts. Observers spoke with a fisherman on 59 occasions to try to arrange a trip, but only arranged five trips in advance (8.5%). Out of 60 times observers left a message (either voicemail or with another person), observers received 17 returned calls from fishermen. For one of the returned calls, the observer was unable to take the call and the fisherman left a message. The observer called the same fisherman back and left another voicemail, but the fisherman never called back a second time during summer months. The Observer Program followed up on phone numbers that were disconnected or incorrect; some of them have already been updated.

TABLES

Table 1. Proclamations (Proc.) issued for summer (June–August) 2022 affecting estuarine anchored large- and small-mesh gill-net fisheries.

Effective Date	Proc. Number	Regulation change
4/28/2022	M-10-2022	This proclamation supersedes proclamation M-9-2022 dated April 26, 2022. This proclamation makes it unlawful to use fixed or stationary gill nets of any mesh size in Management Unit A due to dead sturgeon takes nearing the authorized amount for Management Unit A. A portion of Management Unit A remains open to the use of run-around, strike and drop gill nets with a stretched mesh length of 5 ½ inches through 6 ½ inches for harvesting blue catfish. Run-around, strike and drop gill nets with a stretched mesh length of 3 inches through 4 inches may also still be used in portions of Management Unit A. This action is being taken to comply with the NC Division of Marine Fisheries' Federal Incidental Take Permit for endangered Atlantic sturgeon.
6/21/2022	M-13-2022	This proclamation supersedes proclamation M-11-2022 dated April 29, 2022. It decreases the yardage limits for the commercial Spanish mackerel drift gill net fishery in Management Unit B.

Table 2. For estuarine anchored small-mesh gill nets, estimated percent observer coverage calculated from observer trips (<4 inch) and estimated fishing trips using Trip Ticket Program data (<5 inch) by management unit during summer (June–August) 2022 for Incidental Take Permit Year 2022. Management Unit A was closed to anchored gill nets of all sizes during summer.

Management Unit	Estimated Fishing Trips	Observed Trips	Percent Observer Coverage
A	closed	closed	closed
B	896	15	1.7
C	66	2	3.0
D1	8	1	12.7
D2	22	2	9.3
E	189	10	5.3
Total	1,180	30	2.5

Table 3. Number of "No-Contact" trips by management unit completed by Marine Patrol and observers during summer (June–August) 2022 for Incidental Take Permit Year 2022. "No Contact" refers to unsuccessful attempts to find and observe estuarine anchored gill-net effort. Management Unit A was closed to anchored gill nets of all sizes during summer.

Management Unit	Marine Patrol No-Contact Trips	Observer No-Contact Trips	Total No-Contact Trips
A	closed	closed	closed
B	44	24	68
C	57	10	67
D1	13	1	14
D2	8	6	14
E	165	0	165
Total	287	41	328

Table 4. Citations written by Marine Patrol officers for estuarine anchored gill nets by date and violation code during summer (June–August) 2022 for Incidental Take Permit Year 2022.

Date	Code	Description
6/1/2022	NETG12	Net in middle third of marked navigational channel
8/12/2022	NETG27	Gill Net set within 50 yards from shore 3H.0103 M-9-2008
8/13/2022	NETG29	RCGL gear without proper buoys 3J.0103(c)

Table 5. Notice of Violations (NOV) for Estuarine Gill Net Permit (EGNP) holders using estuarine anchored gill nets by date and violation code during summer (June–August) 2022 for Incidental Take Permit Year 2022.

Date	Code	Description
6/14/2022	EGNP01	Fishing gill net without a valid Estuarine Gill Net Permit

FIGURES

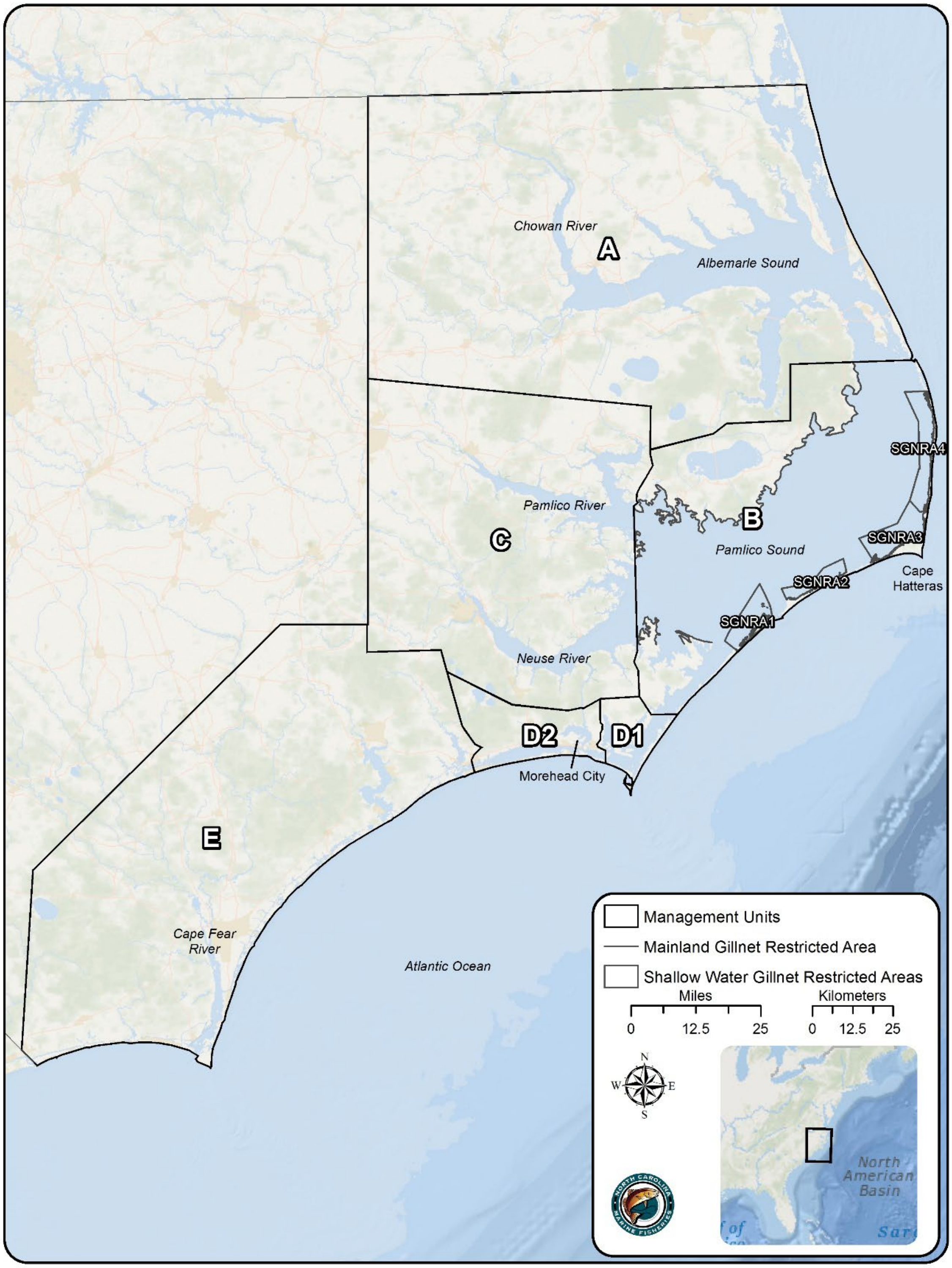


Figure 1. Management units (A, B, C, D1, D2, and E) as outlined in the Incidental Take Permit Conservation Plan.

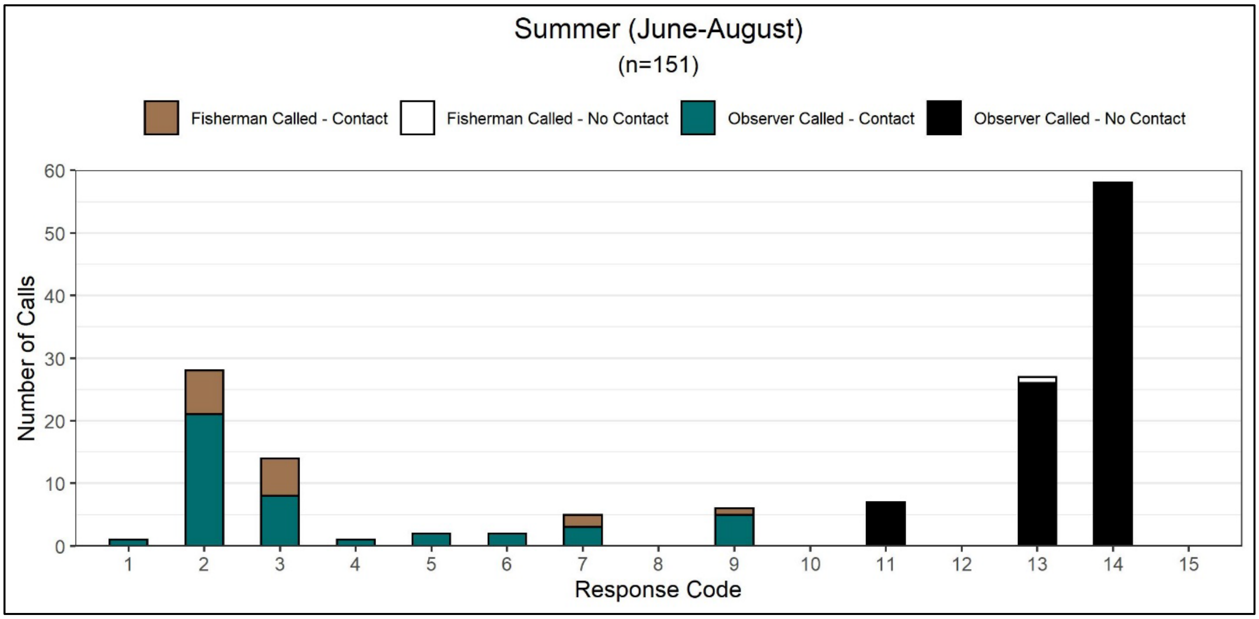


Figure 2. Number of contacts or contact attempts (n=151) during summer (June–August) 2022 to schedule trips. Contact response categories include the following: 1) Left message with someone else; 2) Not fishing general; 3) Fishing other gear; 4) Not fishing because of weather; 5) Not fishing because of boat issues; 6) Not fishing because of medical issues; 7) Booked trip; 8) Hung up, got angry, trip refused; 9) Call back later time/date; 10) Saw in person; 11) Disconnected; 12) Wrong number; 13) No answer; 14) No answer, left voicemail; 15) Not fishing because of natural disaster (e.g., hurricane). Contact responses are shown as those when the observer talked with a fisherman (teal), when the observer did not (black), and when the fisherman returned an observer's call and spoke to an observer (bronze) or left a message (white). For the single time a fisherman called but did not leave a message, an observer called him back and left another message.

Red Drum Landings 2021-2023

Landings are complete through July 15, 2022.
2021 landings are final. 2022 landings are preliminary.

Year	Month	Species	Pounds	2009-2011 Average	2013-2015 Average
2021	9	Red Drum	28,365	28,991	35,003
2021	10	Red Drum	52,629	43,644	63,659
2021	11	Red Drum	20,820	14,318	27,646
2021	12	Red Drum	19,514	3,428	2,197
2022	1	Red Drum	12,506	5,885	1,700
2022	2	Red Drum	23,447	3,448	3,996
2022	3	Red Drum	14,568	5,699	3,971
2022	4	Red Drum	413	7,848	6,528
2022	5	Red Drum	10,805	13,730	9,661
2022	6	Red Drum	11,069	12,681	6,985
2022	7	Red Drum	7,474	13,777	15,618
2022	8	Red Drum	14,868	21,252	15,846

FY22 Fishing Year (Sept 1, 2021 - Aug 31, 2022) Landings	**201,610**

Year	Month	Species	Pounds	2009-2011 Average	2013-2015 Average
2022	9	Red Drum	25,752	28,991	35,003
2022	10	Red Drum	***	***	***
2022	11	Red Drum		14,318	27,646
2022	12	Red Drum		3,428	2,197
2023	1	Red Drum		5,885	1,700
2023	2	Red Drum		3,448	3,996
2023	3	Red Drum		5,699	3,971
2023	4	Red Drum		7,848	6,528
2023	5	Red Drum		13,730	9,661

2023	6	Red Drum	12,681	6,985
2023	7	Red Drum	13,777	15,618
2023	8	Red Drum	21,252	15,846

FY23 Fishing Year (Sept 1, 2022 - Aug 31, 2023) Landings	**25,752**

***landings are confidential

YEAR	MONTH	SPECIES	POUNDS	DEALERS	TRIPS	AVERAGE	CONF
2018	1	SOUTHERN FLOUNDER	610	14	43	7,713	
2018	2	SOUTHERN FLOUNDER	1,833	34	154	4,617	
2018	3	SOUTHERN FLOUNDER	2,815	43	387	23,512	
2018	4	SOUTHERN FLOUNDER	8,142	74	769	68,389	
2018	5	SOUTHERN FLOUNDER	18,350	90	952	122,514	
2018	6	SOUTHERN FLOUNDER	42,501	105	1,407	154,090	
2018	7	SOUTHERN FLOUNDER	57,283	117	1,496	170,387	
2018	8	SOUTHERN FLOUNDER	72,496	121	1,917	201,862	
2018	9	SOUTHERN FLOUNDER	109,125	114	1,776	396,263	
2018	10	SOUTHERN FLOUNDER	363,361	109	3,064	781,717	
2018	11	SOUTHERN FLOUNDER	226,856	89	1,355	392,150	
2018	12	SOUTHERN FLOUNDER	471	5	5	37,303	
2019	1	SOUTHERN FLOUNDER	524	25	74	7,713	
2019	2	SOUTHERN FLOUNDER	558	23	69	4,617	
2019	3	SOUTHERN FLOUNDER	1,412	44	216	23,512	
2019	4	SOUTHERN FLOUNDER	5,966	66	448	68,389	
2019	5	SOUTHERN FLOUNDER	36,666	92	1,038	122,514	
2019	6	SOUTHERN FLOUNDER	61,199	109	1,438	154,090	
2019	7	SOUTHERN FLOUNDER	59,404	109	1,554	170,387	
2019	8	SOUTHERN FLOUNDER	95,629	109	1,779	201,862	
2019	9	SOUTHERN FLOUNDER	51,734	59	551	396,263	
2019	10	SOUTHERN FLOUNDER	327,394	120	2,337	781,717	
2019	11	SOUTHERN FLOUNDER	159,595	58	537	392,150	
2020	3	SOUTHERN FLOUNDER	***	***	***	***	
2020	4	SOUTHERN FLOUNDER	***	***	***	***	
2020	8	SOUTHERN FLOUNDER	***	***	***	***	
2020	9	SOUTHERN FLOUNDER	86,549	30	788	396,263	
2020	10	SOUTHERN FLOUNDER	340,711	138	2,623	781,717	
2020	11	SOUTHERN FLOUNDER	52,602	25	68	392,150	
2021	3	SOUTHERN FLOUNDER	***	***	***	***	
2021	4	SOUTHERN FLOUNDER	***	***	***	***	
2021	5	SOUTHERN FLOUNDER	***	***	***	***	
2021	6	SOUTHERN FLOUNDER	***	***	***	***	
2021	7	SOUTHERN FLOUNDER	***	***	***	***	
2021	8	SOUTHERN FLOUNDER	***	***	***	***	
2021	9	SOUTHERN FLOUNDER	68,089	28	735	396,263	
2021	10	SOUTHERN FLOUNDER	416,838	130	2,383	781,717	
2021	11	SOUTHERN FLOUNDER	***	***	***	***	
2022	5	SOUTHERN FLOUNDER	***	***	***	***	
2022	7	SOUTHERN FLOUNDER	***	***	***	***	
2022	9	SOUTHERN FLOUNDER	150,998	94	1,298	396,263	
2022	10	SOUTHERN FLOUNDER	***	***	***	***	

NOTE: 2022 data are preliminary. 2018-2021 data are complete.

*****Data are confidential**

YEAR	SPECIES	GEAR	POUNDS	DEALERS	TRIPS	CONF
2018	SOUTHERN FLOUNDER	GIGS	92,302	88	2,089	
2018	SOUTHERN FLOUNDER	GILLNETS	365,189	122	9,131	
2018	SOUTHERN FLOUNDER	OTHER	6,432	79	562	
2018	SOUTHERN FLOUNDER	POUND NET	439,919	37	1,545	
2019	SOUTHERN FLOUNDER	GIGS	91,330	81	1,836	
2019	SOUTHERN FLOUNDER	GILLNETS	324,822	119	6,834	
2019	SOUTHERN FLOUNDER	OTHER	4,727	65	354	
2019	SOUTHERN FLOUNDER	POUND NET	379,201	34	1,017	
2020	SOUTHERN FLOUNDER	GIGS	33,192	49	369	
2020	SOUTHERN FLOUNDER	GILLNETS	187,312	105	2,474	
2020	SOUTHERN FLOUNDER	OTHER	1,288	21	83	
2020	SOUTHERN FLOUNDER	POUND NET	258,089	27	559	
2021	SOUTHERN FLOUNDER	GIGS	31,898	46	358	
2021	SOUTHERN FLOUNDER	GILLNETS	253,468	101	2,420	
2021	SOUTHERN FLOUNDER	OTHER	949	23	72	
2021	SOUTHERN FLOUNDER	POUND NET	198,709	23	292	
2022	SOUTHERN FLOUNDER	GIGS	29,220	39	264	
2022	SOUTHERN FLOUNDER	GILLNETS	107,256	69	966	
2022	SOUTHERN FLOUNDER	OTHER	1,143	14	21	
2022	SOUTHERN FLOUNDER	POUND NET	16,591	6	53	

NOTE: 2022 data are preliminary. 2018-2021 data are complete.
*****Data are confidential**

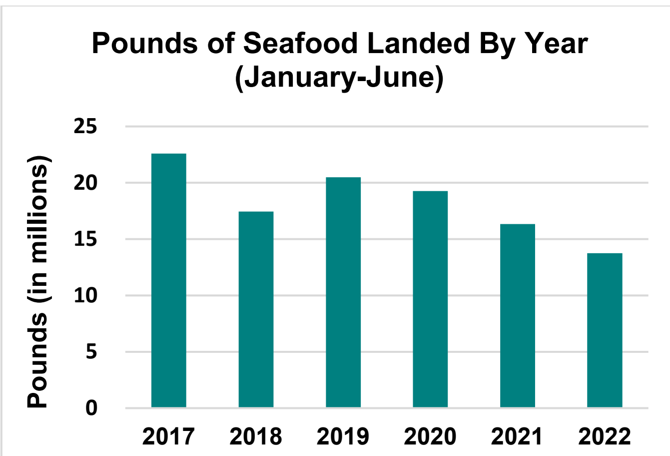
NORTH CAROLINA DIVISION OF MARINE FISHERIES

Fish Dealer Report

License & Statistics Section, PO Box 769, Morehead City, NC 28557 November 2022

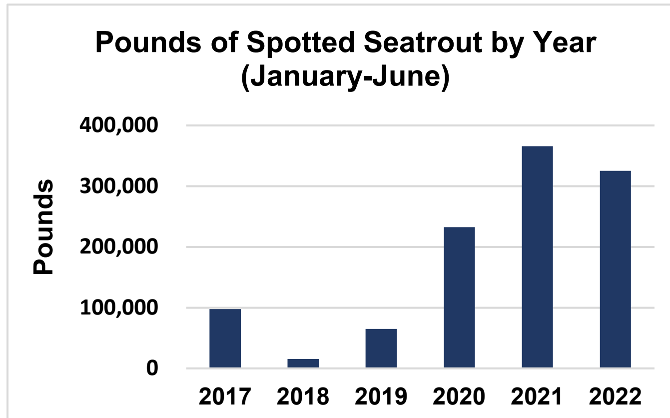
2022 COMMERCIAL LANDINGS REVIEW

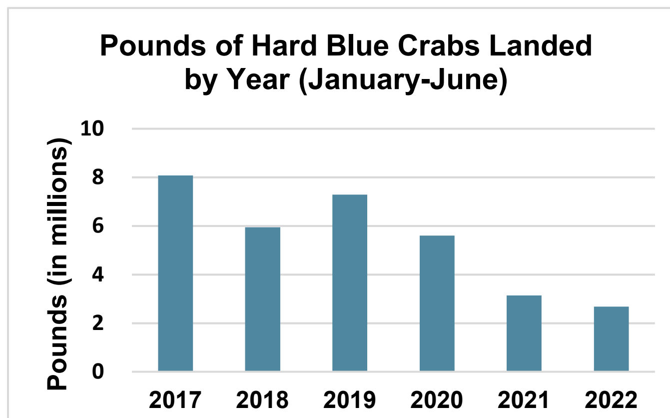
Preliminary data collected by the North Carolina Division of Marine Fisheries reveals that fishermen landed 13.8 million pounds of seafood from January to June 2022. This was a 28.5% decrease from the previous 5-year average for the same time period.



The top five species landed were Hard Blue Crab (2.7 million pounds), Catfishes (1.6 million pounds), Summer Flounder (1.3 million pounds), Atlantic Cutlassfish (Ribbonfish) (879,398 pounds), and Shrimp (634,759 pounds).

Despite being the top landed species in the state this year, Hard Blue Crab landings have decreased to about 55% compared to the previous 5-year average. Additionally, shrimp (heads on and Brown, White, and Pink shrimp combined) and Bluefish landings decreased 67% and 59%, respectively, compared to their previous 5-year averages. In contrast, Spotted Seatrout and Spot landings substantially increased compared to their previous 5-year averages, by 110% and 95%, respectively.





Landings in this report are summarized. To see actual 2022 landings, please see the 2022 Semi-Annual Landings Bulletin

COMMERCIAL STATISTICS PROGRAM 5-YEAR COMPLETION REPORT

In the late 1970s, the National Marine Fisheries Service (NMFS) began developing the Commercial Statistics Program (CSP) with the mission to "cooperatively collect, manage, and disseminate landings (including finfish and shellfish) and bioprofile information for marine commercial fisheries in the Southeast Region." Bioprofile information collected by this program included the species harvested, the total landings for that species, the market grade/size of the species, and the condition (whole, gutted, etc.) of the landings. North Carolina became a member of the CSP in 1978, allowing the state to receive a federal grant each year on a 5-year funding cycles. Currently, the CSP funds a full-time Data Entry Clerk and Commercial Port Agent within the North Carolina Trip Ticket Program (NCTTP).

Annual Performance Reports and a 5-year Completion Report must be submitted to NMFS to continue receiving CSP funds. The NCTTP staff completed the most recent 5-year Completion Report in October 2022 and will receive another 5-year cycle of CSP funds.

FEDERAL HURRICANE FLORENCE FISHERIES RELIEF PROGRAM

In December 2021, North Carolina received $7.7 million in federal Hurricane Florence relief funds to distribute to qualified applicants, which included seafood dealers and processors, ocean fishing piers, bait and tackle shops, and for-hire operators. Commercial fishermen were not included in this program because they received aid via a separate, state-funded relief program in 2019 called the North Carolina Hurricane Florence Fisheries Relief Program.

To qualify for the federal relief program, applicants were required to be a North Carolina resident who suffered damages caused by the storm or demonstrated a loss in revenue during the September to November 2018 period as compared to the average of the previous three years for the same period. Checks were distributed to approved applicants in September 2022.

STAFF CHANGES

Deputy Director Dee Lupton retired from the Division of Marine Fisheries after 28 years of dedicated service. The application period for the Deputy Director position is currently open.

Within the Trip Ticket Program, Sam McNeely, the technician working on the Program 405 Conversion Factor Project, left the Division and has been replaced by Lily Zeller (Lily.Zeller@ncdenr.gov, 252-725-2667). Marisa Ponte (Marisa.Ponte@ncdenr.gov, 252-808-8107) is the new Assistant Quota Monitoring Biologist within the Quota Monitoring Program. Finally, Alexis Rakestraw (Alexis.Rakestraw@ncdenr.gov, 252-337-5362) is the new Commercial Port Agent in Elizabeth City.

TRIP TICKET TEMPLATE UPDATE

Upon receiving feedback from the fishing industry and our Commercial Port Agents, Trip Ticket Program staff updated the paper trip ticket templates. You can expect to see these new trip tickets within the next year. If you have questions about these changes, please contact Michael Thompson (Michael.Thompson@ncdenr.gov, 252-269-1847).

TRIP TICKET REMINDERS

When purchasing Atlantic Menhaden for bait, please note that Menhaden has its own bait code. When filling out the trip ticket, use species code 4200 (mixed Menhaden bait) instead of species code 7900 (mixed bait).

TECH TIPS

Dealers with permits to deal in quota-monitored species, such as Striped Bass, Summer and Southern Flounder, Black Sea Bass, and Spiny Dogfish can now use the Trip Ticket software to electronically submit daily Quota Monitoring Logs in the same way as trip tickets. First, update the software by clicking “Check for Update” in the bottom right corner of the Trip Ticket System screen. Once the software is updated, send the daily reports by clicking “Reports” at the top of the screen, above the “Dealer Info” button, then selecting “Quota Monitoring Report.”

On the Quota Monitoring Report screen, simply set the unload date for the report and click “Send QM Report to Agency”. The report will automatically pull any landings from trip tickets that have been entered for the unload date selected and will include them in the Quota Monitoring Log that is sent to the Division. When the file sends successfully, a record will show at the bottom of the screen in the “QM Files Sent to Agency” box. These reports must be submitted by noon daily for the previous day.

UPCOMING NC MARINE FISHERIES COMMISSION MEETING

November 17-19, 2022

The public may access the meeting virtually. Please visit the MFC webpage for updates and details.

TRIP TICKET CONTACTS

For questions regarding rules, procedures, or requirements, please contact a port agent at your local Division of Marine Fisheries office.

Elizabeth City	Alexis Rakestraw	252-337-5362 (office/cell) Alexis.Rakestraw@ncdenr.gov
Manteo	Marty Brill	252-342-0156 (cell) 252-473-2158 (office) Martin.Brill@ncdenr.gov
Morehead City	Chuck Davis	252-808-7935 (cell) 252-808-8029 (office) Chuck.Davis@ncdenr.gov
Washington	Jon Anglemyer	252-908-6786 (office/cell) Jon.Anglemyer@ncdenr.gov
Wilmington	Pam Zuaboni	252-241-0118 (cell) 910-796-7216 (office) Pam.Zuaboni@ncdenr.gov

For supplies, please contact our data clerks at 252-808-8104.

If you have any questions regarding use of the NC Trip Ticket System software, please contact Willow Patten (Willow.Patten@ncdenr.gov, 252-904-7810) or Marisa Ponte (Marisa.Ponte@ncdenr.gov, 252-808-8107).

NORTH CAROLINA DIVISION OF MARINE FISHERIES

Semiannual Fisheries Bulletin

2022 Commercial Statistics

License and Statistics Section, PO Box 769, Morehead City, NC 28557 November 2022

Preliminary North Carolina Commercial Landings
January - June 2017-2022

	January – June (Pounds – rounded)					
FINFISH	2017	2018	2019	2020	2021	2022
Amberjacks[1]	58,948	63,247	76,163	54,171	64,263	64,470
Anglerfish (Monkfish & Monkfish livers)	51,791	40,205	38,294	25,653	19,736	11,476
Bluefish	1,119,042	470,193	526,497	631,509	568,499	269,427
Bonito	9,391	12,311	12,368	12,646	6,145	4,997
Butterfish	31,680	23,861	30,619	10,432	22,488	32,028
Carp	14,819	17,265	32,125	8,194	6,849	3,312
Catfishes	705,211	722,707	763,031	663,048	1,164,594	1,558,939
Cobia	17,633	17,695	19,901	16,159	11,851	11,495
Croaker, Atlantic	869,373	1,574,302	1,214,880	470,948	467,683	263,266
Cutlassfish, Atlantic	41,751	25,055	210,198	397,831	900,620	879,398
Dolphinfish	189,255	128,922	198,310	48,787	22,858	25,500
Drum, Black	43,362	41,121	19,848	19,035	55,765	45,836
Drum, Red	34,186	53,458	28,786	17,003	56,805	72,803
Eel, American	4,393	2,336	2,178	434	524	1,025
Flounder, Southern	130,183	74,241	106,324	*	*	*
Flounder, Summer	1,191,430	1,385,287	1,258,138	912,846	1,123,341	1,260,594
Flounders, Other	*	*	*	*	*	*
Garfish	19,641	12,623	24,608	15,029	7,085	4,079
Grouper, Gag	25,497	33,488	66,857	35,012	23,252	21,990
Grouper, Red	8,326	6,596	11,621	1,133	1,543	884
Grouper, Scamp	15,957	20,352	17,747	8,083	5,930	5,246
Grouper, Snowy	65,044	70,100	78,250	48,600	55,831	40,168
Groupers, Other	4,775	5,211	13,352	6,493	9,692	8,082
Grunts	16,871	14,032	23,663	14,168	12,475	7,715
Hakes	2,506	974	2,067	1,899	2,193	2,039
Harvestfish (Starbutters)	36,472	73,485	55,934	30,527	89,492	73,202
Hogfish (Hog Snapper)	5,069	3,161	7,500	4,110	4,580	5,256
Jacks (Crevalle, Rainbow Runner, Blue Runner)	833	316	1,894	1,883	1,165	2,075
Mackerel, Atlantic (Boston)	629	1,418	799	431	282	190
Mackerel, King	137,608	91,191	175,169	125,131	98,360	90,045
Mackerel, Spanish	248,664	253,065	357,278	497,620	474,301	483,669
Menhaden, Atlantic	532,323	420,421	405,683	435,823	283,725	334,880
Mullet, Sea (Kingfishes)	356,193	227,466	392,881	284,955	392,438	404,601
Mullet, Striped	189,321	238,572	262,913	252,289	538,697	507,743
Perch, White	159,796	118,547	72,721	173,654	136,761	297,216
Perch, Yellow	15,562	12,298	6,160	5,894	6,805	10,285
Pigfish	2,465	2,780	2,278	2,695	5,426	4,483
Pinfish	79	207	343	255	*	10
Pompano	1,166	1,890	6,150	1,507	2,737	1,863
Porgies	22,057	22,591	23,632	14,106	14,165	10,702
Pufferfish	1,955	261	2,197	522	154	19
Scup	165,567	64,138	171,502	35,119	46,849	17,933
Sea Basses	376,302	334,513	262,785	210,967	186,517	135,110
Seatrout, Spotted	97,732	15,389	64,854	232,443	365,618	325,246
Shad, American	90,868	52,081	40,972	134,576	58,884	9,371

	January – June (Pounds – rounded)					
	2017	2018	2019	2020	2021	2022
Shad, Gizzard	121,783	209,605	207,563	229,970	173,857	121,997
Shad, Hickory	73,627	75,402	111,716	68,876	95,346	92,244
Sharks	559,296	433,412	503,170	368,352	266,813	289,919
Sharks, Dogfish, Smooth	152,938	198,810	101,594	47,044	28,827	12,635
Sharks, Dogfish, Spiny	390,805	755,015	1,000,130	1,500,853	131,383	54,076
Sheepshead	14,455	11,240	21,227	6,035	13,844	12,043
Skates	39,454	32,527	64,839	35,303	*	*
Skippers	9,147	11,937	8,932	7,195	8,150	7,655
Snapper, Vermilion (Beeliner)	105,757	105,130	188,260	94,353	65,829	66,197
Snappers, Other	2,157	7,262	17,755	12,473	15,617	28,715
Spadefish	7,969	4,807	4,914	7,527	9,567	6,751
Spot	29,685	42,015	19,324	57,084	56,827	79,815
Striped Bass	84,076	94,841	130,992	114,421	27,930	24,476
Swordfish	291,170	332,961	249,433	269,338	172,089	241,162
Tilefish, Blueline	41,943	32,282	42,167	35,794	52,029	40,633
Tilefish, Other	29,661	11,387	12,094	11,317	18,620	6,692
Triggerfish	53,137	82,275	72,889	56,410	29,284	34,230
Tuna, Bigeye	41,052	62,330	54,988	89,846	79,697	168,540
Tuna, Bluefin	303,781	200,423	323,901	371,371	270,159	276,346
Tuna, Yellowfin	509,674	329,979	154,717	271,770	257,596	267,707
Tunas, Other	52,705	38,120	8,115	16,367	9,320	11,286
Tunny, Little (False Albacore)	88,374	56,799	176,058	119,642	34,800	72,497
Wahoo	14,546	9,642	18,098	4,953	3,543	2,200
Weakfish (Gray Trout)	34,507	13,602	85,173	39,799	29,603	22,434
Unclassified Fish for Food[2]	46,091	48,944	48,665	31,587	52,968	34,470
Unclassified Fish for Industrial/Bait[2]	80,614	60,615	52,983	31,326	23,815	51,854
TOTAL FINFISH	**10,290,132**	**10,010,732**	**10,769,162**	**9,762,624**	**9,244,491**	**9,335,239**
SHELLFISH						
Blue Crabs, Hard	8,084,106	5,952,576	7,284,705	5,606,541	3,147,184	2,677,513
Blue Crabs, Peeler	717,038	327,855	401,122	258,147	409,695	268,268
Blue Crabs, Soft	407,962	225,796	172,311	114,339	209,288	126,506
Clams, Hard (Meats)	152,208	130,891	70,840	37,835	40,387	62,405
Clams, Hard (Number)	7,971,372	6,902,125	3,625,100	1,965,720	2,162,538	3,194,561
Octopus	124	123	178	86	81	70
Oysters (Meats)	414,315	322,777	361,521	329,641	525,266	525,084
Oysters (Bushels)	78,320	61,016	68,340	62,314	99,294	99,260
Scallop, Sea (Meats)	92,827	55,331	126,445	76,666	8,318	*
Shrimp (Heads On)[3]	2,281,795	318,464	1,211,922	3,043,672	2,632,642	634,759
Squid	18,406	25,173	16,826	12,645	19,605	10,974
Stone Crabs	3,658	2,918	2,990	3,074	4,631	3,677
Whelks/Conchs (Meats)	47,820	48,890	37,267	17,855	47,353	70,377
Unclassified Shellfish	81,175	35,255	44,338	12,779	40,086	40,530
TOTAL SHELLFISH	**12,301,433**	**7,446,048**	**9,730,465**	**9,513,279**	**7,084,536**	**4,420,163**
GRAND TOTAL	**22,591,565**	**17,456,780**	**20,499,628**	**19,275,904**	**16,329,027**	**13,755,403**

[1] Includes species from genus *Seriola* (Greater Amberjack, Lesser Amberjack, Almaco Jack, and Banded Rudderfish).

[2] Prior to 2021, minnows were included in the Unclassified Fish for Food category but were moved to the Unclassified Fish for Industrial/Bait in this report.

[3] Includes brown, pink, and white shrimp.

* Units not shown to avoid disclosure of private enterprise. Quantities were included in the “Unclassified Fish for Food” or “Unclassified Shellfish” categories.

NOTE: Landings collected by North Carolina Division of Marine Fisheries Trip Ticket Program (November 2022).

NC Marine Fisheries Commission

Fishery Management Plans

November 2022 Business Meeting

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
KATHY B. RAWLS
Director

October 28, 2022

MEMORANDUM

TO:	N.C. Marine Fisheries Commission
FROM:	Corrin Flora, Fishery Management Plan Coordinator Fisheries Management Section
SUBJECT:	Fishery Management Plan Update and Schedule Review

Issue

Update the N.C. Marine Fisheries Commission (MFC) on the status of North Carolina fishery management plans (FMPs).

Action Needed

For informational purposes only, **no action is needed at this time**.

Overview

This memo provides an overview on the status of four North Carolina FMPs for the November 2022 MFC business meeting.

Eastern Oyster and Hard Clam FMPs

The 2022 FMP Schedule includes review of the Eastern Oyster and Hard Clam FMPs. The Division has appointed a Plan Development Team who are currently identifying available data sources to assess the needs of the wild fisheries of North Carolina.

Estuarine Striped Bass FMP

Estuarine Striped Bass continues to be managed under Amendment 1 and associated Supplement and Revisions. The Division and Wildlife Resources Commission (WRC) staff jointly developed draft Amendment 2. At its May 2022 business meeting, the MFC selected preferred management for Amendment 2. As part of monitoring FMP development, the DEQ Secretary reported progress to the appropriate legislative bodies for review. At its August 2022 meeting, the MFC was updated on the progress of the plan and passed a motion to table the discussion until the November meeting.

Based on stock concerns identified during preparation of the Annual Review specifically continuing low juvenile abundance, where the Division is updating the 2020 Albemarle-Roanoke benchmark stock assessment. Data through 2022 is being included in the stock assessment update. Division and WRC staff continue to work together on the update.

Striped Mullet FMP

A peer reviewed, benchmark stock assessment for striped mullet was recently completed. The assessment indicated the stock was overfished and experiencing overfishing in the terminal year of 2019. The Division held public scoping September 26 – October 7. The scoping meetings are opportunities where the Division received stakeholder ideas and concerns prior to development of the FMP. Stakeholders participated in three in-person meetings, one of which was a hybrid format with participation in-person and via virtual meeting platform. At the November MFC business meeting, Division staff will present an overview of the stakeholder input received. In addition, the MFC will have the opportunity to provide additional management strategies and vote on approval of the Striped Mullet FMP Amendment 2 goal and objectives.

Spotted Seatrout FMP
A benchmark stock assessment for spotted seatrout was recently completed and underwent peer review. The peer review panel and the Division agreed that the spotted seatrout stock assessment is the best available science and is appropriate for management. The assessment contains data through 2019 and estimates the stock is not overfished, with biomass above the target, but is experiencing overfishing. A stock assessment overview will be presented to the MFC at its November meeting.

Blue Crab FMP
The Blue Crab FMP Amendment 3 adaptive management framework included an update to the stock assessment at least once between full reviews of the FMP. The 2018 stock assessment indicated the stock was overfished and overfishing was occurring in the terminal year of 2016. Amendment 3 implemented management to address the stock status. The stock assessment update will begin in 2023 and will include data through 2022.

FISHERY MANAGEMENT PLAN UPDATE
SPOTTED SEATROUT
AUGUST 2022

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	February 2012	
Amendments:	None	
Revisions:	None	
Supplements:	Supplement A to the FMP	February 2014
Information Updates:	None	
Schedule Changes:	None	
Comprehensive Review:	2019 — Ongoing	

Spotted seatrout (*Cynoscion nebulosus*) is managed under the authority of two state and one interstate fishery management plans (FMP). The North Carolina Marine Fisheries Commission (NCMFC) currently manages spotted seatrout under the North Carolina Spotted Seatrout FMP (NCDMF 2012) and the North Carolina FMP for Interjurisdictional Fisheries (NCDMF 2022). Supplement A to the 2012 North Carolina Spotted Seatrout FMP (NCDMF 2014) maintains short–term measures in the spotted seatrout fishery (40% reduction at 14-inch total length minimum size) to address several sources of uncertainty in the 2009 stock assessment through acquisition and assessment of additional data. The supplement examined sources of uncertainty in the assessment, the rationale for not implementing on schedule the North Carolina Spotted Seatrout FMP February 2014 management measures and presented possible interim management measures. At the February 2014 NCMFC meeting the commission voted to maintain short-term management measures in the spotted seatrout fishery (Proclamation FF-38-2014: 14-inch minimum size, 75-fish commercial trip limit with weekend closures in joint waters except in Albemarle and Currituck sounds; Proclamation FF-39-2014: 14-inch minimum size, four-fish recreational bag limit). These measures will remain in effect until a new amendment is completed.

As required in the approved 2012 FMP, a stock assessment (NCDMF 2015a) was completed on schedule (2014-2015), peer reviewed, approved for management, and was presented to the NCMFC at its May 2015 business meeting. A new benchmark stock assessment began in late 2020. The North Carolina Division of Marine Fisheries (NCDMF) will review the state FMP for spotted seatrout to determine if changes to management are needed through the FMP amendment process, after the stock assessment is complete and accepted for management use.

The Atlantic States Marine Fisheries Commission (ASMFC) manages spotted seatrout in all Atlantic States who have a declared interest in the species. In addition to the state FMP, the

ASMFC manages spotted seatrout under the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout (ASMFC 2011). The goals for the Omnibus Amendment are to bring the FMPs for the three species under the authority of the ASMFC Interstate Fishery Management Program Charter and bringing compliance requirements to each state. Because the intent of the Omnibus amendment was to bring the ASMFC spotted seatrout FMP into compliance with the new ASMFC charter, management measures were not adjusted and the identified objectives and compliance requirements to the states of the Omnibus Amendment are the same as Amendment 1 to the ASMFC spotted seatrout FMP (ASMFC 1990) and are as follows:

- Manage the spotted seatrout fishery restricting catch to mature individuals (12-inch minimum size limit).
- Manage the spotted seatrout stock to maintain appropriate spawning stock biomass (20% SPR).
- Develop research priorities that will further refine the spotted seatrout management program to maximize the biological, social, and economic benefits derived from the spotted seatrout population.

To ensure compliance with interstate requirements, North Carolina also manages this species under the North Carolina Fishery Management Plan for Interjurisdictional Fisheries (IJ FMP; NCDMF 2022). The goal of the IJ FMP is to adopt fishery management plans, consistent with N.C. law, approved by the Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, or the ASMFC by reference and implement corresponding fishery regulations in North Carolina to provide compliance or compatibility with approved fishery management plans and amendments, now and in the future. The goal of these plans, established under the Magnuson-Stevens Fishery Conservation and Management Act (federal council plans) and the Atlantic Coastal Fisheries Cooperative Management Act (ASMFC plans) are like the goals of the Fisheries Reform Act of 1997 to "ensure long-term viability" of these fisheries.

Management Unit

The management unit for the North Carolina Spotted Seatrout FMP (NCDMF 2012) includes all spotted seatrout within the coastal and joint waters of North Carolina. The unit stock, or population unit, for North Carolina's assessment of spotted seatrout include all spotted seatrout caught in North Carolina and Virginia. Virginia landings were included in the stock assessment of spotted seatrout because of the high rate of mixing observed between North Carolina and Virginia.

Goal and Objectives

The goal of the North Carolina Spotted Seatrout FMP (NCDMF 2012) is to determine the status of the stock and ensure long-term sustainability for the spotted seatrout stock in North Carolina. To achieve this goal, it is recommended that the following objectives be met:

- Develop an objective management program that provides conservation of the resource and sustainable harvest in the fishery.
- Ensure the spawning stock is of sufficient capacity to prevent recruitment-overfishing.
- Address socio-economic concerns of all user groups.

- Restore, improve, and protect important habitats that affect growth, survival, and reproduction of the North Carolina spotted seatrout stock.
- Evaluate, enhance, and initiate studies to increase understanding of spotted seatrout biology and population dynamics in North Carolina.
- Promote public awareness regarding the status and management of the North Carolina spotted seatrout stock.

DESCRIPTION OF THE STOCK

Biological Profile

Spotted seatrout range from Massachusetts to southern Florida and the Bahamas on the U.S. Atlantic Coast and continue through the Gulf of Mexico to the Yucatan Peninsula, Mexico (Murphy et al. 2006). Genetic data supports a single unit stock in Virginia and North Carolina (Ellis et al. 2019). In addition, based on genetic data, New River, North Carolina is an area of complex, seasonal mixing between two genetically distinct populations (Ellis et al. 2019): Georgia through Cape Fear River, North Carolina, and Bogue Sound, North Carolina and north (O'Donnell et al. 2014; Ellis et al. 2019). They inhabit shallow coastal and estuarine waters throughout their range and are considered a euryhaline species (Deaton et al. 2010). In North Carolina, the current state record was recorded at 12.3 pounds in 1961. The maximum reported age of spotted seatrout is 9 years in North Carolina for both male and female fish (NCDMF 2012). Most spotted seatrout in North Carolina are mature by age 1 and 7.9 inches for males and 9.9 inches for females. All males are mature at 12 inches and females at 15 inches. Spawning in North Carolina occurs from April to October with peak spawn around May (Burns 1996). Spawning occurs within the first few hours after sunset (Luczkovich et al. 1999) and a single fish is capable of spawning multiple times (batch spawners) throughout the season. In Florida, it has been observed that during peak spawning, spotted seatrout older than 3 years old may spawn every two days while younger fish may spawn as frequently as every four days (Roumillat and Brouwer 2004). Estimates of the number of eggs a female can produce in a year from the Southeast and Gulf Coasts vary, based on size and age and range, from 3 million to 20 million per year (Nieland et al. 2002; Roumillat and Brouwer 2004; Murphy et al. 2011).

Stock Status

The 2014 North Carolina spotted seatrout stock assessment (NCDMF 2015b) indicated the spotted seatrout stock in North Carolina and Virginia is not overfished and overfishing is not occurring (Figures 1 and 2).

Stock Assessment

The 2014 assessment of spotted seatrout in North Carolina and Virginia was conducted using a Stock Synthesis model that incorporated data collected from commercial and recreational fisheries, two fishery-independent surveys, and a tagging study (NCDMF 2015b). Data included 1991 through 2012 and relied on expanded fishery-independent data sources, including Virginia age, a juvenile abundance index, and North Carolina State University tag-return data (Ellis 2014). The fishing year was defined as the biological year, March 1 through February 28 or 29, to incorporate cold stun mortalities within a single model year.

The results of this assessment suggest the age structure of the spotted seatrout stock has been expanding during the last decade. However, an abrupt decline is evident in the model's estimate of recruitment after 2010, although this is not mirrored in the empirical survey data. Spawning stock biomass (SSB) has declined since 2007. In 2012, estimated SSB was 2,513,270 pounds (1,140 metric tons), which is greater than the threshold (SSB30%=868,621 pounds or 395 metric tons; Figure 1), indicating the stock is not overfished. There is no trend in fishing mortality (*F*), but periods of high *F* seem to coincide with spawning stock biomass declines and may be attributed to cold stun events. The 2012 estimate of fishing mortality was 0.40, which is less than the threshold (F20%=0.66), indicating the stock is not experiencing overfishing; however, the 2012 estimate of fishing mortality (0.40) is very near the target fishing mortality of F30%=0.42 (Figure 2).

A benchmark stock assessment for spotted seatrout began in 2020 coinciding with the scheduled FMP review and is scheduled to be completed in late 2022.

DESCRIPTION OF THE FISHERY

Current Regulations

The NCDMF currently allows the recreational harvest of spotted seatrout seven days per week with a minimum size limit of 14-inches total length (TL) and a daily bag limit of four fish. The commercial harvest is limited to a daily limit of 75 fish with a minimum size limit of 14-inches TL). It is unlawful for a commercial fishing operation to possess or sell spotted seatrout for commercial purposes taken from Joint Fishing Waters of the state from midnight on Friday to midnight on Sunday each week; the Albemarle and Currituck sounds are exempt from this weekend closure. In the event of a catastrophic cold stun, the NCDMF has the authority to close the fishery until the following spawning period. In 2018, the spotted seatrout commercial and recreational fishery was closed from January 5 through June 15 by proclamation due to a state-wide cold stun event.

Commercial Fishery

Annual landings have been variable throughout the time series (Table 1; Figure 3). Commercial landings in 2021 (694,784 pounds) increased by 22% compared to the previous year (568,574 pounds; Table 1; Figure 3). Commercial landings in 2021 were the highest since 1991. This sharp increase in commercial landings is most likely due to several strong year classes of fish and mild winters in 2019, 2020 and 2021, resulting in high numbers of available fish. During the early to mid-1990s, landings in the ocean and estuarine areas were more similar than in the remainder of the time series (1995-2021) in which estuarine landings have dominated. The primary gear of harvest are estuarine gill nets (set, drift, and run around).

Recreational Fishery

Recreational landings of spotted seatrout are estimated from the Marine Recreational Information Program (MRIP). Recreational estimates across all years have been updated and are now based on the MRIP's new Fishing Effort Survey-based calibrated estimates. For more information on MRIP see https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

Recreational harvest of spotted seatrout estimated by MRIP (Type A + B1) in 2020 was 2,241,421 pounds, or 1,223,508 fish, much higher than the time series average of 1,535,506 pounds, or 976,689 but lower than the previous year (Table 1; Figure 3). Estimated recreational releases in 1(6,332,064 fish) were well above the time series average of 3,484,026 fish, and slightly higher than the previous year's releases of 6,215,778 fish (Table 1).

The North Carolina Saltwater Fishing Tournament recognizes anglers for landing and/or releasing fish of exceptional size or rarity by issuing citations that document the capture for the angler. Citations awarded through the North Carolina Saltwater Fishing Tournament for spotted seatrout have varied by year throughout the time series, averaging 338 citations (Table 2; Figure 4). The number of awarded citations in 2021 (655 citations) increased from the previous year (579 citations) and was the highest number of citations since 2007 (1,000 citations). The number of release citations (fish over 24 inches that are released) awarded (283 release citations) was the highest since release citations began in 2008. The percent of spotted seatrout release citations (43%) was the highest since 2018 and 2019 (both at 37%; Table 2).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fish houses are sampled monthly to provide length, weight, and age data. This information is used to characterize the commercial fishery for stock assessments and to monitor trends in the size and age of fish being removed from the stock. The average sizes of fish landed by the commercial fishery are typically larger than the recreational fishery and is primarily driven by the larger maximum size observed in the commercial landings; in addition, modal length for the commercial fishery was slightly higher (17 inches fork length) than the recreational fishery (15 inches fork length; Table 3; Figure 5). Undersized fish represent a small portion of the harvest in both sectors; 4.5% of commercial harvest and 1.3% of the recreational harvest was below the 14-inch size limit in 2021 (Figure 5).

The number of fish sampled by division staff at commercial fish houses has varied over time due to annual variability in landings of the fishery. The mean length of spotted seatrout in 2021 (17.5 inches fork length) was similar to the time series (1991-2020) average (16.6 inches fork length) and the mean and minimum lengths in 2021 (17.5 and 10.9-inches fork length, respectively) were all approximately equal to the previous two years (Table 3; Figure 6). In addition, for the past three years (2019-2021), minimum length has been consistently greater than the time series average (9.3 inches fork length). Maximum length in 2021 decreased to 29.9 inches fork length and was just above the time series average (29.3 inches fork length). The bulk of spotted seatrout landings by the commercial fishery in 2021 came from the ocean and estuarine gill net fishery (95%) with pound nets (2%), gigs (1%), and all other gears (mainly beach seines, swipe nets, and haul seines) accounting for the rest (2%).

Recreational catch is almost exclusively hook-and-line with few fish being landed by gigs. The mean (17.0 inches fork length), minimum (11.1 inches fork length), and maximum (26.5 inches fork length) lengths of fish measured in 2021 from the recreational fishery were similar to the previous year (17.0, 12.1, 26.8 inches fork length, respectively) and greater than the time series (1991-2020) average of each (16.0, 10.4, 25.8 inches fork length, respectively; Table 3; Figure 7). Ninety-two percent of the spotted seatrout sampled from the recreational fishery in 2021 were between 14 and 19 inches (Figure 5).

Fishery-Independent Monitoring

The NCDMF utilizes numerous independent monitoring programs to provide indices of juvenile (Program 120) and adult (Program 915) abundance to include in stock assessments. Program 120, the North Carolina Estuarine Trawl Survey, is a fishery independent multispecies monitoring program that has been ongoing since 1971 in the months of May and June. One of the key objectives of this program is to provide a long-term database of annual juvenile recruitment for economically important species. This survey samples a fixed set of 104 core stations with additional stations as needed. The core stations are sampled from western Albemarle Sound south to the South Carolina border each year without deviation two times in the months of May and June. An additional set of 27 spotted seatrout juvenile stations in Pamlico Sound and its major tributaries were added in 2004 and are sampled during the months of June and July. Data from the spotted seatrout specific stations are used to generate an index of relative abundance of age zero spotted seatrout, calculated as the average number of fish per tow. The resulting relative abundance index for the time series is variable with no significant trend overall, and peaks in 2006, 2008, 2012, 2013, and 2018 suggesting relatively higher recruitment in those years (Figure 8). The Program 120 relative abundance index in 2021 was 0.20, which was a 70% decrease from the previous year, and the lowest value since the beginning in 2004 (0.67 spotted seatrout per tow). The 2021 relative abundance index was a 90% decrease from the time series average (2004-2020; 2.08 spotted seatrout per tow).

The NCDMF started a fishery independent gill net survey (Program 915) in 2001 to generate a long-term database of age composition and to develop indices of abundance for numerous commercial and recreationally important finfish species, including spotted seatrout. The survey utilizes a stratified random sampling scheme of multi-mesh gill nets designed to characterize the size and age distribution for key estuarine species in Pamlico Sound and help managers assess the spotted seatrout stocks without relying solely on commercial and recreational fishery dependent data. Three regions encompassing most of the estuarine waters in North Carolina are sampled monthly from February to December. Pamlico Sound stations include waters on the backside of the barrier islands and the bays of Hyde and Dare counties. Relative abundance from Pamlico Sound has remained relatively steady from 2001 to 2015 (averaged 0.51 fish per set), increased to a time series high in 2019 (1.81 fish per set) and remained high in 2021 (1.46 fish per set; Figure 9). For the central river stations that include Pamlico, Pungo and Neuse rivers, abundance rose sharply in 2021 to the highest value in the time series (1.38 fish per set). Spotted seatrout abundance in the Cape Fear and New rivers has fluctuated without trend throughout the time series (Figure 11). Relative abundance in 2021 in the Cape Fear and New rivers was 0.91 fish per set, the second highest value in the time series. During 2020 no indices of abundance are available for spotted seatrout from the fishery-independent assessment (Program 915). Sampling in this program was suspended in February 2020 due to COVID-19 restrictions and protected species interactions but resumed July 2021.

Spotted seatrout age samples are collected from numerous NCDMF fishery independent and dependent sources. To date, a total of 20,668 otoliths from spotted seatrout have been aged since 1991 (Table 4). With the exception of 2003, the minimum age of sampled spotted seatrout has been age zero for every year the NCDMF has recorded this information. Maximum ages have varied every year, ranging from age five to age nine. Modal ages, which give an indication of the age of the largest cohort in the fishery, averages age one. Spotted seatrout length-at-age was summarized based on all available age data (1991-2020; Figure 12). Average growth of spotted seatrout slows down around age-4, but fish as large as 24.7 inches have the potential to be young of the year (age-0), demonstrating the species' fast growth. In 2021, the number of fish aged (1,006 fish) increased from the previous year (634 fish), which is to be expected with delays in sampling due to COVID-19 in 2020. Spotted seatrout sampled in 2021 had a modal age of 1 and maximum age of 6, an increase from the previous year (5).

RESEARCH NEEDS

The following research needs were compiled from those listed in the 2012 North Carolina Spotted Seatrout FMP. Improved management of spotted seatrout is dependent upon research needs being met. Research needs are not listed in order of priority.

- Develop a juvenile abundance index to gain a better understanding of a stock recruitment relationship. — Ongoing, using program 120 since 2004; CRFL grant 2F40 is investigating an optimal sampling design for P120
- Research the feasibility of including measures of temperature or salinity into the stock recruitment relationship. — Not Completed
- Determine batch fecundity estimates for North Carolina spotted seatrout. — Not Conducted
- Size specific fecundity estimates for North Carolina spotted seatrout. — Not Conducted
- Area specific spawning surveys could help in the delineation of area specific closures to protect females in spawning condition. — Not Conducted
- Investigation of the relationship of temperature with both adult and juvenile mortality. — Ongoing: Ellis et al. 2017a, 2017b; CRFL project 2F40-F024 started in 2015, monitoring temperatures in overwintering habitat of spotted seatrout
- Incorporate cold stun event information into the modeling of the population. — Unsuccessfully attempted using stock synthesis model from the 2012 stock assessment, is being investigated in the 2019 benchmark stock assessment
- Estimate or develop a model to predict the impact of cold stun events on local and statewide spotted seatrout abundance. — Unsuccessfully attempted using stock synthesis model from the 2012 stock assessment, is being investigated further during 2019 benchmark stock assessment

- Obtain samples (length, age, weight, quantification) of the cold stun events as they occur. — Ongoing: obtained samples in 2001, 2010, 2014, 2015, 2018; length, weight, sex, age; unable to quantify extent of kills
- Define overwintering habitat requirements of spotted seatrout. — Preliminary work completed in Ellis et. al (2017a, 2017b)
- Determine factors that are most likely to influence the severity of cold stun events in North Carolina and separate into low and high salinity areas. — Preliminary work completed in Ellis et. al (2017a)
- Investigate the distribution of spotted seatrout in nursery and non-nursery areas. — Not Completed
- Further research on the possible influences of salinity on release mortality of spotted seatrout. — Not Completed
- Survey of fishing effort in creeks with conflict complaints. — Not Completed
- Determine targeted species in nursery areas and creeks with conflict complaints. — Not Completed
- Microchemistry, genetic, or tagging studies are needed to verify migration patterns, mixing rates, or origins of spotted seatrout between North Carolina and Virginia. — Genetic study completed: NCSU study CRFL grant 2F40-F022; tagging studies ongoing: Tim Ellis data (2008-2013); CRFL project 2F40-F017, NC Multi Species Tagging Study 2014 — Present
- Tagging studies to verify estimates of natural and fishing mortality. — Ongoing: Tim Ellis data (2008-2013); CRFL project 2F40-F017, NC Multi Species Tagging Study 2014 — Present
- Tagging studies to determine if there are localized populations within the state of North Carolina (e.g., a southern and northern stock). — Ongoing: Tim Ellis data (2008-2013); CRFL project 2F40-F017, NC Multi Species Tagging Study 2014 — Present
- A longer time series and additional sources of fishery-independent information. — Longer time series available for P915 as well as P915 surveys for rivers and southern portion of state
- Increased observer coverage in a variety of commercial fisheries over a wider area. — Ongoing
- Expand nursery sampling to include SAV bed sampling in high and low salinity areas during the months of July through September. — Not Completed
- Evaluate the role of shell hash and shell bottom in spotted seatrout recruitment and survival, particularly where SAV is absent. — Not Completed
- Evaluate the role of SAV in the spawning success of spotted seatrout. — Not Completed

MANAGEMENT STRATEGY

Maintain a spawning potential ratio of 20% to increase the likelihood of sustainability through an expanded age structure and an increase in the spawning stock biomass. This strategy should provide a greater cushion for the population and likely lead to faster recovery of the population after cold stun events, which can lead to mass mortalities in the winter months potentially affecting the number of mature fish available to spawn the following spring. The Director maintains authority to intervene in the event of a catastrophic cold stun event and close the fishery in specific areas or statewide until June 15. This reduces fishing mortality on spotted seatrout until after the peak in their spawning season.

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATIONS

The review of the plan is underway. A benchmark stock assessment is being conducted, incorporating data through February 2020.

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TABLES

Table 1: Recreational harvest (number of fish landed and weight in pounds) and releases (number of fish) and commercial harvest (weight in pounds) of spotted seatrout from North Carolina for the period 1991–2021.

	Recreational			Commercial	
Year	Numbers Landed	Numbers Released	Weight Landed (lb)	Weight Landed (lb)	Total Weight (lb)
1991	988,049	719,372	1,360,530	660,662	2,021,192
1992	908,233	476,405	1,390,746	526,271	1,917,017
1993	569,327	542,137	857,720	449,886	1,307,606
1994	798,937	601,148	1,207,520	412,358	1,619,878
1995	863,057	764,503	1,221,065	574,296	1,795,361
1996	575,357	1,028,974	699,078	226,580	925,658
1997	779,611	480,093	1,025,110	232,497	1,257,607
1998	702,274	351,114	1,125,898	307,671	1,433,569
1999	1,080,411	1,168,909	1,878,913	546,675	2,425,588
2000	728,906	645,107	1,095,729	376,574	1,472,303
2001	499,556	1,210,336	659,893	105,714	765,607
2002	746,908	1,829,880	957,824	175,555	1,133,379
2003	388,715	903,292	515,678	181,462	697,140
2004	560,834	934,206	728,027	130,961	858,988
2005	1,517,647	3,744,921	1,695,036	129,855	1,824,891
2006	1,444,778	2,722,351	2,034,469	312,624	2,347,093
2007	1,241,296	3,558,110	1,998,275	374,722	2,372,997
2008	1,372,973	4,509,440	2,114,130	304,430	2,418,560
2009	1,857,890	5,369,092	2,878,160	320,247	3,198,407
2010	630,748	8,034,670	1,277,174	202,647	1,479,821
2011	723,502	7,486,377	1,353,388	75,239	1,428,627
2012	1,602,836	4,967,987	2,720,028	265,016	2,985,044
2013	1,107,957	4,312,436	1,881,881	367,648	2,249,529
2014	725,086	3,950,447	1,451,592	242,245	1,693,837
2015	249,260	4,883,109	430,579	128,762	559,341
2016	978,624	6,533,887	1,724,492	254,590	1,979,082
2017	1,217,834	5,151,510	2,157,198	299,911	2,457,109
2018	449,473	15,245,249	658,555	128,922	787,477
2019	1,937,250	7,185,562	3,334,163	378,491	3,712,654
2020	2,053,354	6,215,778	3,632,315	568,764	4,201,079
2021	1,223,508	6,332,064	2,241,421	694,784	2,936,205
Mean	976,689	3,484,026	1,535,506	308,709	1,844,215

Table 2: Total number of awarded citations for spotted seatrout (>24 inches total length for release or > five pounds landed) from the North Carolina Saltwater Fishing Tournament for the time period 1991–2021.

Year	Total Citations	Release Citations+	% Release
1991	185		0
1992	203		0
1993	12		0
1994	237		0
1995	483		0
1996	132		0
1997	125		0
1998	332		0
1999	695		0
2000	511		0
2001	518		0
2002	353		0
2003	328		0
2004	378		0
2005	290		0
2006	686		0
2007	1,000		0
2008	428	5	1
2009	434	14	3
2010	168	16	10
2011	37	3	8
2012	143	5	3
2013	162	21	13
2014	197	18	9
2015	176	16	9
2016	214	44	21
2017	464	81	17
2018	198	73	37
2019	468	172	37
2020	579	193	33
2021	655	283	43

+ Spotted seatrout release citations (fish released greater than 24 inches total length) began in 2008.

Table 3: Mean, minimum, and maximum lengths (fork length, inches) of spotted seatrout measured from the commercial and recreational fisheries, 1991–2021.

Year	Commercial				Recreational			
	Mean Length	Minimum Length	Maximum Length	Total Number Measured	Mean Length	Minimum Length	Maximum Length	Total Number Measured
1991	14.4	7.7	28.7	1,207	15.1	4.9	31.9	745
1992	16.0	8.4	27.9	1,791	15.6	5.1	24.2	543
1993	16.3	8.5	29.7	1,898	15.7	9.3	25.0	485
1994	15.6	7.0	29.1	1,224	16.0	10.6	24.0	1,076
1995	17.1	8.5	29.1	2,728	15.6	8.5	31.6	853
1996	16.0	7.0	27.6	748	14.6	8.9	24.3	307
1997	14.9	8.1	29.9	4,155	15.3	8.9	23.1	622
1998	14.5	8.0	29.9	4,698	16.4	11.0	36.5	551
1999	15.6	7.6	30.2	6,167	16.4	11.6	26.8	699
2000	17.5	6.0	30.7	2,901	15.6	11.3	25.2	330
2001	16.3	7.6	30.7	1,595	14.8	11.5	26.0	326
2002	16.1	8.0	28.9	3,897	14.9	11.8	24.8	283
2003	17.2	9.5	29.6	2,305	14.6	9.9	25.0	130
2004	16.6	9.0	27.9	2,676	15.3	8.9	22.5	294
2005	16.8	8.5	27.5	2,429	14.2	8.7	25.2	664
2006	16.3	8.9	29.3	6,493	15.5	10.1	25.9	706
2007	17.3	9.6	31.0	8,455	15.9	10.8	27.7	521
2008	17.0	7.3	30.3	5,877	15.6	11.5	26.5	790
2009	16.7	5.4	29.5	6,631	16.0	9.1	26.0	779
2010	17.5	11.4	30.9	4,060	17.5	12.4	24.8	336
2011	16.6	8.8	27.8	1,274	17.0	12.3	24.2	638
2012	16.5	7.4	31.1	4,822	16.5	13.0	24.1	939
2013	16.7	8.7	28.5	6,144	16.8	10.1	23.5	865
2014	17.3	5.5	28.3	3,321	17.6	13.1	26.0	381
2015	18.3	8.9	30.9	2,676	16.9	12.8	25.0	154
2016	17.3	9.4	31.7	3,025	16.8	13.0	25.2	647
2017	17.6	7.6	32.9	3,066	17.0	11.6	25.8	864
2018	17.2	10.5	28.0	1,180	15.7	9.3	23.3	274
2019	17.3	10.1	28.9	2,622	16.7	10.7	24.6	1,574
2020	17.5	10.9	33.4	2,851	17.0	12.1	26.8	1,119
2021	17.5	10.9	29.9	3,432	17.0	11.1	26.5	1,019

Table 4: Modal age, minimum age, maximum age, and number aged for spotted seatrout collected through NCDMF sampling programs, 1991–2021

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
1991	1	0	7	679
1992	1	0	6	572
1993	1	0	6	645
1994	1	0	9	688
1995	1	0	5	623
1996	1	0	6	734
1997	1	0	6	710
1998	1	0	9	765
1999	1	0	6	869
2000	1	0	7	566
2001	1	0	5	425
2002	1	0	7	713
2003	1	1	7	405
2004	1	0	6	598
2005	1	0	5	727
2006	1	0	8	970
2007	2	0	8	702
2008	1	0	7	616
2009	2	0	6	660
2010	1	0	6	623
2011	1	0	6	421
2012	1	0	5	593
2013	2	0	5	635
2014	1	0	7	530
2015	2	0	5	448
2016	1	0	5	456
2017	1	0	7	881
2018	1	0	5	516
2019	1	0	8	1,167
2020	2	0	5	634
2021	1	0	6	1,006

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Table 5: Summary of the NCMFC management strategies and their implementation status for the 2012 N.C. Spotted Seatrout FMP.

Management Strategy	Implementation Status
50% reduction in harvest needed, six fish bag limit, 14-inch minimum size limit, and weekend closure for commercial gears year-round (no possession on weekends).	Accomplished; Proclamation authority
A maximum of two fish over 24 inches for recreational fishermen	Proclamation authority
The small mesh gill net attendance requirement is extended to include weekends, December through February	Accomplished
Development of a mutual aid agreement between NCDMF Marine Patrol and WRC Wildlife Enforcement Officers for Inland fishing waters	Accomplished
Move forward with the mediation policy process to resolve conflict between spotted seatrout fishermen	Conflict resolution process established under Rule 15A NCAC 03I .0122.
Remain status quo with the assumption that the Director will intervene in the event of a catastrophic event and do what is necessary in terms of temporary closures by water body	Repealed Rule 15A NCAC 03M .0504 and used proclamation authority in 15A NCAC 03M .0512; Beginning in May 2017 re-established spotted seatrout Rule 15A NCAC 03M .0522 due to ASMFC considering retiring Interstate Spotted Seatrout FMP
More extensive research on cold stun events by NCDMF, Universities, etc.	Preliminary research accomplished (Ellis et al. 2017a, 2017b), additional work ongoing.

Table 6: Summary of the NCMFC management strategies and their implementation status for Supplement A to the 2012 N.C. Spotted Seatrout FMP adopted in 2014.

Management Strategy	Implementation Status
2014: 14-inch minimum size limit, four recreational bag limit, 75 fish commercial trip limit, no gill nets in joint waters on weekends, unlawful for a commercial operation to possess or sell spotted seatrout taken from joint waters on weekends.	Proclamation authority
2014: 14-inch minimum size limit, three fish recreational bag limit with a December 15- January 31 closure, 25 fish commercial trip limit (no closure)	Delay in management strategy
If a cold stun occurs close spotted seatrout harvest through June 1 and retain four fish recreational bag limit and 75 fish commercial trip limit	Proclamation authority
Revisit the Spotted Seatrout FMP in three years to determine if sustainable harvest measures are working	On schedule to begin July 2017*

* The NCMFC approved the 2017 FMP schedule in August 2017, which included a schedule change for spotted seatrout to begin in 2019, two years later than originally planned.

FIGURES

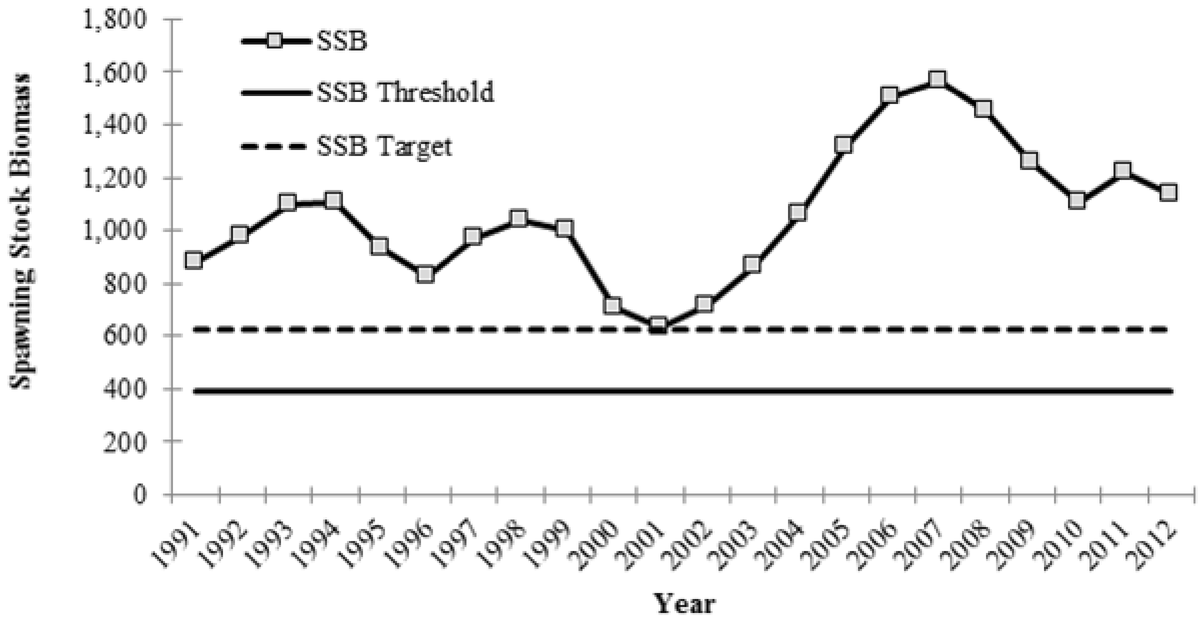

Figure 1. Annual predicted spawning stock biomass in metric tons, compared to estimated $SSB_{Threshold}$ ($SSB_{20\%}$) and SSB_{Target} ($SSB_{30\%}$), 1991–2012. 2012 is the terminal year for the last spotted seatrout stock assessment (NCDMF 2015b).

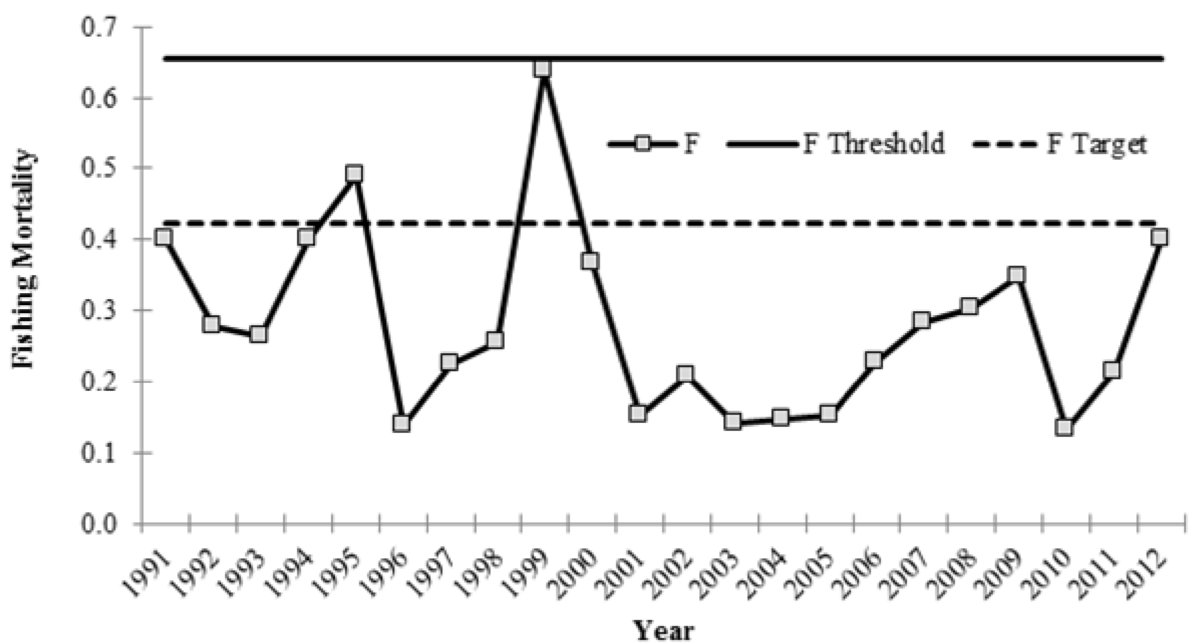

Figure 2. Annual predicted fishing mortality rates (numbers-weighted, ages 1–4) compared to estimated $F_{Threshold}$ ($F_{20\%}$) and F_{Target} ($F_{30\%}$), 1991–2012. 2012 is the terminal year for the last spotted seatrout stock assessment (NCDMF 2015b).

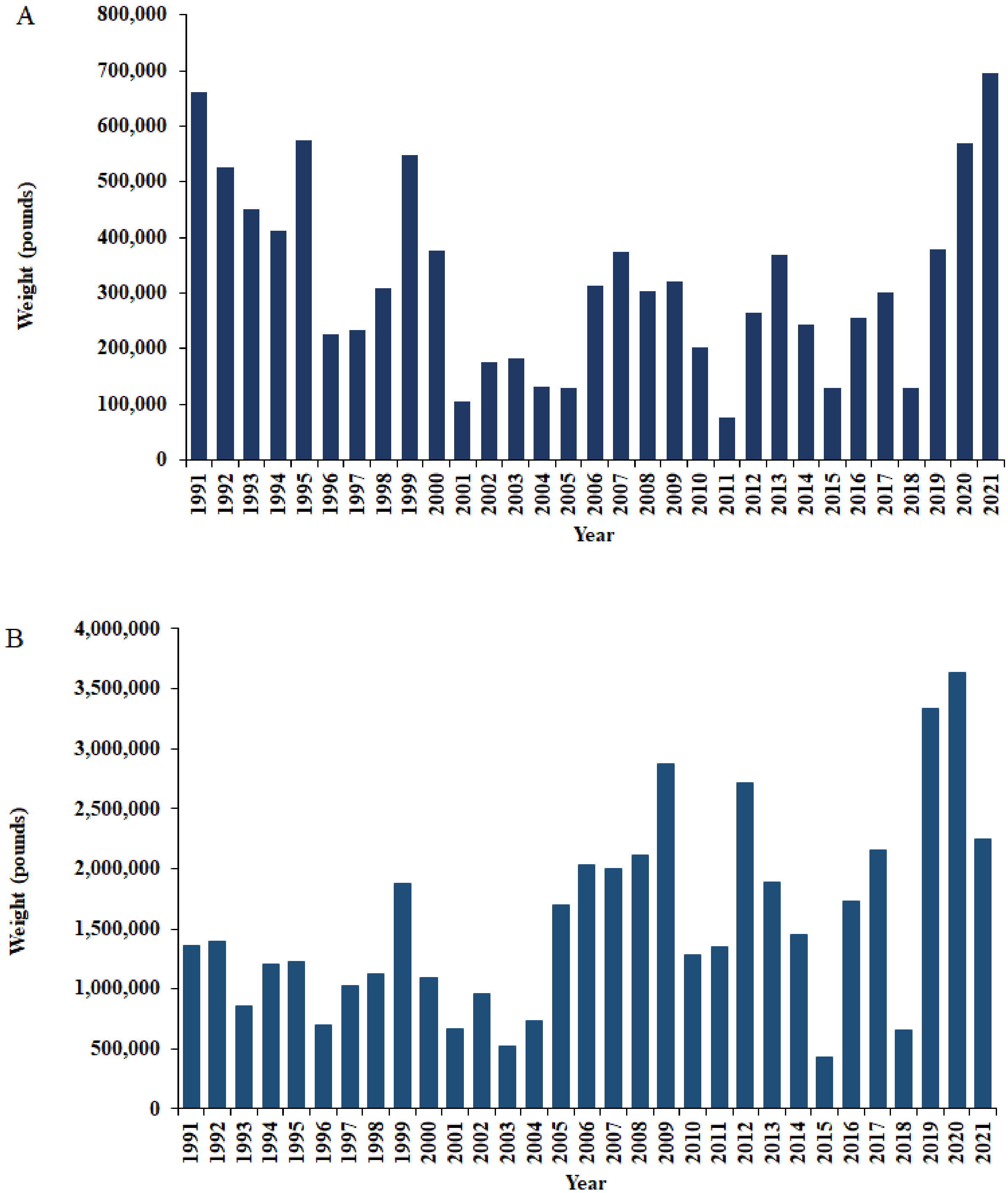

Figure 3. Commercial landings (pounds) reported through the North Carolina Trip Ticket Program (A) and recreational landings (Type A + B1; pounds) estimated from the Marine Recreational Information Program survey (B) for North Carolina, 1991–2021.

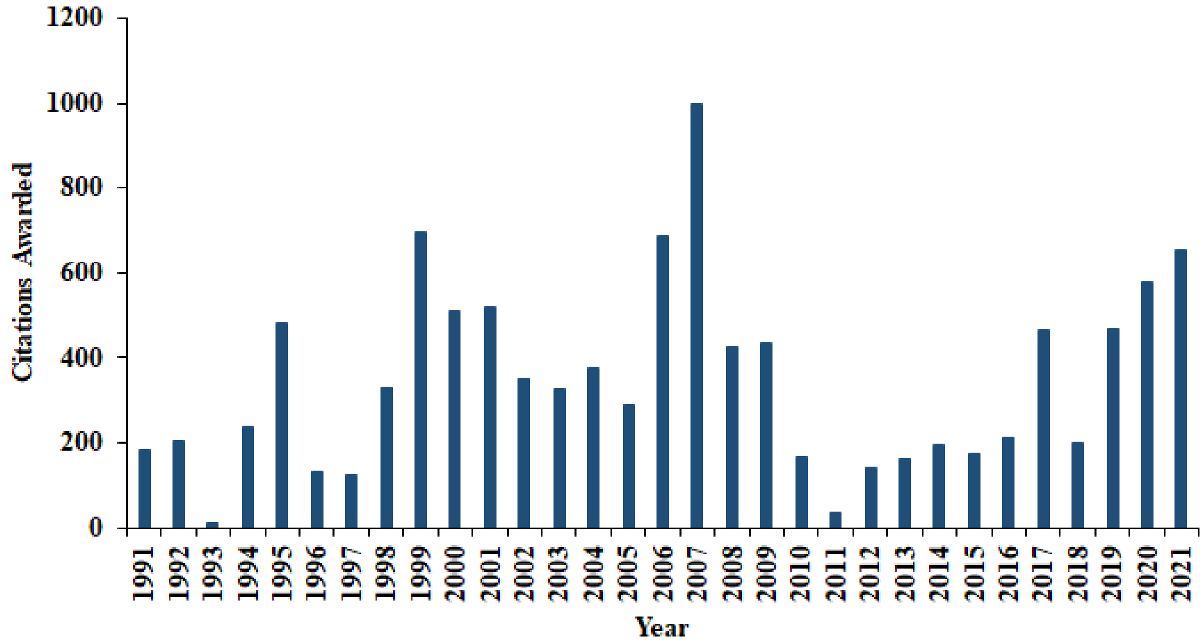

Figure 4. North Carolina Saltwater Fishing Tournament citations awarded for spotted seatrout, 1991–2021. Citations are awarded for spotted seatrout >24 inches total length for release or > five pounds landed.

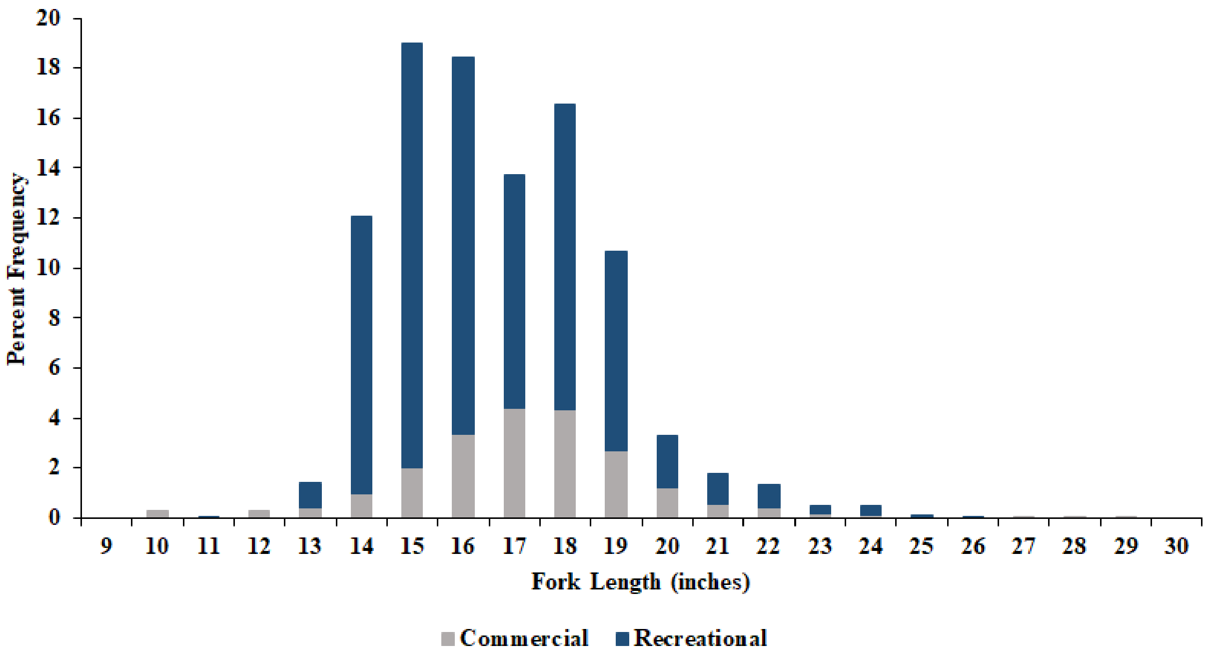

Figure 5. Commercial and recreational length frequency distribution from spotted seatrout harvested in 2021.

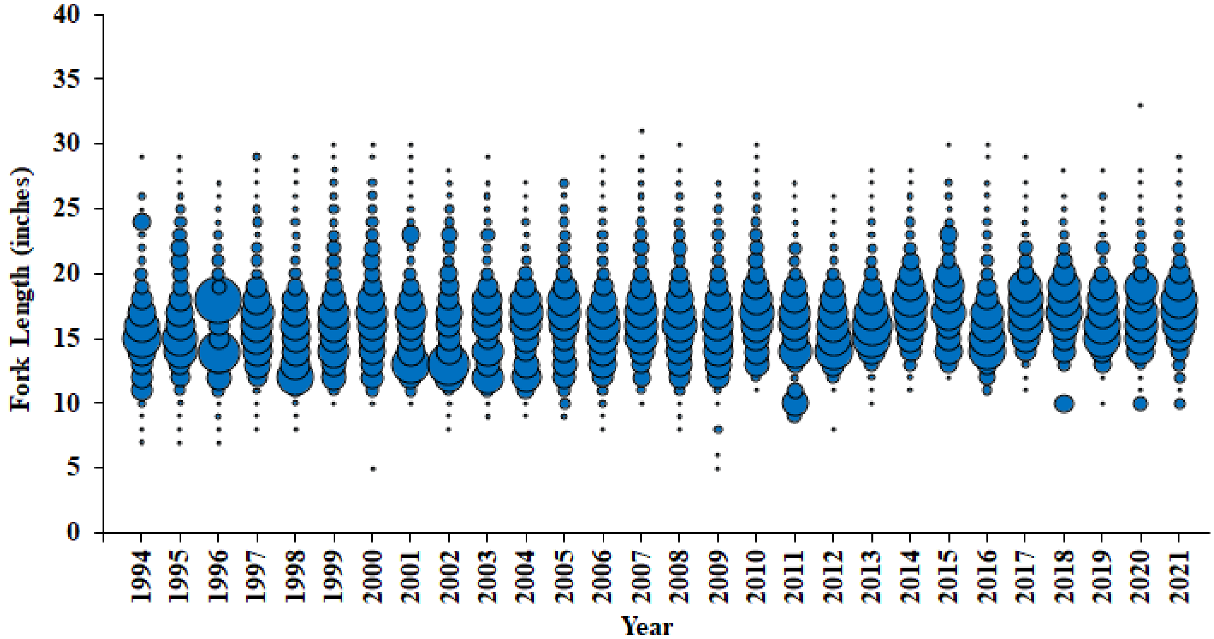

Figure 6. Commercial length frequency (fork length, inches) of spotted seatrout harvested, 1994–2021. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

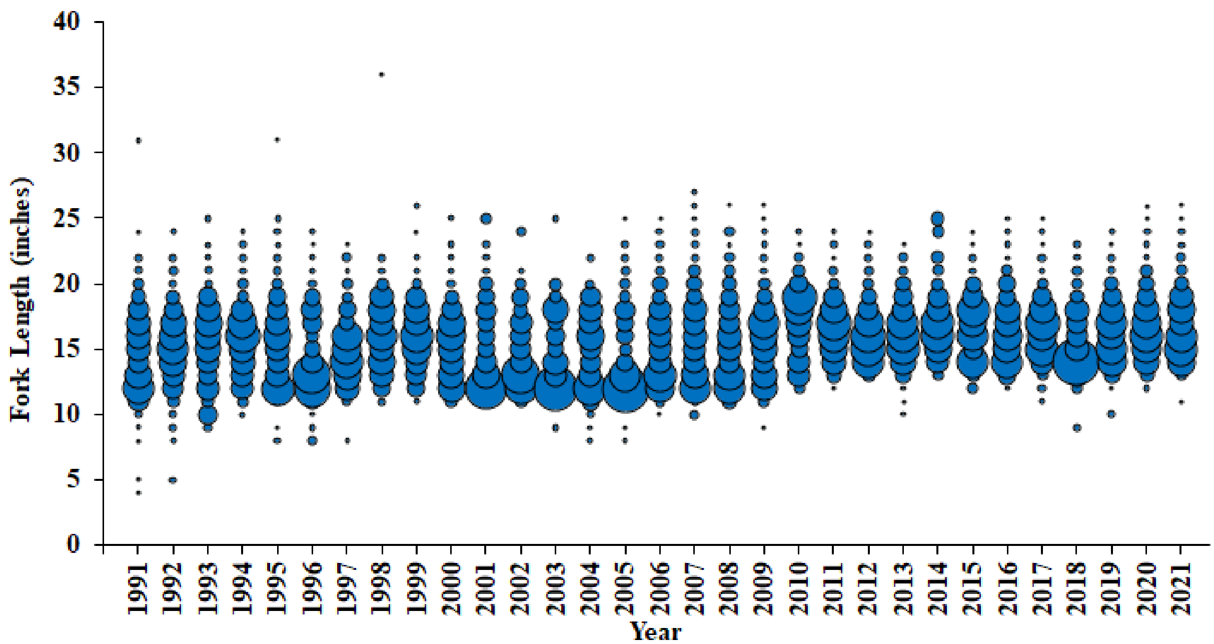

Figure 7. Recreational length frequency (fork length, inches) of spotted seatrout harvested, 1991–2021. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

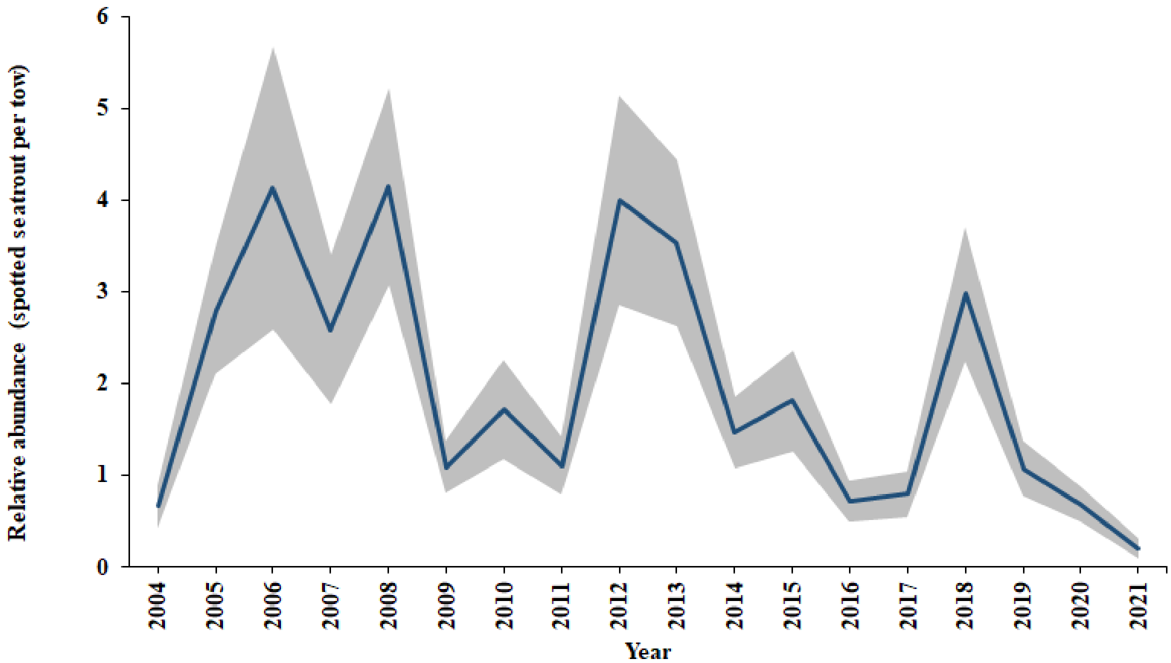

Figure 8. Relative abundance index (fish per tow) from the North Carolina Estuarine Trawl Survey (Program 120) during June and July, 2004–2021. Error bars represent ± 1 standard error.

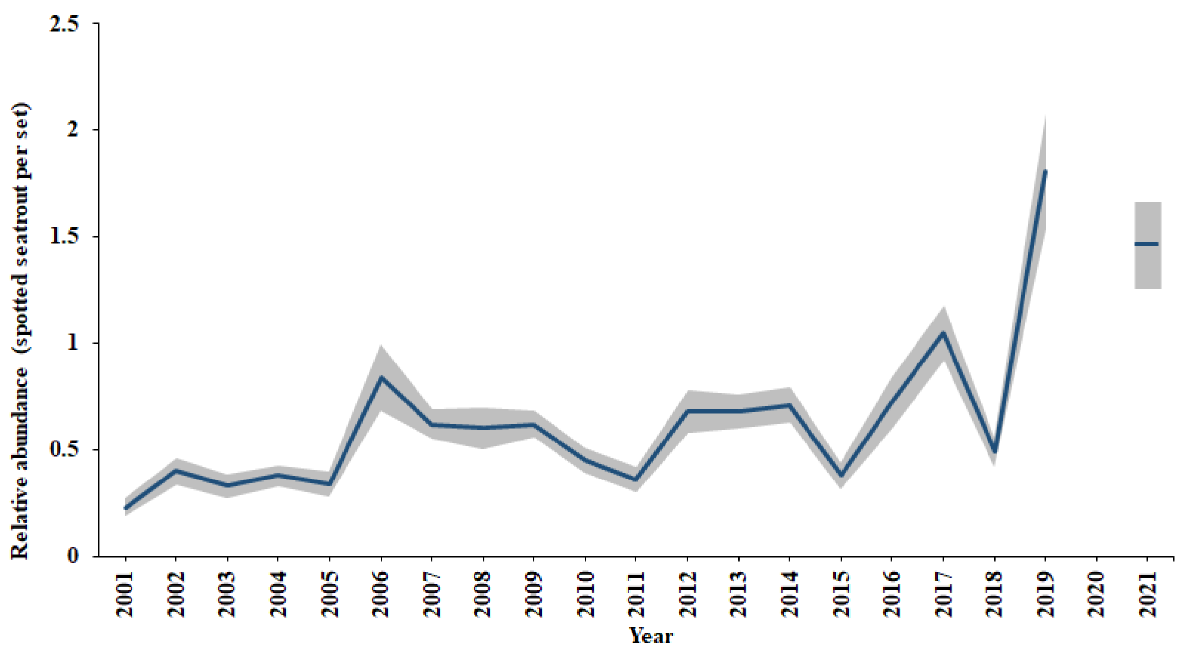

Figure 9. Relative abundance index (fish per set) of spotted seatrout collected from Program 915 in Pamlico Sound, 2001–2021. Error bars represent ± 1 standard error. Sampling not conducted in 2020.

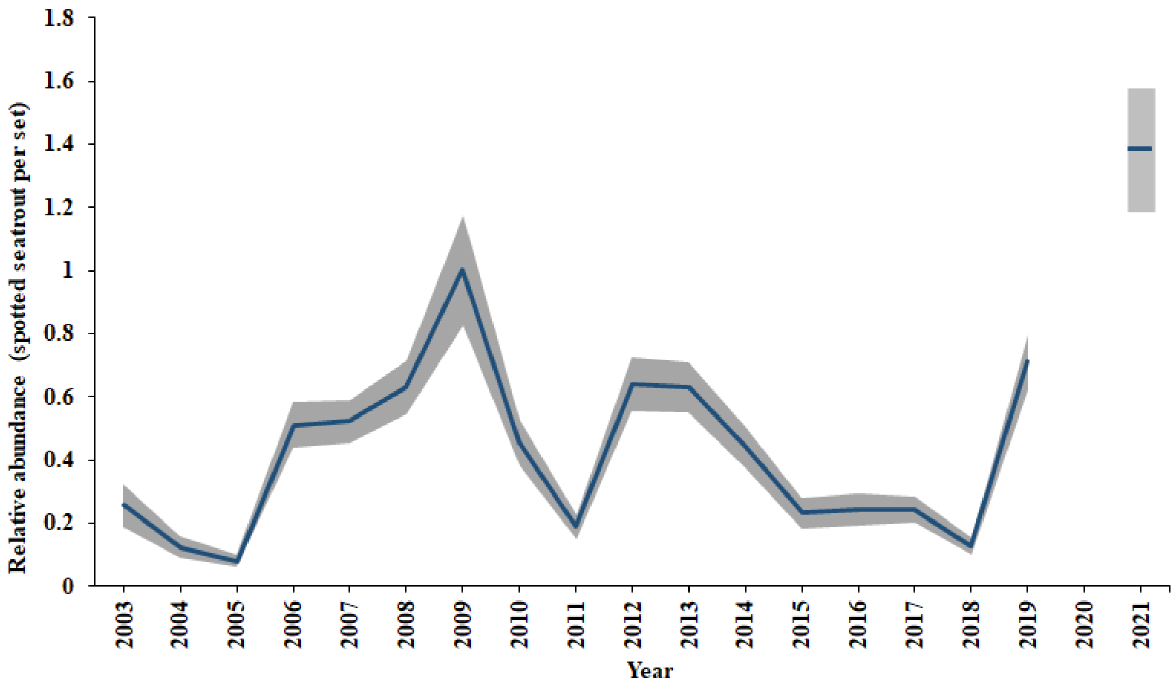

Figure 10. Relative abundance index (fish per set) of spotted seatrout collected from Program 915 in Pungo, Pamlico, and Neuse rivers, 2004–2021. Error bars represent ± 1 standard error. Sampling not conducted in 2020.

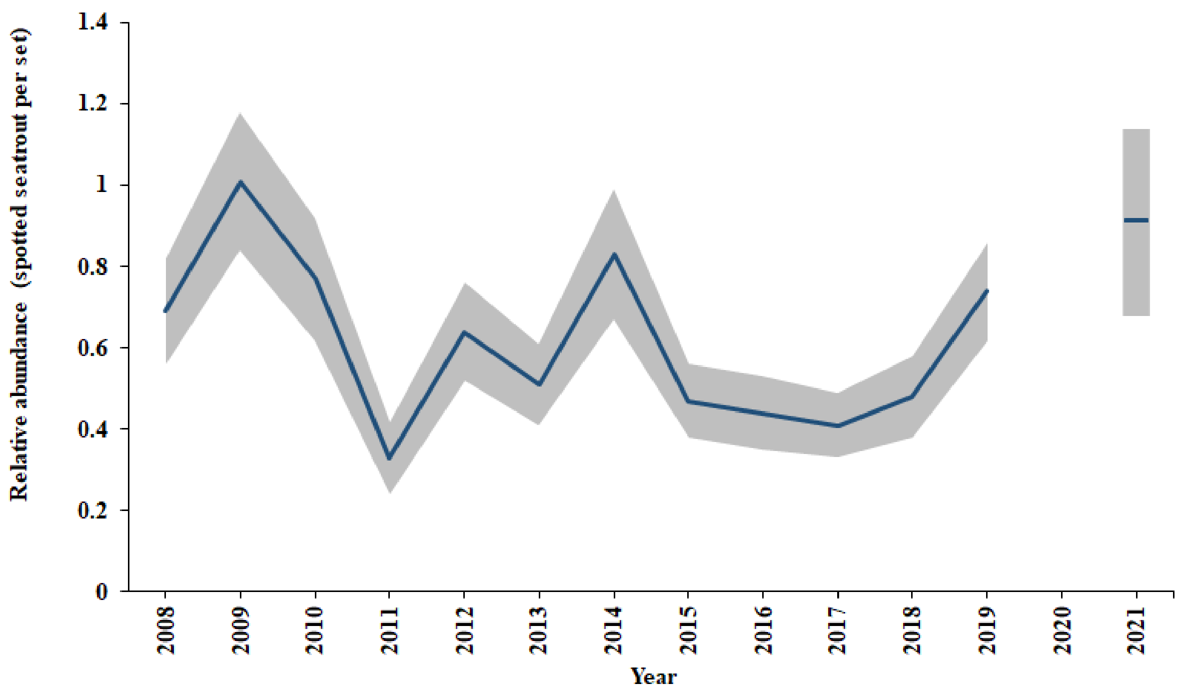

Figure 11. Relative abundance index (fish per set) of spotted seatrout collected from Program 915 in New and Cape Fear rivers, 2008–2021. Error bars represent ± 1 standard error. Sampling not conducted in 2020.

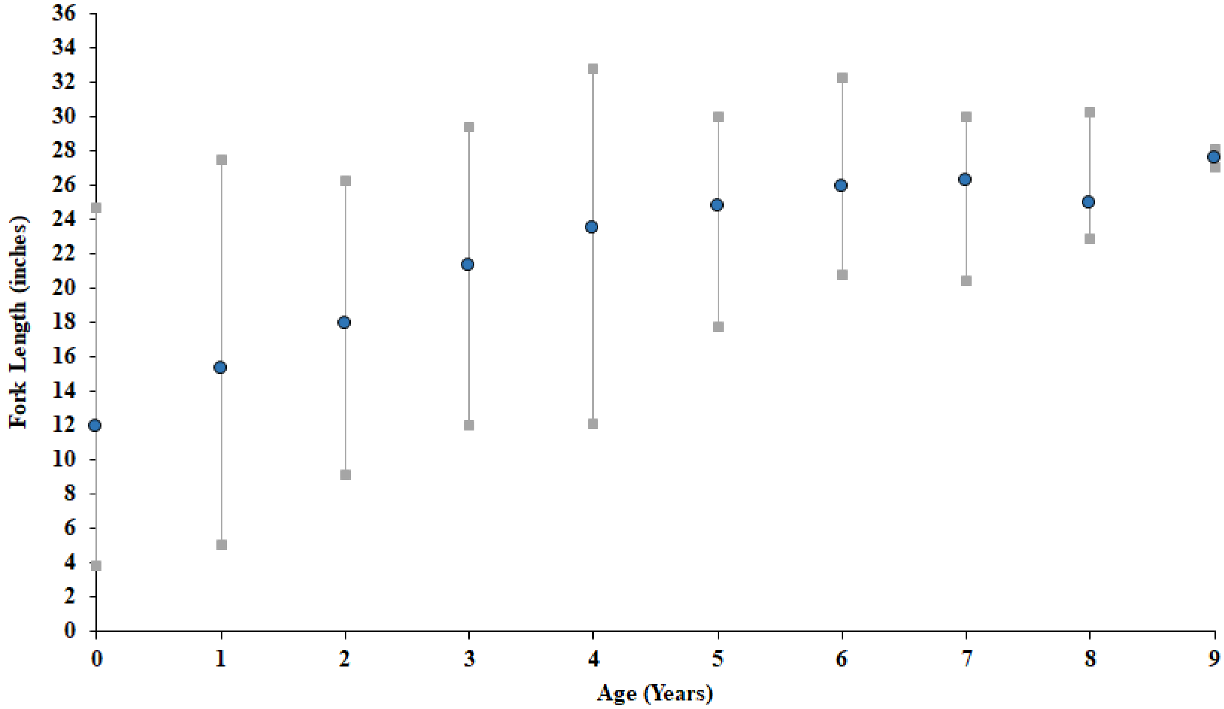

Figure 12. Spotted seatrout length at age based on all age samples collected from 1991 to 2020. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed size for each age.

Stock Assessment of Spotted Seatrout, *Cynoscion nebulosus*, in Virginia and North Carolina Waters, 1991–2019

Prepared by

North Carolina Division of Marine Fisheries
Spotted Seatrout Plan Development Team

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EXECUTIVE SUMMARY

The North Carolina Fisheries Reform Act requires that fishery management plans be developed for the state's commercially and recreationally significant species to achieve sustainable harvest. Stock assessments are the primary tools used by managers to assist in determining the status of stocks and developing appropriate management measures to ensure their long-term viability.

A seasonal size-structured assessment model was applied to data characterizing commercial and recreational landings and discards, fisheries-independent survey indices, and biological data collected from 1991 through 2019. A nonstationary process was assumed for natural mortality and growth in the model. The seasonal time step and nonstationary natural mortality assumption allows for capturing the cold-stun signals that have been observed for Spotted Seatrout. Both the observed data and the model predictions suggest a shift in population dynamics around the year of 2004 when the survey index data became available. Lower fishing mortality and higher spawning stock biomass and recruitment with greater variation were predicted for the time period after 2004. This trend was also observed in the recreational landing and discards data, with higher values in the time period after 2004.

Reference point thresholds for the Spotted Seatrout stock were based on 20% spawner potential ratio (SPR). The estimated F threshold $F_{20\%}$ was 0.60 per year, and the estimated terminal year (2019) F was 0.75 per year. Thus, the estimated $F/F_{20\%}$ for 2019 is greater than one (1.3), suggesting the stock is currently experiencing overfishing. The estimated SSB threshold ($SSB_{20\%}$) for 2019 was 1,143 metric tons, and the estimated 2019 SSB was 2,259 metric tons. Therefore, the estimated $SSB/SSB_{20\%}$ for 2019 is greater than one (2.0), suggesting the stock is not currently overfished.

An independent, external peer review of this stock assessment recommended the stock assessment for use in management for at least the next five years.

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1 INTRODUCTION

1.1 The Resource

Spotted Seatrout (*Cynoscion nebulosus*), also known as Speckled Trout, are a euryhaline species found from Massachusetts to Mexico (Manooch 1984), inhabiting shallow coastal and estuarine waters throughout their range. Spotted Seatrout is a member of the family Sciaenidae (drums), which includes Weakfish (*C. regalis*), Spot (*Leiostomus xanthurus*), kingfishes or sea mullet (*Menticirrhus* spp.), Atlantic Croaker (*Micropogonias undulatus*), Black Drum (*Pogonias cromis*), and Red Drum (*Sciaenops ocellatus*). This family of fishes is highly sought after in commercial and recreational fisheries. Spotted Seatrout has two other species within its genus found in Virginia and North Carolina waters—Weakfish (Gray Trout) and Silver Seatrout (*C. nothus*). Spotted Seatrout can be distinguished from the other two species by the circular specks or spots on its body, dorsal fin, and caudal fin.

1.2 Life History

1.2.1 Stock Definitions

The unit stock for this assessment consists of all Spotted Seatrout within North Carolina and Virginia waters. Tagging studies in North Carolina and Virginia indicate moderate mixing between the two states (between 6 and 10%; Ellis 2014; NCDMF, unpublished data; Susanna Musick, Virginia Game Fish Tagging Program—VGFTP, personal communication). In contrast, tagging studies in North Carolina and South Carolina suggest Spotted Seatrout rarely move between the two states (<1%; Davy 1994; Ellis 2014; NCDMF, unpublished data). Several genetics studies have been completed in recent years that further investigated Spotted Seatrout stock structure in Virginia, North Carolina, and South Carolina (O'Donnell et al. 2014; Ellis et al. 2019). Overall, genetic data support a single unit stock in Virginia and North Carolina coastal waters (Ellis et al. 2019); however, studies by Ellis et al. (2019) and O'Donnel et al. (2014) both suggest Spotted Seatrout in the Cape Fear, North Carolina region are genetically distinct from Spotted Seatrout found in Bogue Sound, North Carolina northward through Virginia and the New River, North Carolina serving as an area of complex, seasonal mixing and connectivity between these two populations.

In this stock assessment, Spotted Seatrout occurring in the waters between the Cape Fear River and South Carolina state line are included because it is a relatively small area with a low percentage of the total landings (0.5–11.5% of total North Carolina and Virginia landings from 1994 to 2019; NCDMF, unpublished data) and the available tagging data suggest extremely limited movement of Spotted Seatrout between North and South Carolina.

1.2.2 Movements & Migration

As with many estuarine and marine fish in North Carolina, Spotted Seatrout have distinct seasonal migrations. During the winter, Spotted Seatrout migrate to relatively shallow habitats of upper estuaries (Ellis 2014; Ellis et al. 2017b). As the waters warm in the summer, Spotted Seatrout return to oyster beds and shallow bays and flats (Daniel 1988). Movement rates and distance traveled is greatest in spring and fall (Ellis 2014; Moulton et al. 2017). Although Spotted Seatrout seasonally migrate, movements north in the spring and southern movements in the fall, Spotted Seatrout have considerable residency based on tag return studies, with most individuals usually traveling less than 50 km (Music 1981; Brown-Peterson et al. 2002; Ellis 2014; Moulton et al. 2017; Loeffler et al. 2019).

A coast-wide stock assessment of Spotted Seatrout has not been conducted given the largely non-migratory nature of the species (ASMFC 2008). Instead, a list of goals for coast-wide management exist to help guide states that have an interest in the Spotted Seatrout fishery so they can manage their stocks independently (ASMFC 1990).

South Carolina, Virginia, and North Carolina have long-term tagging studies of Spotted Seatrout. South Carolina tagged fish from 1978 to 2009 and less than 1% were recaptured in North Carolina or Virginia (Davy 1994; Wenner and Archambault 1996; Wiggers 2010). Virginia has an ongoing tagging program; from 1995 to 2020, a total of 6.4% of the Spotted Seatrout tagged in Virginia were recaptured outside of the state (mostly in North Carolina, but ranging from Ocean City, Maryland to Savannah, Georgia; Susanna Musick, VGFTP, personal communication). Ellis et al. (2018) collected North Carolina tagging data from 2008 to 2014. Overall, a total of 86% (i.e., 452 fish) of the tagged fish that a recapture location was recorded for were recaptured in North Carolina and 14% (i.e., 71 fish) were recaptured in the Chesapeake Bay. The remaining 0.4% (i.e., two fish) were recaptured in South Carolina. Ellis' (2014) analysis of tagged fish indicated Spotted Seatrout are capable of migrating more than 180 km; however, the majority (56%) of movement based on tag returns is local (<20 km). North Carolina Division of Marine Fisheries' tagging data (2014–2020) indicates a similar pattern (NCDMF, unpublished data). The majority of fish tagged in North Carolina were recaptured in North Carolina waters (91%) although some fish were recaptured in the Chesapeake Bay (Maryland and Virginia waters, 8%) and South Carolina (1%).

1.2.3 Age & Size

Spotted seatrout can reach a maximum size of 1,003 mm (39.5 inches) and 7.92 kg (17.4 lb; FWC 2022). North Carolina's state record was a 5.67-kg (12-lb 8-ounce) fish caught in 2022. The annual average size of Spotted Seatrout landed in the North Carolina recreational fishery between 1991 and 2019 ranged from 361 to 447 mm (14.2 to 17.6 inches); in the commercial fishery, annual average length ranged between 366 and 465 mm (14.4 to 18.3 inches). The maximum observed length in North Carolina's recreational fishery was 927 mm (36.5 inches) while the maximum observed length in the commercial fishery was 836 mm (32.9 inches). The maximum otolith-based age of Spotted Seatrout has been reported to be 10 years old in Virginia (Ihde and Chittenden 2003), 9 years old in North Carolina, 9 years old in South Carolina (Wenner and Archambault 1996), 8 years old in Georgia (GACRD 2003), and 10 years old in Florida (Addis et al. 2018). Although the oldest individual Spotted Seatrout observed in many studies was male (Moffett 1961; Maceina et al. 1987; Colura et al. 1994; Murphy and Taylor 1994; DeVries et al. 1997), both female and male Spotted Seatrout have been aged up to age 9 in North Carolina.

Virginia's state record was a 7.26-kg (16-lb) fish caught in 1977. The annual average size of Spotted Seatrout landed in the Virginia recreational fishery between 1991 and 2019 ranged from 384 to 610 mm (15.1 to 24.0 inches) total length (TL). In the commercial fishery, annual average length ranged between 397 and 537 mm (15.6 to 21.2 inches) TL. The maximum observed length in Virginia's recreational fishery was 770 mm (30.3 inches) TL while the maximum observed length in the commercial fishery was 870 mm (34.3 inches) TL.

1.2.4 Growth

Following the first winter, male Spotted Seatrout attain an average of 246 mm (9.70 inches) in length and females reach an average of 325 mm (12.8 inches) in length (NCDMF, unpublished data). Smith et al. (2008) calculated a growth rate of 1.44 mm/day for juveniles in Chesapeake Bay, which is two to three times higher than growth rates reported in Florida (McMichael and Peters 1989; Powell et al. 2004). Growth rate begins to decrease with age in North Carolina reaching an asymptote by age 4. The predicted average maximum size for Spotted Seatrout in North Carolina is 671 mm (26.4 inches) for males and 775 mm (30.5 inches) for females.

Several studies have examined environmental effects on Spotted Seatrout growth. There is evidence of reduced metabolism of Spotted Seatrout at high temperatures and salinities (temperature-dependent), which may be accompanied by reduced activity and growth (Wuenshel et al. 2004); however, greater Spotted Seatrout growth has also been observed in habitats with both higher salinities and greater seagrass densities (Bortone et al. 2006). Similarly, refuge, better feeding success, and/or habitat complexity were found to be potentially important for relative growth of hatchery-reared late juvenile Spotted Seatrout; Hendon and Rakocinski (2016) found that relative growth of hatchery-raised Spotted Seatrout was significantly greater in submerged aquatic vegetation and non-vegetated shoreline habitats as compared to open water habitats.

1.2.4.1 Age-Length

Available otolith-based annual age data (raw data) from both fisheries-dependent and fisheries-independent data sources in Virginia and North Carolina were fit with a von Bertalanffy age-length model. Data were subset for females (n=14,664) including unknown sex (n=708), males (n=9,014) including unknown sex (n=708), and sex-aggregated (24,386) including unknown sex (n=708). Length at age was modeled using the von Bertalanffy (1938) growth model as:

$$L_{i,j} = L_{\infty,j}\left(1 - \exp\left(-K_j\left(t_{i,j} - t_{0,j}\right)\right)\right)\exp\left(\varepsilon_{L,i,j}\right)$$

$$\varepsilon_{L,i,j} \sim N(0, \sigma^2_{L,j})$$

where j indexes the sex, L_i and t_i are the fork length (mm) and age (fractional age in years) of individual i, respectively, and the parameters to be estimated were the asymptotic length L_∞, the growth coefficient K, and the theoretical age at which a fish has a length of zero t_0. The length $L_{i,j}$ of individual fish sampled was assumed to follow a lognormal distribution.

A Bayesian hierarchical approach was used to estimate parameters with a hierarchical structure for priors on the growth parameters. Growth parameters $L_{\infty,j}$, K_j, and $t_{0,j}$ were assumed to vary by sex and the logarithm of sex-specific parameters were assumed to be multivariate normally distributed (*MVN*), and $t_{0,j}$ was assumed to follow a normal distribution controlled by sex-average parameters:

$$\begin{bmatrix} lnL_{\infty,j} \\ lnK_j \end{bmatrix} \sim MVN\left(\begin{bmatrix} ln\bar{L}_\infty \\ ln\bar{K} \end{bmatrix}, \Sigma\right),$$

$$t_{0,j} \sim N\left(\bar{t_0}, \sigma^2_{t_0}\right),$$

where $\bar{L}_\infty$, $\bar{K}$, and $\bar{t_0}$ are sex-average parameters with uniform distributions and the standard deviation σ_{t_0} was also assumed to be uniformly distributed. The variance-covariance matrix Σ was modeled with an inverse-Wishart distribution (Gelman and Hill 2007) as:

$$\Sigma = \begin{bmatrix} \sigma^2_{L\infty} & \varphi \\ \varphi & \sigma^2_K \end{bmatrix},$$

where σ_{L_∞} and σ_K are standard deviations of lnL_∞ and lnK across sexes and represent variability in growth between sexes; φ is the covariance of lnL_∞ and lnK across sexes. High negative correlation of L_∞ and K have previously been observed in the von Bertalanffy growth model (Kimura 2008; Midway et al. 2015); therefore, in order to improve model convergence, L_∞ and K parameters were modeled jointly with a negative correlation.

Posterior distributions were obtained using the Metropolis-Hasting algorithm using Markov Chain Monte Carlo simulation (Hilborn et al. 1994; Hoff 2009). Three concurrent chains were run with a total of 100,000 iterations for each chain. The first 70,000 iterations were discarded as burn-in and every 10th of the remaining samples from each chain were saved for analysis. The Just Another Gibbs Sampler software (JAGS; version 4.3.0; JAGS Community Team 2021) was used to run the Bayesian analysis.

Estimates of L_∞, K, and t_0 were within the range of estimates from previous studies (Table 1.1). Plots of the observed and predicted values from this study are shown in Figure 1.1.

1.2.4.2 Length-Weight

Parameters of the length-weight relationship were also estimated in this study. The relation of fork length in millimeters to weight in grams (raw data) was modeled for each sex separately based on data collected from both fisheries-dependent and fisheries-independent sources in Virginia and North Carolina. Data were subset as female (n=13,264), male (n=9,249), and sex-aggregated (n=50,612) for the weight-at-length modeling. Sex-aggregated data included unknown sex (n=28,099). Modeling was performed using non-linear least squares. Weight at length was modeled as:

$$W_i \sim a * L_i^{\,b}$$

where W_i and L_i are the weight (g) and length (mm) of individual i, respectively, and a and b are estimated parameters.

The estimated parameters from this and previous studies are presented in Table 1.2. Plots of the observed and predicted values from this study are shown in Figures 1.2–1.4.

1.2.5 Reproduction

The spawning season for Spotted Seatrout varies depending on location (Texas: Brown-Peterson et al. 1988; Mississippi: Brown-Peterson et al. 2001; Gulf of Mexico estuaries: Brown-Peterson et al. 2002; South Carolina: Roumillat and Brouwer 2004; Florida: Lowerre-Barbieri et al. 2009) and peaks around the full moon (Tucker and Faulkner 1987; McMichael and Peters 1989). Virginia Spotted Seatrout spawn from May through August with peaks in the gonadosomatic index in May and July (Brown 1981). The spawning season in North Carolina is from April to October with a peak in May through June (Burns 1996). The spawning period is generally within the first few hours after sunset (Luczkovich et al. 1999). During this time Spotted Seatrout have been found to acoustically signal spawning using drums, grunts, and staccatos (Montie et al. 2017). During the peak of the season, older Spotted Seatrout (>3 years old) spawn approximately every two days while younger Spotted Seatrout (ages 0 and 1) spawn approximately every four days (Roumillat and Brouwer 2004), though spawning frequency can vary by location and time of year (Brown-Peterson et al. 2001, 2002).

Spawning takes place on or near seagrass beds, sandy banks, natural sand, shell reefs, near the mouths of inlets, and off the beach (Daniel 1988; Brown-Peterson et al. 2002). There is evidence that Spotted Seatrout individuals exhibit strong intra-seasonal and inter-annual spawning site fidelity (Lowerre-Barbieri et al. 2013; Zarada et al. 2019). Estimates of fecundity for Spotted Seatrout range from 3 to 20 million ova per year depending on age, length, and water temperature (Murphy et al. 1999; Nieland et al. 2002; Roumillat and Brouwer 2004; Lowerre-Barbieri et al. 2009); however, fecundity estimates specific to North Carolina and Virginia are not available at this time.

Temperature and salinity have an influence on the reproductive output of female Spotted Seatrout. Temperature and salinity in spawning areas can vary, with temperature ranging from 15 to 31°C and salinity ranging from 18 to 35 ppt (Brown-Peterson et al. 1988; McMichael and Peters 1989; Walters 2005). When water temperatures exceed 30°C, the spawning season can be reduced (Jannke 1971); however, more recent work determined salinity was the most probable factor for differences in spawning season, spawning frequency, and batch fecundity between Gulf of Mexico (GOM) estuaries, particularly low salinity may shorten spawning seasons and decrease spawning frequency and batch fecundity (Brown-Peterson et al. 2002).

The previous North Carolina Division of Marine Fisheries (NCDMF) stock assessment of Spotted Seatrout (NCDMF 2015) applied maturity parameters derived from macroscopic analysis of reproductive tissues. Because this approach relies on visual examination, it is considered subjective and can lead to inaccurate estimates of maturation, which, in turn, can lead to biased estimates of both spawning stock biomass and associated reference points as well as distorting the stock-recruitment relationship (Murawski et al. 2001; Morgan 2008). The NCDMF conducted a maturity study using three different maturity staging methods (macroscopic, whole mount, and histological) to estimate the maturity ogive for Spotted Seatrout and other species in order to improve the accuracy of NCDMF management targets and assessments of fishery stock viability (NCDMF 2021). The histological method is considered more objective, accurate, and reliable of the three approaches (e.g., Vitale et al. 2006; Midway and Scharf 2012). Logistic regression was applied to the maturity samples from female Spotted Seatrout to estimate the length at 50% maturity (L_{50}) and slope. Based on the histological data, the value of L_{50} for females was estimated as 251 mm and the estimated slope was -0.192 (Figure 1.5).

1.2.6 Mortality

1.2.6.1 Natural Mortality

Natural mortality rates are highly variable and are influenced by multiple factors including severe temperatures during the winter months when cold stun events are known to occur and have been documented throughout their range (de Silva, unpublished data; Perret et al. 1980; Johnson and Seaman 1986). Water temperatures below 5°C should trigger concern (Anweiler et al. 2014; Ellis et al. 2017a) as kill events have been found to have population-level impacts (Ellis et al. 2017a, 2018). Spotted seatrout lose equilibrium at ≤ 4°C with no survival after prolonged exposure to 3°C (Ellis at al. 2017a).

Ellis et al. (2018) conducted the first comprehensive Spotted Seatrout conventional tag-return study in North Carolina waters with the objective of quantifying mortality and movement. Estimates of bimonthly natural mortality ranged from 0.062 to 2.5 and varied by season, while annual estimates of natural mortality ranged from 1.1 to 3.8. Ellis et al. (2018) found natural mortality was responsible for 49%–97% of total mortality based on bimonthly estimates and 81% to 92% of total mortality based on annual estimates. The importance of natural mortality compared to fishing mortality was further supported by an acoustic telemetry study. Natural mortality was generally highest during periods of cold temperatures when water temperatures were below 5°C. Estimates of *M* from Ellis et al. (2017b) and Ellis et al. (2018) were particularly high during the winters of 2009/2010 and 2010/2011, periods which coincided with reports of cold-stunned Spotted Seatrout following rapid decreases in temperature throughout the state.

The tag-return model described by Ellis et al. (2018) was adapted to fit to data obtained from two-independent tagging experiments to estimate seasonal natural mortality (Myers and Hoenig 1997; Bacheler et al. 2010). The model was implemented using R statistical software (R Core Team 2021) and JAGS (JAGS Community Team 2021) and fit to tag/recapture data from experiments performed by North Carolina State University (NCSU) during 2008 through 2012 and by the NCDMF during 2014 through 2021. A three-month season time step was used, meaning each year was separated into four seasons: a spring season from March 1st to May 31st, a summer season from June 1st to August 31st, an autumn season from September 1st to November 30th, and a winter season from December 1st to February 28th/29th. Although there was only interest in estimates through February 2020, tag release data from March 2020 to February 2021 were included in the model to lower uncertainty in the final time steps of interest (i.e., the model structure allows for data input from tag-return matrices with more tag-recovery periods than tag-release periods).

Seasonal estimates of median natural mortality (*M*) with 95% lower and upper credibility intervals were obtained for autumn 2008 through winter 2019 (Table 1.3; Figure 1.6). Estimates from winter 2012 to summer 2014 (i.e., the greyed-out time steps in Table 1.3) were disregarded because no tags were released during these time steps. Median estimated *M* ranged from 0.0015 in summer 2017 to 2.4 in autumn 2010 and peaks generally occurred during the winter season, especially during years of known cold stuns (model years 1995, 1999, 2000, 2002, 2004, 2009, 2010, 2013, 2014, 2017). The overall pattern of season *M* was generally similar to the results of Ellis et al. (2018) and aligned with the working groups expectations based on knowledge of cold stun years; however, estimates of *M* in some non-winter seasons were larger than expected (autumn 2010, spring 2012, spring 2017, autumn 2018, and spring 2019). The working group suspects two potential causes: (1) if tag returns occur at a lag, the model becomes less certain as to what season mortality should be assigned and (2) mortality events unrelated to cold stuns can occur from other environmental impacts (e.g., hurricanes and associated poor water quality; Paerl et al. 1998). In one specific instance, the high natural mortality estimate in autumn 2010 is most likely reflective of confirmed high natural mortality in winter 2010 due to a severe cold stun event in December 2010 (Ellis et al. 2018). This error occurred because a large number of tags were released in November 2010 (the autumn time step in this model is September to November) and subsequently were never recaptured. This led the model to conclude there was high mortality in autumn 2010 instead of winter 2010. Overall, credibility intervals were also wider than expected. Sources of uncertainty in the model estimates include multiple time steps in which very few tags were released and allowing the model to assume similar tag loss rates and reporting rates among commercial and recreational sectors between NCSU and the NCDMF data when they most likely differ.

1.2.6.2 Discard Mortality

Commercial

A study in North Carolina (Price and Gearhart 2002) and one in Florida (Murphy et al. 1995) have examined Spotted Seatrout discard mortality associated with commercial small mesh gill nets. Spotted seatrout total discard mortality (at-net plus delayed mortality) in gill nets as reported by Price and Gearhart (2002) were between 66% and 90% depending on mesh size (Table 1.4), whereas Murphy et al. (1995) saw average discard mortalities between 10% and 69% depending on temperature and soak time. In addition, Price and Gearhart (2002), Murphy et al. (1995), and additional NCDMF data from the NCDMF Fisheries-Independent Gill-Net Survey (Program 915; NCDMF 2012a) show that time of year may be a significant factor affecting discard mortality of Spotted Seatrout (Tables 1.5 and 1.6). Mortalities appear higher during spring/summer when water temperatures are warmer and dissolved oxygen levels are lower compared to the fall/winter months. Price and Gearhart (2002) also found differences in delayed mortality between high salinity sites and low salinity sites (Table 1.7).

For the current stock assessment, a commercial discard mortality rate of 30% was assumed because a majority of the Spotted Seatrout commercial effort and landings occur in the late fall and winter when water temperatures are cooler and dissolved oxygen may be higher.

Recreational

Recreational release mortality is likely a significant source of mortality on Spotted Seatrout in North Carolina since Type B2 releases (unobserved or reported live releases) have accounted for an increasing percentage of the overall catch in recent years (between 74 and 97% in the past ten years; National Marine Fisheries Service Fisheries Statistics Division, personal communication). Several hook-and-line release mortality studies have been conducted on Spotted Seatrout throughout the Atlantic and Gulf coasts where estimates of mortality ranged from 4.6% up to 56% (Duffy 1999; Duffy 2002; Gearhart 2002; Hegen et al. 1983; Matlock and Dailey 1981; Matlock et al. 1993; Murphy et al. 1995; Stunz and McKee 2006; Brown 2007; Table 1.8).

Two of the studies were conducted by NCDMF in North Carolina waters: Gearhart (2002) found a hooking mortality rate of 15%, whereas Brown (2007) arrived at a rate of 25%. It was noted that Brown (2007) was limited geographically to the Neuse River and most likely had an inflated release mortality rate due to low dissolved oxygen in the holding pens resulting in deaths not associated with hooking. In comparison, Gearhart (2002) covered a wider geographic range in North Carolina at river (low salinity) and Outer Banks (high salinity) sites from Pamlico, Core, and Roanoke sounds between June 2000 and August 2001. Gearhart (2002) suggested applying separate release mortality rates to fish caught in low versus high salinity areas instead of using the overall release mortality rate, which potentially may overestimate release mortality.

For the current stock assessment, separate rates were applied to fish caught in low versus high salinity areas based on Marine Recreational Information Program (MRIP) data from 1991 through 2019 (see section 2.1.3.5). The MRIP estimates could not be directly separated into regions based on salinity; therefore, raw intercept data from the MRIP survey were used to calculate a ratio of observed catch based on county of landing in low salinity areas (Pamlico, Craven, Hyde, Beaufort, and Currituck counties) versus high salinity areas (Dare, Carteret, Onslow, Pender, New Hanover, and Brunswick counties). The total catch was weighted by the unadjusted mortality rates for low (19.4%) and high (7.3%) salinity sites as reported by Gearhart (2002) and divided by the combined total catch to obtain an overall release mortality rate of 10%. This rate is consistent with the rates used in the previous two Spotted Seatrout stock assessments in North Carolina (Jenson 2009; NCDMF 2015) and Spotted Seatrout stock assessments from South Carolina (Zhao and Wenner 1995), Georgia (Zhao et al. 1997), Florida (Addis et al. 2018), Alabama (Bohaboy et al. 2018), and Louisiana (West et al. 2014).

1.2.7 Food & Feeding Habits

Spotted seatrout have ontogenetic changes in their diet (Holt and Holt 2000). Spotted seatrout less than 38 mm consume copepods as the primary prey. Fish between 38 and 140 mm consume mysids, amphipods, polychaetes, and shrimp. These juvenile Spotted Seatrout have considerable dietary overlap with juvenile Red Drum and tend to inhabit similar areas (Powers 2012; Holt and Holt 2000). Spotted seatrout larger than 140 mm become one of the top predators in estuaries where they feed on a variety of fishes and shrimp (Daniel 1988; McMichael and Peters 1989; Binion-Rock 2018; Binion-Rock et al. 2019).

1.3 Habitat

1.3.1 Overview

Spotted seatrout make use of a variety of habitats during their life history with variations in habitat preference due to location, season, and ontogenetic stage. Although primarily estuarine, Spotted Seatrout use habitats throughout estuaries and occasionally the coastal ocean. Spotted seatrout are found in most habitats identified by the North Carolina Coastal Habitat Protection Plan (CHPP) including water column, wetlands, submerged aquatic vegetation (SAV), soft bottom, and shell bottom (NCDEQ 2016). Protection of each habitat type is therefore critical to the sustainability of the Spotted Seatrout stock.

1.3.2 Spawning Habitat

Spotted seatrout spawning is generally limited to estuarine waters in the late summer and early fall. Peak spawning activity occurs at temperatures between 21 and 29°C and at salinities typically greater than 15 ppt (ASMFC 1984; Mercer 1984; Saucier and Baltz 1992, 1993; Holt and Holt 2003; Kupschus 2004; Stewart and Scharf 2008). Spawning sites have been noted to include tidal passes, channels, river mouths, and waters in the vicinity of inlets with depths of spawning locations ranging from 2 to 10 m (Saucier and Baltz 1992, 1993; Roumillat et al. 1997; Luczkovich et al. 1999; Stewart and Scharf 2008; Lowerre-Barbieri et al. 2009; Boucek et al 2017). Spotted seatrout have been observed to move in the late afternoon or evening to the high intensity spawning sites in an inlet and low-intensity spawning sites within the estuary with larger, older fish being more abundant at the inlet site than the nearby estuary sites (Lowerre-Barbieri et al. 2009; Ricci et al 2017; Zarada et al. 2019). A strong intra-seasonal site fidelity at resident spawning aggregation sites has also been observed in Spotted Seatrout (Lowerre-Barbieri et al. 2013). During the spawning season, studies have found that Spotted Seatrout use SAV habitat as much, if not more, than other spawning sites (Ricci et al 2017; Boucek et al. 2017). Spawning aggregations of Spotted Seatrout have also been found to occur over shell bottom habitats including over subtidal shell bottom (2–5 m) in the lower Neuse River.

In North Carolina, Spotted Seatrout in spawning condition have been collected coast wide (Hettler and Chester 1990; Burns 1996). Spawning Spotted Seatrout were detected using hydrophone and sonobuoy surveys on both the western side of Pamlico Sound including Rose Bay, Jones Bay, Fisherman's Bay, Bay River, and the eastern side of Pamlico Sound near Ocracoke and Hatteras inlets from May through September with peak activity in July (Luczkovich et al. 1999). When Spotted Seatrout aggregations co-occurred with aggregations of Weakfish at Ocracoke Inlet, the habitat was partitioned and each species occupied different depth ranges. Additional hydrophone surveys noted large spawning aggregations of Spotted Seatrout in the Neuse River generally associated with moderate salinities (12–20 ppt), temperatures between 27 and 29°C, saturated dissolved oxygen levels (> 5 mg l-1 O2), and water depths less than 5 m over mud and subtidal shell bottoms (Barrios et al. 2006). Spawning was also reported to occur over both mud and subtidal shell bottoms in these areas. Spawning in Middle Marsh, Back Sound, and Beaufort Inlet has also been confirmed by passive acoustic monitoring.

Eggs of Spotted Seatrout are positively buoyant at spawning salinities allowing for wind- and tidally-driven distribution throughout the estuary (Churchill et al. 1999; Holt and Holt 2003); however, sudden salinity reductions cause Spotted Seatrout eggs to sink, thus reducing dispersal and survival (Holt and Holt 2003). Larval Spotted Seatrout have been collected in surface and bottom waters of estuaries in North Carolina, Florida, and Texas (McMichael and Peters 1989; Hettler and Chester 1990; Holt and Holt 2000). In North Carolina, larval transport studies in the vicinity of Beaufort Inlet indicated that ocean and inlet spawned larvae are dependent on appropriate wind and tidal conditions to pass through inlets and be retained in the estuary (Churchill et al. 1999; Hare et al. 1999; Luettich et al. 1999). Although Spotted Seatrout spawning generally occurs within the confines of the estuary (ASMFC 1984; Mercer 1984; Saucier and Baltz 1992, 1993), spawning aggregations have been located near inlets in North Carolina (Ricci et al. 2017). Therefore, these physical processes appear to directly limit the retention and recruitment success of Spotted Seatrout to high salinity nursery areas (McMichaels and Peters 1989). Behaviors such as directional swimming and movement throughout the water column also provide mechanisms for estuarine dispersal and retention of larvae within the estuary (Rowe and Epifanio 1994; Churchill et al. 1999; Hare et al. 1999).

1.3.3 Nursery & Juvenile Habitat

Wetlands are particularly valuable as nurseries and foraging habitat for Spotted Seatrout (Graff and Middleton 2003). The combination of shallow water, thick vegetation, and high primary productivity provides juvenile and small fishes with appropriate physicochemical conditions for growth, refuge from predation, and abundant prey resources (Boesch and Turner 1984; Mitsch and Gosselink 1993; Beck et al. 2001). Juvenile Spotted Seatrout appear to use estuarine wetlands, particularly the marsh edge habitat of salt/brackish marshes, as nurseries (Tabb 1966; ASMFC 1984; Mercer 1984; Hettler 1989; Rakocinski et al. 1992; Baltz et al. 1993; Peterson and Turner 1994). In North Carolina, juvenile Spotted Seatrout have been found to be abundant in tidal marshes and marsh creeks in eastern and western Pamlico, Bogue, and Core sounds (Epperly 1984; Ross and Epperly 1985; Hettler 1989; Noble and Monroe 1991; Ballie et al. 2015). Additionally, juvenile Spotted Seatrout have been found using salt marsh habitats in the Cape Fear River, although in less abundance than more northern estuaries (Weinstein 1979).

McMichaels and Peters (1989) found that seagrass was the primary habitat for juvenile Spotted Seatrout. In North Carolina, SAV is used extensively by Spotted Seatrout as important nurseries and foraging grounds. Historical data collected by the NCDMF through otter trawl and seine surveys have indicated that juveniles are abundant in high salinity SAV in both Pamlico and Core sounds (Purvis 1976; Wolff 1976; NCDMF, unpublished data). Additionally, meta-analyses indicated that juvenile Spotted Seatrout abundances were found to be greater in SAV than soft bottom and oyster reef and were greater than or equivalent to abundances in wetland habitats (Minello 1999; Minello et al. 2003).

Soft bottom habitats, generally adjacent to wetlands, also function as nursery areas for juvenile Spotted Seatrout (Ross and Epperly 1985; Noble and Monroe 1991; Powers 2012). The benthic microalgae and deposited detrital material provide a rich food base for invertebrates, which are important forage for juvenile Spotted Seatrout (Peterson and Peterson 1979). The primary prey of juvenile Spotted Seatrout (<30 mm in length) consists mainly of benthic invertebrates, including copepods and mysid shrimps; they grow (>30 mm in length), the dominant prey shifts to penaeid and palaemonid shrimps, which remain important in the diet of adults (Peterson and Peterson 1979; Daniel 1988; McMichael and Peters 1989).

Shell bottom habitats have been shown to provide an important forage base of invertebrates and small finfish for juvenile and adult Spotted Seatrout (Coen et al. 1999; ASMFC 2007).

1.3.4 Adult Habitat

Adult Spotted Seatrout use the water column as a migratory corridor and to forage on pelagic fishes and penaeid shrimps with increased importance with increasing size (Lorio and Schafer 1966; ASMFC 1984; Mercer 1984; Daniel 1988; Binion-Rock 2018; Binion-Rock et al. 2019). Adult Spotted Seatrout exhibit a high degree of estuarine fidelity with most movements less than 50 km; however, movements of a few individuals in upwards of 500 km have been noted (Moffett 1961; Iverson and Tabb 1962; Tabb 1966; Overstreet 1983; Callihan 2011; Ellis 2014; O'Donnell et al. 2014).

The Atlantic States Marine Fisheries Commission (ASMFC) lists SAV as a Habitat Area of Particular Concern (HAPC) for Spotted Seatrout (ASMFC 1984). All life stages of Spotted Seatrout have been documented in mesohaline and polyhaline seagrass beds (Tabb 1966; ASMFC 1984; Mercer 1984; Thayer et al. 1984; McMichael and Peters 1989; Rooker et al. 1998). The preferred habitat for Spotted Seatrout is low-flow areas with abundant seagrass and adults have been more commonly associated with soft bottom and SAV than oyster reefs (Tabb 1958; Moulton et al. 2017). SAV provides a safe habitat corridor for Spotted Seatrout and habitat suitability models have indicated that Spotted Seatrout abundance is linearly related to percent seagrass cover until a plateau is reached at 60% coverage (Irlandi and Crawford 1997; Micheli and Peterson 1999; Kupschus 2003).

Spotted seatrout can use shallow flats as migratory refuges from larger predators, which cannot access shallow waters (Peterson and Peterson 1979). Spotted seatrout exhibit conspicuous diel shifts from seagrass to bare substrate and greater rates of movement at night (Moulton et al. 2017). In North Carolina, it has been suggested that a portion of the population moves offshore to deeper marine soft bottom areas and beaches in response to falling temperatures in late autumn (ASMFC 1984; Mercer 1984).

Lenihan et al. (2001) found that adult Spotted Seatrout fed primarily on reef-associated fishes, such as Atlantic Croaker and Silver Perch (*Bairdiella chrysoura*) while inhabiting subtidal oyster reefs in North Carolina. Peterson et al. (2003) found that Spotted Seatrout were documented to use oyster reef habitats as adults; however, data were inconclusive on whether Spotted Seatrout populations were enhanced by the presence of oyster reefs.

1.3.5 Habitat Issues & Concerns

Human activities that alter the preferred environmental conditions of Spotted Seatrout, as well as introductions of excessive nutrients, toxins, and sediment loads can severely impact the habitat value for Spotted Seatrout, especially SAV (NCDEQ 2016; Lefcheck et al. 2018). Excessive nutrient loading in the environment can lead to nuisance algal blooms, increased biological oxygen demand, hypoxia or anoxia, fish kills, and eventually, loss of biodiversity (Paerl 2002, 2018). Much of the nutrient enrichment in North Carolina's estuaries is caused by cultural eutrophication, or the rapid accumulation of nutrients and sediments caused by human land and water use activities (NCDWQ 2000a). Wetland loss and decreasing vegetative buffers can hasten these impacts to the surrounding water (NCDWQ 2000b). The effect of anthropogenic threats on SAV, wetlands, shell bottom, soft bottom, and water quality are summarized in the North Carolina Coastal Habitat Protection Plan (NCDEQ 2016).

Increased loss of wetlands and hydrological modifications due to climate change may cause degraded water quality, fish kills from hypoxia, salinity regime changes, and shoreline erosion resulting in increased sediment and nutrient loading (Meeder and Meeder 1989; Paerl et al. 2001; Mallin et al. 2002; Paerl 2018; Mallin et al. 2019) and higher costs for storm repair (Costanza et al. 2008). Declines in SAV, globally and in North Carolina, due to increased coastal development and decreased water quality, are also altering these ecosystems and their community structure.

Tabb et al. (1962) reported that excessively turbid waters in Everglades National Park following Hurricane Donna resulted in mass mortalities of Spotted Seatrout when their gill chambers became packed with suspended sediments. In 1999, the Pamlico Sound was reported to have salinities reduced by three-fourths, vertical stratification of the water column, bottom water hypoxia, increased algal biomass, displacement of marine organisms, and an increase in the presence of fish disease following hurricanes Dennis, Floyd, and Irene (Paerl et al. 2001). Similar events were observed after hurricanes Matthew (2016) and Florence (2018; Osburn et al. 2019); however, there is no conclusive evidence that hurricanes have a measurable impact on the Spotted Seatrout population in North Carolina (Burgess et al. 2007).

Some simplistic climate change scenario models of Florida Bay have shown that increasing water temperatures may improve habitat suitability for Spotted Seatrout; however, under the same climate change scenarios their prey species show significant decreases which could result in a prey-limited population (Kearney et al. 2015). It has been predicted that hundreds of finfish and invertebrate species will be forced to move northward due to increasing temperatures caused by climate change (Morley et al. 2018).

Generally, Spotted Seatrout overwinter in estuaries, only moving to deeper channels or to nearshore ocean habitats in response to water temperatures below 10°C (Tabb 1966; ASMFC 1984); however, extreme cold waves accompanied by strong winds mix and chill the water column, causing sudden drops in water temperature. The abrupt temperature declines numb Spotted Seatrout and can result in mass mortality. Many estuarine temperature refuges, such as deep holes and channels, are often far from inlets and become death traps as Spotted Seatrout are cold stunned before they can escape (Tabb 1966; Ellis et al. 2017a; McGrath and Hilton 2017). This suggests that the severity and duration of cold weather events can have profound effects on the Spotted Seatrout population in North Carolina's estuaries (Ellis et al. 2017b).

1.4 Description of Fisheries

1.4.1 Commercial Fishery

Virginia

Predominant gears in Virginia's commercial Spotted Seatrout fishery since 1994 have been haul seines (~67%) and gill nets (23.7%). A small amount is also harvested using hook and line and pound net. During more recent years, the commercial haul seine fishery has been targeting Spotted Seatrout during the months of September and October. Virginia currently has between eight and ten haul seine fishermen who target Spotted Seatrout during these months. Gill-net fishermen also target sotted seatrout during this time period. The 2021/2022 commercial season is the first season under the new incidental catch provision and preliminary results show that most incidental catch was harvested by gill nets.

North Carolina

Spotted seatrout have been commercially harvested in North Carolina using a variety of gears, but four gear types are most common: estuarine gill net, long haul seine, beach seine, and ocean gill net. Estuarine gill nets are the predominant gear. Historically, long haul seines (swipe nets) used in estuarine waters were the dominant gear, but effort and landings by this gear have diminished in recent years.

Monthly landings of Spotted Seatrout by estuarine anchored gill nets occur year round but mostly occur during the late fall and winter (October–February) with slight increases in the spring (April–May).

There has been a shift from anchored gill nets to actively fished runaround and strike netting techniques that may have been prompted by expanded fishery rules requiring gill-net attendance for small mesh (<5 inches stretch mesh) beginning in 1998. The importance of runaround gill nets (inclusive of strike netting) in North Carolina has steadily increased since 1972 and a continued surge in the mid-1990s may have been caused by the 1995 gill-net closure in Florida state waters (NCDMF 2006) as some Florida commercial fishermen moved their operations to North Carolina. More jet drive boats, spotting towers, night fishing, and runaround gillnetting were reported by the mid-1990s.

Monthly landings of Spotted Seatrout by estuarine runaround gill nets are highest in November and December. A large spike in the number of positive trips occurs during October without a corresponding spike in catch. This could be indicative of Spotted Seatrout bycatch in other fisheries that are active during October such as the striped mullet (*Mugil cephalus*) fishery.

The long haul season starts in the spring and continues through the fall. The majority of trips occur in July; however, the best catches occur in November and December.

The small mesh beach seine fishery operates predominantly during the spring (April–May) and fall (September–October). Beach seine landings of Spotted Seatrout typically occur during the spring (April–May) and fall (October–November) months. If conditions are favorable, fishermen along the northern Outer Banks particularly target Spotted Seatrout during the full moon in May.

Landings of Spotted Seatrout by ocean set gill nets are most active from October through February, but good catches occur in April and May.

1.4.2 Recreational Fishery

Spotted seatrout are taken by a variety of methods throughout the coastal zone. Depending on the time of year, anglers fish for Spotted Seatrout from the surf, inlets, piers and jetties, bays and rivers, and inland creeks. The fall season produces the largest portion of the catch and offers the most widespread fishing opportunities. Anglers catch Spotted Seatrout using an array of artificial and natural baits. Preferred artificial baits include soft and hard bodied lures of various colors and shapes fished on the bottom, mid-water, and top water. Bottom fishing using natural baits (including peeler/soft crabs, live shrimp, and various finfish) is also a popular and productive method of fishing for Spotted Seatrout.

Spotted seatrout are often selective feeders requiring anglers to use a variety of baits (natural and artificial) and different fishing techniques. While baits and fishing techniques are constantly evolving, the past twenty years have seen significant changes and improvements in artificial baits and other tackle available to anglers that target and catch Spotted Seatrout. There is anecdotal evidence that these improvements have had a positive impact on catch rate and overall fishing success. In the early 2000s, manufacturers introduced scented soft-bodied artificial baits that have become very popular and lead to increased success of anglers targeting Spotted Seatrout. Hard-bodied artificial baits have also undergone design and color pattern changes increasing their effectiveness. Many anglers also attest to better catch rates due to the widespread use of braided fishing lines. Braided lines along with new graphite rod building technology provide increased sensitivity improving strike detections resulting in more fish caught.

In addition to hook-and-line catches, some Spotted Seatrout are taken by gig and recreational commercial gear (gill nets) in North Carolina where permitted (ASMFC 1984; Watterson 2003). In Virginia, gigging is generally impractical, and regulations prohibit recreational use of commercial gear (gill nets) for species that have a commercial quota (including Spotted Seatrout).

1.5 Fisheries Management

1.5.1 Management Authority

The NCDMF is responsible for the management of estuarine and marine resources occurring in all state coastal fishing waters extending to three miles offshore. The Virginia Marine Resources Commission (VMRC) is responsible for tidal waters of Virginia and the ocean waters extending to three miles offshore.

Spotted seatrout have been managed along the Atlantic Coast through an Interjurisdictional Fishery Management Plan (FMP) developed by the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC Spotted Seatrout FMP was initially approved in 1984 (ASMFC 1984) and has been reviewed annually since 2001. Amendment 1, approved by the ASMFC Policy Board in November 1990, developed a list of goals for coast-wide management but allowed each state that had an interest in the Spotted Seatrout fishery (Florida through Maryland) to manage their stocks independently (ASMFC 1990). The adoption of the Omnibus Amendment 2 (ASMFC 2011) to the Interstate Fishery Management Plan for Spotted Seatrout requires states to comply with Atlantic Coastal Fisheries Cooperative Management Act (1993) and the ASMFC Interstate Fishery Management Program Charter. North Carolina and Virginia are currently in compliance with the minimum size limit for both recreational and commercial sectors and have adopted the recommended 20% spawning potential ratio (SPR) threshold.

1.5.2 Management Unit Definition

The management unit includes Spotted Seatrout and its fisheries in all of Virginia and North Carolina's fishing waters.

1.5.3 Regulatory History

Virginia

Effective July 1, 1992, the VMRC established a 14-inch TL minimum size limit for both the commercial and recreational fisheries, as well as a ten-fish possession limit for the recreational fishery and commercial hook-and-line fishery. In 1995, at a Virginia Finfish Advisory Committee (FMAC) meeting, recreational anglers asked for the commercial fishery of Spotted Seatrout to be regulated by a quota since recreational anglers were held to a ten-fish possession limit. FMAC and staff agreed to a commercial quota of 51,104 pounds. This quota was established using the average landings of Spotted Seatrout from 1993 and 1994 plus 25%. The quota has remained at this level since August 1, 1995, after the VMRC held a public hearing in July 1995 and it was approved and put into regulation. The season runs from September 1 through August 31 of the following year. Effective April 1, 2011, the VMRC lowered the commercial hook-and-line and the recreational possession limit to five fish from December 1 through March 31 and only allowed one fish 24 inches or greater. Effective April 1, 2014, the VMRC established a five fish commercial hook-and-line and recreational possession limit and allowed only one fish 24 inches TL or greater as a year-round regulation. Also, effective April 1, 2014, an 80% trigger was also added to regulation. Once this trigger was hit, then the fishery would move into a bycatch fishery of 100 pounds per vessel (with an equal amount of other species on board) until the quota was landed. Due to directed harvest using large haul seines during the beginning of the season, the 80% trigger has been met by mid-October most years, causing the fishery to switch over to the 100 pounds per vessel per day regulations early in the season. Additionally, language was added to regulation in 2014 to require mandatory buyer reporting from August 1 through November 30 of each year. Effective September 1, 2018, the VMRC established an exemption in the Spotted Seatrout minimum size limit for pound net or haul seine fishermen where the catch of Spotted Seatrout may consist of up to 5.0%, by weight, of Spotted Seatrout less than 14 inches TL.

Because the fishery was getting shut down so quickly after it was opened, harvesters asked staff to consider changes to the regulation in 2021 to cut down on dead discards in the gill-net fishery. Without scientific stock evidence, staff was hesitant to change the overall commercial quota but did change regulation to remove the trigger and bycatch provision and institute an incidental catch provision.

North Carolina

The size limit rule (15A NCAC 03M .0504) for Spotted Seatrout in North Carolina became effective September 1989 (12 inches TL). The first harvest restriction (ten fish recreational bag limit or taken by hook and line) was established through proclamation authority of hook-and-line regulated species (1994). This was put into rule in 1997 by amending 15A NCAC 03M .0504. The rules remained the same until 2009 when the size limit was increased by proclamation (14 inches TL). Rules for Spotted Seatrout management from 1991 to 2009 were that:

(a) it is unlawful to possess Spotted Seatrout less than 12 inches total length.

(b) it is unlawful to possess more than ten Spotted Seatrout per person per day taken by hook and line or for recreational purposes. In 2010, the daily bag limit was reduced to six fish and of those six fish, only two could be greater than 24 inches TL. In 2011, the bag limit was reduced to four fish with a 14-inch TL size limit for recreational fishermen and commercial fishermen using hook and line gear.

The trout rule was repealed in 2012, and Spotted Seatrout was managed under the proclamation authority granted in 15A NCAC 03M. 0512 (Compliance with Fishery Management Plans) until 2017 when the NCDMF re-established the Spotted Seatrout rule 15A NCAC 03M. 0522 due to ASMFC considering retiring the Interstate Spotted Seatrout FMP.

1.5.4 Current Regulations

Virginia

The current regulations in Virginia are a 14-inch TL minimum size limit and five fish commercial hook-and-line and recreational possession limit and allows only one fish 24 inches TL or greater. In addition, the catch of Spotted Seatrout by pound net or haul seine may consist of up to 5.0%, by weight, of Spotted Seatrout less than 14 inches TL. A commercial landings quota of 51,104 pounds is set for each 12-month period of September 1 through August 31 of the following year. As of 2021, when the fishery is predicted to hit 100% of the quota (51,104 pounds) staff will announce a switch over to an incidental catch fishery. When the commission announces that the directed commercial landings quota has been reached, it shall be unlawful for any commercial fisherman to take, harvest, land, or possess more than the daily incidental catch limit for the remainder of the fishing year. The daily incidental catch limit shall be 50 pounds of Spotted Seatrout per licensee aboard the vessel, not to exceed 100 pounds per vessel. In addition, seafood buyers are now required to report daily Spotted Seatrout purchases from August 1 through November 30 until the directed commercial landings quota has been reached.

North Carolina

The NCDMF currently allows the recreational harvest of Spotted Seatrout seven days per week with a minimum size limit of 14-inches TL and a daily bag limit of four fish. Since 2011, the commercial harvest is limited to a daily limit of 75 fish and a minimum size limit of 14-inches TL except for when using hook and line gear. When using hook and line gear, the commercial harvest limit is four fish per day. It is unlawful for a commercial fishing operation to possess or sell Spotted Seatrout for commercial purposes taken from Joint Fishing Waters of the state from midnight on Friday to midnight on Sunday each week; the Albemarle and Currituck sounds are exempt from this weekend closure. In the event of a cold stun, the NCDMF has the authority to close the fishery until the following spawning period. The Spotted Seatrout fishery has been closed three times due to cold stun events. It was closed from January 14 through June 15, 2011, from February 5 through June 14, 2014, and from January 5 through June 14, 2018.

1.6 Assessment History

1.6.1 Review of Previous Methods & Results

The 2015 NCDMF Spotted Seatrout assessment applied a forward-projecting length-based, age-structured model (Stock Synthesis text version 3.24f) and data collected from 1991 through 2012, including tag-recapture data (NCDMF 2015). A two-sex model that accounted for sex specific differences in mortality and growth was assumed. The results of that assessment suggested an expansion of the age structure but also predicted an abrupt decline in estimated recruitment after 2010. Estimates of spawning stock biomass also showed a decline in the final years of the time series. Based on the results of that assessment, the stock was not overfished and overfishing was not occurring in 2015.

1.6.2 Progress on Research Recommendations

Research recommendations put forward in the 2015 NCDMF stock assessment of Spotted Seatrout (NCDMF 2015) are listed below and progress, if any, is discussed.

High

- Histological maturity; fecundity evaluation/batch fecundity

  The NCDMF completed an analysis of histological maturity for Spotted Seatrout in North Carolina (NCDMF 2021). To date, there has been no research into fecundity evaluation or batch fecundity in North Carolina or Virginia.

- Validate juvenile abundance survey; improve juvenile abundance survey through expansion and addition of random stations (or replace fixed design with random or random stratified)

  A Coastal Recreational Fishing License (CRFL) project is currently in progress that is quantitatively analyzing the Estuarine Trawl Survey (Program 120) to identify redundancies, highlight underrepresented habitats, and suggest feasible modifications to their use in identifying fish nursery habitat. Another CRFL project in progress has similar objectives including evaluation of the performance of the current Program 120 survey design in terms of its accuracy, precision, and ability to capture annual variability of juvenile abundance for producing annual recruitment indices and to determine if Program 120 could be optimized using alternative sampling schemes that are more cost-effective and robust to environmental changes.

- Continue and expand tagging studies for estimating natural and fishing mortality, understanding stock structure, and examining migration (e.g., ocean vs. creeks)

  The NCDMF Multispecies Tagging Program (Program 366) is an ongoing tagging program that was started in 2014. Over 9,000 Spotted Seatrout have been tagged between October 2014 and February 2020 throughout coastal North Carolina. Fishing and natural mortality were estimated for a five-year CRFL completion report (Loeffler et al. 2019) and the current stock assessment.

- Collect data to characterize the length distribution of recreational releases

  During August of 2021, NCDMF implemented a new citizen science initiative called “Catch U Later” to collect recreational fisheries-dependent discard data. “Catch U later” is a smartphone and tablet application that allows recreational anglers to report trip and biological data (length frequencies) for flounder species. To date, over 350 flounder records have been submitted. During 2022, “Catch U Later” will be expanded to include additional species including Kingfish, Red Drum, Weakfish, and Spotted Seatrout.

- Conduct further studies to identify appropriate unit stock

  Ellis et al. (2019) conducted a genetic analysis of Spotted Seatrout from Virginia to Florida and identified two separate stocks—one from Virginia to Bogue Sound, North Carolina and a second from the Cape Fear River and southward to Florida. The New River was identified as a mixing area between these two stocks.

- Develop a custom model that allows for incorporation of variable natural mortality rates

  A customized, seasonal, size-structured model was developed in the current assessment. In this model, nonstationary natural mortality and growth were assumed to incorporate the inter-annual variability in natural mortality rates and growth.

- Develop a fishery-independent survey for Virginia waters

  No progress to date.

Medium

- Initiate surveys that assess Spotted Seatrout winter and spawning habitats

  Ellis (2014) and the NCDMF Multispecies Tagging Program (Program 366) both have information on conventionally tagged Spotted Seatrout recaptured from November through March, which would provide information on overwintering areas; however, an analysis has not yet been completed. Ellis et al. (2017b) used telemetry tags to track fish during three consecutive winters while overwintering in North Carolina estuaries.

- Compare maturity ogives between North Carolina and Virginia

  No progress to date.

- Improve discard estimates

  No progress to date.

- Conduct further studies to estimate discard mortality by gear and sector

  No progress to date.

- Investigate relationship between environmental variables and adult and juvenile mortality

  Ellis et al. (2017a) investigated how low temperature and variable salinity impact mortality of adult Spotted Seatrout. Laboratory experiments in this study suggest the temperatures in which Spotted Seatrout become stunned, or experience a complete loss of equilibrium, range from 2 to 4°C; however, Spotted Seatrout begin showing signs of stress at temperatures as low as 7°C. An adult Spotted Seatrout's critical thermal minimum, or the lowest temperature Spotted Seatrout can be exposed to for a short time and still survive, was found to be approximately between 2–3°C. When adult Spotted Seatrout were acclimated and exposed to low water temperatures for an extended period of time, a water temperature of 3°C was found to be 100% lethal to Spotted Seatrout after less than two days. At 5°C, a total of 93% of Spotted Seatrout were still alive after five days, but only 15% survived after ten days. There was high, but not complete, survival (83%) after ten days at 7°C. Ellis et al. (2017a) also observed that Spotted Seatrout subjected to rapid temperature declines in higher salinity were able to withstand lower temperatures before becoming completely stunned compared to fish in lower salinity; the critical thermal minimum was lower by about 1°C in high salinity. In addition, under long term exposure to 7°C water temperatures, several Spotted Seatrout mortalities were observed in lower salinity compared to no mortalities in high salinity at 7°C. Neither effect was statistically significant though, so further research is needed to determine if salinity does influence Spotted Seatrout survival of cold stuns.

- Selectivity of program 915 indices—gear/availability

  In progress. Details not yet available.

Low

- Collect more age and sex samples from the recreational fishery

  The NCDMF Carcass Collection Program, in which fishermen can donate their carcasses to freezers located in select locations throughout coastal North Carolina, has allowed us to collect more age and sex samples from the recreational fishery; however, more age and sex samples from this sector are still needed.

- Evaluate influences of salinity on release mortality

  Gearhart (2002) found differences in delayed mortality in hooking mortality study between high salinity sites and low salinity sites. Price and Gearhart (2002) also found differences in delayed mortality for gill-net caught fish between high salinity and low salinity sites.

- Conduct marginal increment analysis

  No progress to date.

- Conduct an age validation study

  No progress to date.

2 DATA

Note that all data were summarized by fishing year (March to February) to correspond with the life history of the species (a March 1 birth date was assumed). Data were summarized for fishing years 1991 (March 1991) to 2019 (February 2020), where available, to coincide with the time series used in the stock assessment model.

2.1 Fisheries-Dependent

2.1.1 Commercial Landings

2.1.1.1 Survey Design and Methods

<u>Virginia</u>

The VMRC's commercial fisheries records include information on both commercial harvest (fish caught and kept from an area) and landings (fish offloaded at a dock) in Virginia. Records of fish harvested from federal waters and landed in Virginia have been provided by the NMFS and its predecessors since 1929 (NMFS, pers. comm.). The VMRC began collecting voluntary reports of commercial landings from seafood buyers in 1973. A mandatory harvester reporting system was initiated in 1993 and collects trip-level data on harvest and landings within Virginia waters. Data collected from the mandatory reporting program are considered reliable starting in 1994, the year after the pilot year of program. The Potomac River Fisheries Commission has provided information on fish caught in their jurisdiction and landed in Virginia since 1973.

North Carolina

Prior to 1978, North Carolina's commercial landings data were collected by the National Marine Fisheries Service (NMFS). In 1978, the NCDMF entered into a cooperative program with the NMFS to maintain and expand the monthly surveys of North Carolina's major commercial seafood dealers. Beginning in 1994, the NCDMF instituted a mandatory trip-ticket system to track commercial landings.

On January 1, 1994, the NCDMF initiated a Trip Ticket Program (TTP) to obtain more complete and accurate trip-level commercial landings statistics (Lupton and Phalen 1996). Trip ticket forms are used by state-licensed fish dealers to document all transfers of fish sold from coastal waters from the fishermen to the dealer. The data reported on these forms include transaction date, area fished, gear used, and landed species as well as fishermen and dealer information.

The majority of trips reported to the NCDMF TTP only record one gear per trip; however, as many as three gears can be reported on a trip ticket and are entered by the program's data clerks in no particular order. When multiple gears are listed on a trip ticket, the first gear may not be the gear used to catch a specific species if multiple species were listed on the same ticket but caught with different gears. In 2004, electronic reporting of trip tickets became available to commercial dealers and made it possible to associate a specific gear for each species reported. This increased the accuracy of reporting by documenting the correct relationship between gear and species.

2.1.1.2 Sampling Intensity

Virginia

All registered licensees are required to report daily harvest from Virginia tidal and federal waters to the VMRC on a monthly basis.

North Carolina

North Carolina dealers are required to record each transaction with a fisherman and report trip-level data to the NCDMF on a monthly basis.

2.1.1.3 Biological Sampling

Virginia

Field sampling at fish processing houses or dealers involves multi-stage random sampling. Targets are set based on mandatory reporting of harvest data by harvesters from the previous years. A three-year moving average of landings by gear and by month (or other temporal segment) provides a preliminary goal for the amount of length and weight samples to be collected. Real time landings are used to adjust the preliminary targets. Targets for ageing samples (see below for criteria) are tracked and collection updates are done weekly. Sampling data are recorded on electronic measuring boards. Weights of individual fish are recorded on electronic scales and downloaded directly to the electronic boards. A fish identification number unique to each specimen is created as well as a batch number for a subsample from a specific trip.

Subsamples of a catch or batch are processed for sex information (gender and gonadal maturity or spawning condition index). Such subsamples are indexed by visual inspection (macroscopic) of the gonads. Females are indexed as gonadal stage I–V and males I–IV, with stage I representing an immature or resting stage of gonadal development and stages IV (males) and V (females) representing spent fish. Fish that cannot be accurately categorized in terms of spawning condition are not assigned a gonadal maturity stage.

Ancillary data for fish sampled at dealers are collected and include date harvested, harvest area, gear type used, and total catch (recorded if only a subsample was measured). This information would allow for expansion of the sample size to the total harvest reported for a species. Estimates of effort are not typically recorded by this program but can be extrapolated from mandatory harvest reports sent to the VMRC on a monthly basis by harvesters, sometime after a sampling event.

The numbers of Spotted Seatrout lengths sampled from commercial landings by the VMRC are summarized in Table 2.1.

North Carolina

Commercial length-frequency data were obtained by the NCDMF commercial fisheries-dependent sampling program. Spotted seatrout lengths are collected at local fish houses by gear, market grade, and area fished. Random samples of culled catches are taken to ensure adequate coverage of all species in the catches. Length frequencies obtained from a sample were expanded to the total catch using the total weights from the trip ticket. All expanded catches were then combined to describe a given commercial gear for a specified time period.

In cases where the weight of particular species' market grades was included on the trip ticket but were not sampled, an estimate of the number of fish landed for the grade was made by using the mean weight per individual from samples of that species and grade from the same year. Species numerical abundance was calculated by determining the number of individuals/market grade and then summing all the market grades for each species. Catches were analyzed by gear type (i.e., gill nets, seines, and other), month, year, and season (i.e., March–November and December–February).

The numbers of Spotted Seatrout lengths sampled from commercial landings by the NCDMF are summarized in Table 2.2.

2.1.1.4 Potential Biases & Uncertainty

Because trip tickets are only submitted when fish are transferred from fishermen to dealers, records of unsuccessful fishing trips are not available for both the VMRC and the NCDMF. As such, there is no direct information regarding trips where a species was targeted but not caught. Information on these unsuccessful trips is necessary for calculating a reliable index of relative abundance for use in stock assessments.

Another potential bias for NCDMF data relates to the reporting of multiple gears on a single trip ticket. It is not always possible to identify the gear used to catch a particular species on a trip ticket that lists multiple gears and species.

2.1.1.5 Development of Estimates

Annual commercial landings statistics were calculated by year and season (season 1: March 1–November 30, season 2: December 1–February 28/29) for both states combined and separately by state.

Length data were summarized in 40-mm length bins by year and season. Length data were pooled over states and summarized for the commercial fisheries.

2.1.1.6 Estimates of Commercial Landings Statistics

Between 1991 and 2019, total commercial landings for Virginia and North Carolina combined have ranged from 24 to 245.1 mt in season 1 and ranged from 11 to 145.1 mt in season 2 (Table 2.3; Figure 2.1). Annually (March through February), total commercial landings for both states combined have ranged from 38 to 335 mt. Commercial landings of Spotted Seatrout have been consistently higher for season 1 than season 2.

Commercial length-frequency data are summarized in Figures 2.2 and 2.3.

2.1.2 Commercial Discards

2.1.2.1 Survey Design and Methods

The Sea Turtle Bycatch Monitoring Program (Program 466) was designed to monitor bycatch in the North Carolina estuarine gill-net fishery, providing onboard observations to characterize effort, catch, and finfish bycatch by area and season. Additionally, this program monitors fisheries for protected species interactions. The onboard observer program requires the observer to ride onboard the commercial fishermen's vessel and record detailed gill-net catch and discard information for all species encountered. Observers contact licensed commercial gill-net fishermen throughout the state in order to coordinate observed fishing trips.

2.1.2.2 Sampling Intensity

Trips are observed per management unit based on the average number of trips per month and management unit reported to the trip ticket program for the previous five-year period. Per the sea turtle incidental take permit (ITP; NMFS 2013, 2014), the division is required to observe a minimum of 7% (goal of 10%) of anchored large mesh gill-net trips and a minimum of 1% (goal of 2%) of anchored small mesh gill-net trips by management unit by season. The mesh size categories in the sea turtle ITP (large mesh >= 4-inch inside stretched mesh (ISM), small mesh <= 4-inch ISM) are different than the categories in the trip ticket program (large mesh >= 5-inch ISM, small mesh <= 5-inch ISM).

2.1.2.3 Biological Sampling

Data collected from each species include length, weight, and fate (landed, live discard, dead discard).

2.1.2.4 Potential Biases & Uncertainty

Program 466 began sampling statewide in May 2010. To provide optimal coverage throughout the state, management units were created to maintain proper coverage of the fisheries. Management units were delineated on the basis of four primary factors: similarity of fisheries and management; extent of known protected species interactions in commercial gill net fisheries; unit size; and the ability of the NCDMF to monitor fishing effort. Total effort for each management unit can vary annually based on fishery closures due to protected species interactions or other regulatory actions. Therefore, the number of trips and effort sampled each year by management unit varies both spatially and temporally.

Program 466 data do not span the entire time series for the assessment (no data are available for 1991–2000 and spatially limited data are available 2000–2003). Since 2004, observed trips were sparse for some seasons and management areas for several years despite widespread fishing effort. However, observations were likely adequate to determine whether discards in this fishery were a significant source of removals from the population. Observer data have been collected throughout the Pamlico Sound since 2000 and outside the Pamlico Sound since 2004. Data from 2000 to 2003 were not included due to spatial limitations.

Lastly, observed trips ideally would be random across fishery participants within each sampling stratum; however, participants avoid and occasionally refuse to take an observer. Although anecdotally small, the number of participants who are not observed has not been quantified.

2.1.2.5 Development of Estimates

A generalized linear model (GLM) framework was used to predict Spotted Seatrout discards in North Carolina's estuarine gill-net fishery based on data collected during 2004 through 2019. Only those variables available in all data sources were considered as potential covariates in the model. Available variables were fishing year, season, mesh category (large: ≥5 inches and small: <5 inches), and management unit, all of which were treated as categorical variables in the model. Effort was measured as soak time (days) multiplied by net length (yards). Live and dead discards were modeled separately.

All available covariates were included in the initial model and assessed for significance using the appropriate statistical test. Non-significant covariates were removed using backwards selection to find the best-fitting predictive model. The offset term was included in the model to account for differences in fishing effort among observations (Crawley 2007; Zuur et al. 2009, 2012). Using effort as an offset term in the model assumes the number of Spotted Seatrout discards is proportional to fishing effort (A. Zuur, Highland Statistics Ltd., personal communication).

The best-fitting model for live discards and for dead discards was applied to available effort data from the NCTTP to estimate the total number of live discards and dead discards for the estuarine gill-net fishery. A discard mortality rate of 60% (see section 1.2.6) was applied to the estimates of live discards to estimate those live discards that were not expected to survive. This number was added to the number of dead discards to estimate the total number of dead discards.

Length data were summarized by 2-cm length bins and year.

2.1.2.6 Estimates of Commercial Discard Statistics

The best-fitting GLM for the commercial gill-net live discards assumed a zero-inflated Poisson distribution (dispersion=3.1). The significant covariates for the count part of the model were year mesh and area while the significant covariates for the binomial part of the model were mesh and area. The best-fitting GLM for the dead discards assumed a zero-inflated Poisson distribution (dispersion = 1.4). The significant covariates for the count part of the model were year, season, and area while the significant covariates for the binomial part of the model were season, mesh, and area.

Estimates of dead commercial discards for North Carolina were variable for the gill-net estuarine fishery during 2004 through 2019 (Figure 2.4). Estimates were minimal compared to the magnitude of all fisheries overall. Though estimates of discards from Virginia were not available, they were assumed minimal as well.

Annual length-frequency distributions of commercial gill-net estuarine fishery discards are shown in Figures 2.5.

2.1.3 Recreational Fishery Monitoring

2.1.3.1 Survey Design and Methods

The Marine Recreational Information Program (MRIP) is designed to provide annual and bi-monthly estimates of marine recreational fisheries catch and effort data. Information on commercial fisheries has long been collected by the NMFS; however, data on marine recreational fisheries were not collected in a systematic manner by the NMFS until implementation of the Marine Recreational Fishery Statistics Survey (MRFSS) in 1979. The purpose of the MRFSS was to provide regional estimates of effort and catch from the recreational sector. Importantly, the National Research Council (NRC) identified under-coverage, inefficiency, and bias issues within the MRFSS survey and estimation methodologies (NRC 2006). These deficiencies spurred the development of the MRIP as an alternative data collection program to the MRFSS. The MRIP is a national program that uses several component surveys to obtain timely and accurate estimates of marine recreational fisheries catch and effort and provide reliable data to support stock assessment and fisheries management decisions. The program is reviewed periodically and undergoes modifications as needed to address changing management needs. A detailed overview of the program can be found online at https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

The MRIP uses three complementary surveys: (1) the Fishing Effort Survey (FES), a mail survey of households to obtain trip information from private boat and shore-based anglers; (2) the For-Hire Telephone Effort Survey (FHTES) to obtain trip information from charter boat operators; and (3) the Access Point Angler Intercept Survey (APAIS), a survey of anglers at fishing access sites to obtain catch rates and species composition from all modes of fishing. The data from these surveys are combined to provide estimates of the total number of fish caught, released, and harvested; the weight of the harvest; the total number of trips; and the number of people participating in marine recreational fishing. In 2005, the MRIP began at-sea sampling of headboat (party boat) fishing trips.

The APAIS component was improved in 2013 to sample throughout the day (24-hour coverage) and remove any potential bias by controlling the movement of field staff to alternative sampling sites. The MRFSS allowed samplers to move from their assigned site to more active fishing locations but could not statistically account for this movement when calculating estimates. The MRIP implemented the FES in 2018 to replace the Coastal Household Telephone Survey (CHTS) due to concerns of under-coverage of the angling public, declining number of households using landline telephones, reduced response rates, and memory recall issues.

2.1.3.2 Sampling Intensity

Creel clerks collect intercept data year-round (in two-month waves) by interviewing anglers completing fishing trips in one of four fishing modes (man-made structures, beaches, private boats, and for-hire vessels). Intercept sampling is separated by wave, mode, and area fished. Sites are chosen for interviewing by randomly selecting from access sites that are weighted by estimates of expected fishing activity. The intent of the weighting procedure is to sample in a manner such that each angler trip has a representative probability of inclusion in the sample. Sampling is distributed among weekdays, weekends, and holidays. In North Carolina, strategies have been developed to distribute angler interviews in a manner to increase the likelihood of intercepting anglers landing species of management concern.

The FES mail survey employs a dual-frame design with non-overlapping frames (1) state residents are sampled from the United States Postal Service computerized delivery sequence file (CDS) and (2) non-residents are individuals who are licensed to fish in one of the target states but live in a different state and are sampled from state-specific lists of licensed saltwater anglers. Sampling from the CDS uses a stratified design in which households with licensed anglers are identified prior to data collection. The address frame for each state is stratified into coastal and non-coastal strata defined by geographic proximity to the coast. For each wave and stratum, a simple random sample of addresses is selected from the CDS and matched to addresses of anglers who are licensed to fish within their state of residence. Non-resident anglers are sampled directly from state license databases. The sample frame for each of the targeted states consists of unique household addresses that are not in the targeted state but have at least one person with a license to fish in the targeted state during the wave.

The FES mail survey collects fishing effort data for all household residents, including the number of saltwater fishing trips by fishing mode (shore and private boat). The FES is a self-administered mail survey, administered for six two-month reference waves annually. The initial survey mailing is sent one week prior to the end of the reference wave so that materials are received right at the end of that wave. This initial mailing is delivered by regular, first-class mail and includes a cover letter stating the purpose of the survey, a survey questionnaire, a post-paid return envelope, and a $2 cash incentive. One week after the initial mailing, a follow-up thank you and reminder postcard is mailed via regular first-class mail to all sampled addresses. For addresses that could be matched to a landline telephone number, an automated voice message is also delivered as a reminder to complete and return the questionnaire. Three weeks after the initial survey mailing, a final mailing is delivered to all addresses that have not yet responded to the survey.

2.1.3.3 Biological Sampling

Fish that are available during APAIS interviews for identification, enumeration, weighing, and measuring by the interviewers are called landings or Type A catch. Fish not brought ashore in whole form but used as bait, filleted, discarded dead, or are otherwise unavailable for inspection are called Type B1 catch. Finally, fish released alive are called Type B2 catch. Type A and Type B1 together comprise harvest, while all three types (A, B1, and B2) represent total catch. The APAIS interviewers routinely sample fish of Type A catch that are encountered. Fish discarded during the at-sea headboat survey are also sampled. The headboat survey is the only source of biological data characterizing discarded catch that are collected by the MRIP; however, this number has been negligible (0 Spotted Seatrout headboat discards between 2005 and 2019). The sampled fish are weighed to the nearest five one-hundredth (0.05) of a kilogram or the nearest tenth (0.10) of a kilogram (depending on scale used) and measured to the nearest millimeter for the centerline length. The numbers of Spotted Seatrout measured in Virginia and North Carolina by the MRIP are summarized in Table 2.4.

2.1.3.4 Potential Biases & Uncertainty

The MRIP was formerly known as the MRFSS. Past concerns regarding the timeliness and accuracy of the MRFSS program prompted the NMFS to request a thorough review of the methods used to collect and analyze marine recreational fisheries data. The NRC convened a committee to perform the review, which was completed in 2006 (NRC 2006). The review resulted in several recommendations for improving the effectiveness and use of sampling and estimation methods. In response to the recommendations, the NMFS initiated the MRIP, a program designed to improve the quality and accuracy of marine recreational fisheries data. The MRIP estimation method and sampling design for the APAIS were implemented in 2013, replacing MRFSS. In 2016, the NMFS requested that the NRC, now referred to as the National Academies of Sciences, perform a second review to evaluate how well and to what extent the NMFS has addressed the NRC's original recommendations (NASEM 2017). The review noted the impressive progress made since the earlier review and complimented the major improvements to the survey designs. The review also noted some remaining challenges and offered several recommendations to continue to improve the MRIP surveys. MRIP implemented the FES in 2018 to address the concerns of under-coverage of the angling public, declining number of households using landline telephones, reduced response rates, and memory recall issues of the CHTS.

2.1.3.5 Development of Estimates

The intercept and at-sea headboat data are used to estimate catch per trip for each species encountered. The estimated number of angler trips is multiplied by the estimated average catch per trip to calculate an estimate of total catch for each survey stratum.

Releases of seatrout genus (Spotted Seatrout and Weakfish) are sometimes recorded to the genus (*Cynoscion*) level in the MRIP. Releases are not observed by interviewers and some recreational fishermen are not able to report seatrout to the species level. To estimate the number of Spotted Seatrout released, the proportion of Spotted Seatrout estimated by MRIP as harvested (relative to other *Cynoscion* species) is applied to numbers of reported released *Cynoscion* spp. from the same wave (1–6), mode (type of fishing), and area (inshore vs. ocean). The number of recreational live releases was multiplied by a discard mortality of 10% (see section 1.2.6.2) to estimate the number of dead recreational discards.

The length data from the MRIP sampling of the Type A catch were expanded to total recreational harvest by wave/mode/area strata for each of the states by year and season. The length frequencies were then summed over the states by wave/mode/area strata to provide length frequencies by year and season for the recreational harvest.

2.1.3.6 Estimates of Recreational Fishery Statistics

Recreational harvest (Type A + B1) in terms of weight ranged from 164 to 1,769 mt in season 1 (Table 2.5; Figure 2.6) and from 1 to 716 mt in season 2 (Table 2.6; Figure 2.6) between 1991 and 2019. In terms of numbers, recreational harvest (Type A + B1) in season 1 (Table 2.5; Figure 2.7) has exceeded the recreational harvest in season 2 throughout the time series (Table 2.6; Figure 2.7). Estimates of live releases (Type B2) have increased in recent decades, especially in season 1 (Tables 2.5 and 2.6; Figure 2.8).

Annual length-frequency data for the recreational fishery are presented in Figures 2.9 and 2.10.

2.2 Fisheries-Independent

All the available fisheries-independent data come from North Carolina as there are currently no fisheries-independent sampling programs in Virginia that catch sufficient numbers of Spotted Seatrout to develop a reliable index.

2.2.1 Fisheries-Independent Gill-Net Survey (Program 915)

2.2.1.1 Survey Design and Methods

The Fisheries-Independent Gill-Net Survey, also known as Program 915 (P915), began on May 1, 2001 and originally included Hyde and Dare counties (Figure 2.11). In July 2003, sampling was expanded to include the Neuse, Pamlico, and Pungo rivers (Figure 2.12). Additional areas in the Southern District were added in April 2008 (New and Cape Fear rivers; Figure 2.13) and in the Central District in May 2018 (the White Oak River to Back Sound).

Floating gill nets are used to sample shallow strata while sink gill nets are fished in deep strata. Each net gang consists of 30-yard segments of 3-, 3.5-, 4-, 4.5-, 5-, 5.5-, 6-, and 6.5-inch stretched mesh, for a total of 240 yards of nets combined. Catches from an array of gill nets comprise a single sample; two samples (one shallow, one deep)—totaling 480 yards of gill net—are completed each trip. Gill nets are typically deployed within an hour of sunset and fished the following morning. Efforts are made to keep all soak times within 12 hours. All gill nets are constructed with a hanging ratio of 2:1. Nets constructed for shallow strata have a vertical height between 6 and 7 feet. Prior to 2005, nets constructed for deep and shallow strata were made with the same configurations. Beginning in 2005, all deepwater nets were constructed with a vertical height of approximately 10 feet. With this configuration, all gill nets were floating and fished the entire water column.

A stratified random sampling design is used, based on area and water depth. Each region is overlaid with a one-minute by one-minute grid system (equivalent to one square nautical mile) and delineated into shallow (<6 feet) and deep (>6 feet) strata using bathymetric data from NOAA navigational charts and field observations. Beginning in 2005, deep sets have been made along the 6-ft contour. Sampling in Pamlico Sound is divided into two regions: Region 1, which includes areas of eastern Pamlico Sound adjacent to the Outer Banks from southern Roanoke Island to the northern end of Portsmouth Island; and Region 2, which includes Hyde County bays from Stumpy Point Bay to Abel's Bay and adjacent areas of western Pamlico Sound. Each of the two regions is further segregated into four similar sized areas to ensure that samples are evenly distributed throughout each region. These are denoted by either Hyde or Dare and numbers 1 through 4. The Hyde areas are numbered south to north, while the Dare areas are numbered north to south. The rivers are divided into four areas in the Neuse River (Upper, Upper-Middle, Lower-Middle, and Lower), three areas in the Pamlico River (Upper, Middle, and Lower), and only one area for the Pungo River. The upper Neuse area was reduced to avoid damage to gear from obstructions, and the lower Neuse was expanded to increase coverage in the downstream area. The Pungo area was expanded to include a greater number of upstream sites where a more representative catch of Striped Bass (*Morone saxatilis*) may be acquired.

2.2.1.2 Sampling Intensity

Initially, sampling occurred during all 12 months of the year. In 2002, sampling from December 15 through February 14 was eliminated due to extremely low catches and unsafe working conditions. Sampling in the Pamlico, Pungo, and Neuse rivers did not begin until July 2003. Each of the sampling areas within each region is sampled twice a month. Within a month, a total of 32 samples are completed (eight areas × twice a month × two samples) in both the Pamlico Sound and the river systems.

2.2.1.3 Biological Sampling

All Spotted Seatrout are enumerated and an aggregate weight (nearest 0.01 kilogram (kg)) is obtained for each net (mesh size) fished. All individuals are measured to the nearest millimeter fork length (FL). Specimens are also retained and taken to the lab where age structures (otoliths) are removed, sex, and maturity stage of gonads are determined. The numbers of biological samples collected in Program 915 is summarized in Table 2.7.

2.2.1.4 Potential Biases & Uncertainty

Spotted seatrout are a target species in Program 915. The survey is designed to collect data of fish using estuarine habitats but nearshore ocean areas, which may be used by Spotted Seatrout, are not sampled. In addition, shallow creeks, which are often used by Spotted Seatrout as overwintering habitat and many deepwater areas of Pamlico Sound, potentially used for spawning, are not sampled in Program 915. Despite being used by Spotted Seatrout and being areas of high fishery activity, Albemarle Sound is not sampled. Ellis (2014) noted acoustic tagged Spotted Seatrout seemed to avoid anchored gill nets, indicating catchability of this species using Program 915 gear may be an issue.

While sample design has been largely consistent some adjustments have been made with the goal of reducing sea turtle interactions. In 2005, some deep water grids were dropped in Pamlico Sound, which may have some influence on deep relative abundance prior to this time period. Beginning in 2011, one area strata in eastern Pamlico Sound was not sampled for a three-month period from June through August to reduce sea turtle interactions. This change eliminated 16 samples per year. Excluding these samples from prior analysis had minimal impact on Spotted Seatrout relative abundance and variance.

2.2.1.5 Development of Estimates

Two indices of relative abundance, spring and fall, were developed from the Program 915 data from Pamlico Sound and the Neuse, Pamlico and Pungo rivers. The spring index was based on data from April through June. The fall index was based on data collected from September through November.

The indices were developed using a GLM approach to attempt to remove the impact of factors other than changes in abundance that may be affecting the indices (Maunder and Punt 2004). Because there was some variability in effort (soak time in hours) among hauls, effort was included as an offset variable in the GLM.

Length data were summarized by 40-mm length bins and year. Length data were summarized for each index; that is, they are based on collections from the same months of the associated index.

2.2.1.6 Estimates of Program 915 Survey Statistics

The spring standardized index was modeled using a zero-inflated negative binomial GLM (dispersion=1.0). Significant variables for the presence/absence (binomial) sub-model included depth, temperature, salinity, and distance from shore and the significant variables for the count sub-model included year, depth, temperature, salinity, dissolved oxygen, distance from shore, sediment size, and strata. The fall standardized index was modeled using a negative binomial GLM (dispersion=1.2). Significant variables included year, dissolved oxygen, sediment size, and strata.

The spring and fall standardized indices derived from Program 915 survey data for the northern region indicate a stable or increasing trend in relative abundance from 2003 to 2019 and the standardized indices do not differ dramatically from the nominal indices (Figure 2.14).

Annual length-frequency distributions for the Program 915 survey indices are shown in Figures 2.15 and 2.16.

3 ASSESSMENT

3.1 Overview

3.1.1 Scope

The unit stock for the current assessment is considered all Spotted Seatrout occurring within Virginia and North Carolina waters. The time period covered in this assessment is 1991–2019.

3.1.2 Summary of Methods

The current assessment is based on a seasonal, size-structured model. The model has a seasonal time step to account for seasonal biological processes and fishing patterns. The seasonal time-step may help capture the impact of cold stuns for Spotted Seatrout during cold winters. A size-structured model is used because: (1) size-based data are usually easier to obtain than age-based data and thus are associated with higher accuracy and less uncertainty; (2) management of most fisheries is based on size; and (3) use of a size-based model reduces the uncertainty introduced by age-size conversion during analysis (Quinn and Deriso 1999; Cao et al. 2017).

3.1.3 Current vs. Previous Method

The 2015 NCDMF Spotted Seatrout assessment (NCDMF 2015) used the Stock Synthesis (SS3) model and data collected from 1991 through 2012. The SS model is a length-based, age-structured model that accounts for sex-specific differences in mortality and growth. The model's inability to capture cold stun mortality was one of the major concerns from external peer reviewers in the previous assessment and thus, developing a customized model to account for variable natural mortalities was listed as a research recommendation with high priority. The seasonal, size-structured model was developed for the current assessment. Both the SS3 model and the seasonal size-structured model can incorporate information from multiple sources including fisheries, surveys, and a variety of biological datasets. Both assessments used only fisheries-independent surveys to derive relative abundance indices and used the maximum likelihood estimator through the Automatic Differentiation Model Builder (ADMB) to estimate parameters; however, unlike the previous assessment, this assessment model (1) used a seasonal time step instead of an annual time step to account for cold stun mortality of Spotted Seatrout during winter months; (2) the population dynamics were modeled by size structure instead of age structure; (3) the available data extended through 2019; (4) sexes were combined; (5) natural mortality and growth were assumed nonstationary; (6) the newly calibrated MRIP data were used for the recreational fishery, which are approximately three times the landings and discards used in the 2015 assessment.

3.2 Data Sources

This assessment included data from commercial and recreational fishing fleets that caught Spotted Seatrout in North Carolina and Virginia waters (Table 3.1). The model was fit to data on seasonal landings (in number), discards (in number), and length compositions. Two fisheries-independent indices of abundance and their associated length compositions were included, namely the Program 915 northern spring index (P915NorthSring, April–June, Pamlico Sound and rivers) and the Program 915 northern fall index (P915NorthFall, September–November, Pamlico Sound and rivers).

3.3 Seasonal, Size-Structured Model Configuration

The model developed in this stock assessment was adapted from a seasonal, size-structured model for northern shrimps (*Pandalus* spp.) developed by Cao et al. (2017). The model was coded in the ADMB (Fournier et al. 2012; http://admb-foundation.org).

3.3.1 Population Dynamics

In a size-structured model, the population dynamics of a stock are described in terms of the number of individuals at each size class over time (Sullivan et al. 1990; Cao et al. 2017). With a seasonal time step, the number of fish in size class *k* at the beginning of the season *t* in year *y* is calculated as:

$N_{k,t+1,y} = \sum_{k'} \left(G_{k',k} N_{k',t,y} exp\left(-M_{k',t,y} - \sum_f F_{f,k',t,y}\right)\right) + R_{k,t+1,y}$ for $t < T$ (growing to next season of the same year)

$N_{k,t'=1,y+1} = \sum_{k'} \left(G_{k',k} N_{k',t=T,y} exp\left(-M_{k',t=T,y} - \sum_f F_{f,k',t=T,y}\right)\right) + R_{k,t'=1,y+1}$ for $t = T$ (growing to next year)

where *t* and *t'* index the season, *y* indexes the year, *k* and *k'* index the size class, *f* indexes the fishing fleet, *N* is the population size, *T* is the maximum number of seasons, *G* is a growth transition matrix, $G_{k',k}$ represents the probability of surviving individuals in size class *k'* that grow to size class *k* during one time step (i.e., one season in a seasonal model), *M* and *F* are instantaneous mortalities, and *R* is the recruitment.

In this assessment, a model year began on March 1st and ended on February 28/29th of the following year. For example, the model year 1991 spanned from March 1st, 1991 to February 29th, 1992. Spawning of Spotted Seatrout in North Carolina and Virginia occurs in May–September and peaks in June–July. In the model, spawning was assumed to occur on June 1st. Each year was separated into two seasons, the non-winter season (t = 1) from March 1st to November 30th and the winter season (t = 2) from December 1st to February 28th/29th. The available length composition data used in this assessment contained lengths from 120 mm to 880 mm. Also, a von Bertalanffy growth model was fit externally using length-age data (section 1.2.4.1) and estimated a mean length of approximately 169 mm for recruits (age 0). Thus, in the model, 19 size classes were used ranging from 120 to 879.9 mm with a 40 mm size bin (i.e., 120–159.9 mm, 160–199.9 mm). The size bins covered in this assessment started at 120 mm to ensure the recruits were included and the length composition data were available for most of the size bins.

3.3.2 Growth

In the assessment model, individuals in a size class grew into the following size classes through a growth transition matrix. The growth transition matrix (*G*) can be determined by assuming growth follows the von Bertalanffy growth curve and the size increment for size class *k* (mm, ΔL_k) follows a normal distribution with mean $E(\Delta L_k)$ and variance $Var(\Delta L_k)$ (Chen et al. 2003; Cao et al. 2017):

$$E(\Delta L_k) = (L_\infty - L_k)\left(1 - exp(-a_t K)\right)$$

$$Var(\Delta L_k) = \sigma_{L\infty}^2\left(1 - exp(-a_t K)\right)^2 + a_t{}^2(L_\infty - L_k)^2\sigma_K^2 exp(-2a_t K)$$
$$+ 2\rho a_t \sigma_{L\infty}\sigma_K\left(1 - exp(-a_t K)\right)(L_\infty - L_k)exp(-a_t K)$$

where L_∞ is the asymptotic length (mm), K is the annual growth coefficient (yr^{-1}), ρ is the correlation coefficient between L_∞ and K, L_k is the mid-length of size class k, $\sigma_{L\infty}$ and σ_K are standard deviations of L_∞ and K respectively, and a_t is a scalar for partitioning the growth for season t within a year, where $0 \leq a_t \leq 1$. The probability of an individual growing from size class k to size class k' within one time step can be calculated as:

$$G_{k,k'} = \int_{k'_{low}}^{k'_{up}} f(x|E(\Delta L_k), Var(\Delta L_k))dx$$

where k'_{up} and k'_{low} are the upper and lower ends of size class k' and $f(.)$ denotes the probability density function of a normal distribution. Negative growth is not permitted and thus, $k' \geq k$ and $\sum_{k'} G_{k,k'} = 1$. The last size class is a plus group with all the individuals staying in the same size class and only subject to mortality.

In this assessment, the growth parameters L_∞ and K were assumed to vary over time and modeled using a random walk process:

$$L_{\infty,y+1} = L_{\infty,y} exp\left(LDev_{y+1}\right)$$
$$K_{y+1} = K_y exp\left(KDev_{y+1}\right)$$

where the growth parameters in year y+1 were determined by the parameters in the previous year y and a multiplicative deviation term in log space (*LDev* and *KDev*). We set $a_1 = 0.75$ and $a_2 = 0.25$ for non-winter season and winter season respectively.

3.3.3 Natural Mortality

Ellis (2014) and Ellis et al. (2018) have demonstrated increasingly high inter-annual variability in natural mortality during periods of cold stuns. Additionally, Ellis et al. (2017) showed high winter natural mortality associated with cold temperature. Thus, to account for the impact of cold stuns in this assessment, the natural mortality was assumed to be constant in the non-winter season but vary by year during the winter season. The natural mortality also varied by size during each season:

$$M_{k,t,y} = M_{t,y} w_k w_y$$

where w_k and w_y are size year scalars respectively and can be pre-specified. In the base model, we set $w_y = 1$ to allow the model to estimate the annual variability in the natural mortality. The size scalar can be determined based on the Lorenzen method (Lorenzen 1996). In this assessment, the Lorenzen M (M_k', in per year) was calculated based on weight (W, in g) with the parameters $M_u = 3.69$ and $d = -0.305$, which are values that were estimated for a wide range of ocean fishes (Lorenzen 1996):

$$M_k' = M_u W_k^d.$$

Then the calculated Lorenzen M values were divided by their average (Avg(M_k')) to generate the size scalar:

$$w_k = \frac{M_k'}{Avg(M_k')}$$

Such a size scalar would scale the Lorenzen M values to have an average that equals to the size-constant target natural mortality $M_{t,y}$. The seasonal natural mortality for a given year ($M_{t,y}$) was modeled with a mean ($\overline{M}$) and a deviation term ($MDev_y$):

$$M_{t,y} = \overline{M_t} exp(MDev_y)$$

where *MDev* is a multiplicative deviation term in log space. In this assessment, the natural mortality for the non-winter season was assumed a fixed constant input, whereas the natural mortality for the winter season was assumed to vary over time and estimated with a deviation. An annual natural mortality of 0.6 was used derived from a meta-analysis (Then et al. 2015; section 1.2.6.1) and then was split into the winter and non-winter seasons based on a ratio of 2:1. As a result, $M_{t=1,y} = \overline{M_{t=1}}$ = 0.2 and $\overline{M_{t=2}}$ = 0.4. Information on how to split the annual natural mortality into seasons were limited, and thus, we tested a series of splitting ratios ranging from 0.2 to 5 (the ratio of winter season relative to non-winter season). The ratio of 2:1 was selected because it produced the lowest total negative log-likelihood. Additionally, a tagging model that was fit externally using tag-recapture data (section 1.2.6.1) estimated a similar ratio (1.78:1).

3.3.4 Female Maturity, Sex Ratio, Fecundity, and Spawning Stock

Female maturity was modeled with a logistic function and the estimated maturity by size was treated as a fixed input to the model. The model was sex combined. The sex ratio was also treated as a fixed input to the model and assumed a 50% female proportion for the first eight size classes (120 mm–440 mm), 70% for the next four size classes (440 mm–600 mm), and 95% for the remaining size classes (600 mm–880 mm). Both female maturity and sex ratio were constant over time. In this assessment, the spawning stock biomass (SSB) was modeled as the population fecundity (number of eggs) and assumed to be equivalent to mature female biomass. Reproduction was assumed to occur once a year on June 1st.

3.3.5 Recruitment

Assuming the age-0 fish represent recruitment, the size-specific seasonal recruitment $R_{k,t,y}$ was modeled as the product of annual recruitment (R_y) and the proportion of R_y that recruits to each season (π_t) and each size (π'_k):

$$R_{k,t,y} = R_y \pi_t \pi'_k.$$

In the base model, $\pi_{t=1}$ = 1 and $\pi_{t=2}$ = 0 because spawning was assumed to only occur in the non-winter season. It was also assumed the fish would recruit to the first seven size classes with the proportion $\pi_{k=1}$ =0.06, $\pi_{k=2}$ =0.11, $\pi_{k=3}$ =0.17, $\pi_{k=4}$ =0.21, $\pi_{k=5}$ =0.20, $\pi_{k=6}$ =0.16, and $\pi_{k=7}$ =0.09, according to the estimates from the von Bertalanffy growth model that was fit externally using length-age data (section 1.2.4.1). These proportions were fixed inputs and assumed constant over time. Recruitment is often driven by environmental factors and spawner abundance often only explains a small amount of the high variation in recruitment. Thus, in the model, the annual recruitment R_y was directly estimated with a deviation term to avoid assuming a fixed spawner-recruitment relationship:

$$R_y = \bar{R} exp(RDev_y)$$

where *RDev* is a multiplicative deviation term in log space, and its standard deviation was fixed at a value of 0.38 from a meta-analysis (R package FishLife; Thorson et al. 2017).

3.3.6 Landings

Time series (by season) of landings from two fleets were modeled, including the commercial landing fleet and the recreational harvest fleet. Landings were fit in number and were modeled with the Baranov catch equation (Baranov 1918):

$$C_{f,k,t,y} = \frac{F_{f,k,t,y}}{M_{k,t,y} + \sum_f F_{f,k,t,y}} \left(1 - exp\left(-M_{k,t,y} - \sum_f F_{f,k,t,y}\right)\right) N_{k,t,y}$$

$$C_{f,t,y}^{pred} = \sum_k C_{f,k,t,y}$$

where C is landings. The landings from North Carolina and Virginia were combined for each fleet.

3.3.7 Discards

In this assessment, discards from the commercial and recreational fisheries were modeled as separate fleets, and thus, a total of two discard fleets were included, namely the commercial discard fleet and the recreational discard fleet. The discard fleets accounted for only the dead discards. Commercial discard data were available starting in 2004 for North Carolina (section 2.1.2); commercial discard data were unavailable for Virginia. The recreational fishery data only report those fish that were released, and thus a 10% post-release mortality rate was applied to calculate the dead discards from the recreational discard fleet for North Carolina and Virginia (section 2.1.3). As with landings, the discards were fit in number to the time series (by season) of discards and were modeled with the Baranov catch equation, and the data from North Carolina and Virginia were combined for each fleet.

3.3.8 Fishing Mortality

For each time series of removals (landings and discards), a separate full seasonal fishing mortality ($F_{f,t,y}$) was estimated. The size-specific fishing mortality ($F_{f,k,t,y}$) was then calculated by multiplying the full seasonal fishing mortality with the corresponding fishery selectivity ($S_{f,b,k}$) for each fleet f, time block b (if applicable), and size class k:

$$F_{f,k,t,y} = F_{f,t,y} S_{f,b,k}\ .$$

In this assessment, the annual fishing mortality was represented by the sum of the fishing mortalities across fleets and seasons.

3.3.9 Abundance Index

The model was fit to two NCDMF indices of relative abundance from the Program 915 fisheries-independent survey, the P915NorthSpring and P915NorthFall indices. Both abundance indices were standardized using a generalized linear model (GLM) approach before being input to the model (Maunder and Punt 2004; section 2.2.1.6). The standardization attempts to reduce the impact of other factors, especially environmental factors on the trend of the index timeseries. Predicted indices (I) were conditional on the selectivity of the surveys (S^{survey}) and were computed from abundance (number of fish) at the midpoint of the survey time period ($N_{i,k,y}^{survey}$):

$$I_{i,y}^{pred} = q_i \sum_k \left(N_{i,k,y}^{survey} S_{i,k}^{survey}\right)$$

$$N_{i,k,y}^{survey} = N_{k,y} exp\left(\frac{month_i}{12}\left(\sum_t\left(-M_{k,t,y} - \sum_f F_{f,k,t,y}\right)\right)\right)$$

where q is the survey catchability and i indexes the ith abundance index.

3.3.10 Catchability

In the model, the catchability scales the abundance index to the estimated population abundance, conditional on the survey selectivity. In this assessment, catchability (q) was assumed to be time-invariant for each survey and all abundance indices were assumed to have a linear relationship to the population abundance. The survey catchability was calculated internally as follows:

$$ln(q_i) = \frac{1}{n_y}\sum_y ln\left(\frac{I_{i,y}^{obs}}{\sum_k N_{i,k,y}^{survey} S_{i,k}^{survey}}\right)$$

where n_y is the total number of years in assessment time period and $I_{i,y}^{obs}$ is the observed abundance index in year y for survey i.

3.3.11 Selectivity

An asymptotic shaped selectivity was assumed for landing fleets and a dome-shaped selectivity was assumed for discard fleets. The asymptotic-shaped selectivity was modeled using a two-parameter logistic curve and the dome-shaped selectivity was modeled using a six-parameter double-normal curve (Methot and Wetzel 2013).

The minimum size limit for Spotted Seatrout in Virginia has been 14 inches since 1992. The minimum size limit in North Carolina was changed from 12 inches (304.8 mm) to 14 inches (355.6 mm) starting in 2009; however, the length compositions show minimal shift associated with the increase of size limit in 2009. Thus, in the base model, the selectivities of commercial and recreational landing fleets were assumed time-invariant. A model with two time blocks (1991–2008; 2009–2019) for fleet selectivities was included in a sensitivity analysis.

The selectivities of commercial and recreational discard fleets could not be freely estimated because no length composition data were input to the model. Therefore, the selectivities for the two discard fleets were estimated externally and treated as fixed inputs in the model. The selectivity of the commercial discard fleet was estimated based on a length composition from the NCDMF observer data, and the selectivity of the recreational discard fleet was estimated based on a NCDMF tagging study and expert opinions. The selectivities for the winter season mirrored those for the non-winter season, except for the parameter of the first peak in the double normal curve. The value of this parameter for the winter season selectivities was set at a length 15 mm larger than the value for the non-winter season selectivities based on the length information from the observer data.

The selectivity of P915NorthSpring and P915NorthFall surveys were assumed to be asymptotic shaped and time-invariant. Both selectivities were modeled using a logistic function.

3.3.12 Length Composition

The model was fit to four length composition time series (by season), including the length compositions from commercial and recreational landings, and the length compositions from

P915NorthSpring and P915NorthFall surveys. There were no length composition data input for discards fleets.

3.3.13 Initialization

Initial (1991) numbers at size ($N_{k,t=1,y=1}$) were estimated in the model assuming the proportions at size (Pas_k) follows a mixture distribution with three normal distributions (f_1, f_2 and f_3) to account for multiple peaks:

$$N_{k,t=1,y=1} = N_{y=1} Pas_k$$

$$Pas_k = \emptyset_1 f_1(L_k) + \emptyset_2 f_2(L_k) + \emptyset_3 f_3(L_k)$$

where $\emptyset_1 + \emptyset_2 + \emptyset_3 = 1$, and the three normal distributions have different means and variances.

3.3.14 Optimization

Model parameters were estimated using a penalized likelihood approach. In the penalized likelihood approach, each data component is assumed to have an error distribution and each observation is assigned a variance so that the observed removals (landings and discards) are fit closely and the observed compositions and abundance indices are fit to a compatible degree. The objective function is the sum of individual log-likelihood components. In this assessment, removals and abundance indices were fit assuming lognormal likelihood. Landings were assumed precise and assigned a minimal observation error with coefficient of variation (CV) = 0.05 for commercial landings and CV = 0.10 for recreational landings. The discards were assigned a larger observation error, with CV = 0.25 for both commercial and recreational discards. The CVs for abundance indices were estimated from the GLM standardization. Length compositions were fit assuming multinomial likelihood with variance described by the effective sample size. For length compositions, the effective sample size for each fleet and survey was the number of sampled trips and a maximum of 200 was imposed to prevent overfitting to composition data.

The deviations (log-scale) for natural mortality of winter season, recruitment, and growth (L_∞ and K) were modeled assuming normal likelihood with a mean of zero. Normal priors with a CV of 0.15 were applied for growth parameters (L_∞, K, $\sigma_{L\infty}$ and σ_K) to prevent the gradient-based parameter search routine from drifting into parameter space that yields negligible changes in the likelihood. The means of these normal priors were from the von Bertalanffy growth model that was fit externally using length-age data (section 1.2.4.1).

In the objective function, weight can be assigned to each likelihood component to account for data quality. All likelihood components were initially assigned a weight equivalent to one.

3.4 Diagnostics

Multiple measures were applied to assess the model convergence. The Hessian matrix (i.e., matrix of second derivatives of the likelihood with respect to the parameters) was checked to ensure it inverted. The model convergence level was checked to ensure it was less than the convergence criteria (0.0001, common default value). Parameters with estimated values hitting bounds or with excessively high variance (PSE > 50%) were identified. The correlation matrix was evaluated to detect high correlations between parameter estimates. A jitter analysis was performed to evaluate whether the model converged on a global solution (Cass-Calay et al. 2014). In the jitter analysis, initial values for all estimated parameters were randomly jittered by 10% for 100 runs. The total likelihood value, annual estimates of spawning stock biomass and fishing mortality, and stock status (see section 4) from the jitter runs were compared to the base run results.

The model fits were evaluated by comparing the estimates of landings, discards, abundance indices, and length compositions to the observed values via visual inspection. For the fits to the abundance indices, the residuals were calculated and then tested for randomness and normality. The runs test was applied to evaluate whether the residuals are randomly distributed (runs.test function; R Core Team 2021), and the Shapiro-Wilk test was applied to determine whether the residuals are normally distributed (shapiro.test function; R Core Team 2021). A significance level of 0.05 was used for both tests.

A retrospective analysis was also performed to evaluate the consistency of estimates over time, and how recent data changed the perspective of the past (Mohn 1999; Harley and Maunder 2003). Specifically, it evaluates systematic changes in the annual estimates as additional years of data were added (Mohn 1999). The analysis is run by peeling back (removing) one year of data from the end of the time series. The retrospective patterns would not be considered concerning if they are random and do not show a clear bias in any direction. The retrospective error (Mohn's ρ) is used to describe the degree of retrospectivity and is calculated as follows (Mohn 1999; Hurtado-Ferro et al. 2015):

$$\text{Mohn's } \rho = \frac{1}{n_{peel}} \sum_{t=terminal\ year-n_{peel}}^{terminal\ year} \frac{X_t|data\ to\ year\ t - X_t|data\ to\ terminal\ year}{X_t|data\ to\ terminal\ year}$$

where X is the variable of interest and n_{peel} is the total number of years that are "peeled off". Hurtado-Ferro et al. (2015) suggested a range between -0.22 and 0.3 for short-lived species; any values falling outside this range would indicate a concerning retrospective pattern. A positive value of Mohn's ρ for biomass and a negative value for fishing mortality may imply consistent overestimation of biomass and high risk of overfishing. Retrospective patterns may either result from inconsistent or insufficient data or result from natural variation in population dynamics. In this assessment, the base model was run with one year of data removed at a time starting from 2019 until the terminal year reached 2014 ($n_{\text{peel}} = 5$). The estimates of annual fishing mortality and spawning stock biomass (X) were evaluated from each retrospective run. Additionally, a series of sensitivity runs were also developed to explore the robustness of the model to some key model inputs and assumptions (See section 3.6).

3.5 Base Run Configuration

The base run was configured as described above. Uncertainties in point estimates were investigated through sensitivity analyses.

3.6 Sensitivity Analyses

Sensitivity of model outcomes to some key model inputs and assumptions were explored through sensitivity analyses (Table 3.2). Annual estimates of spawning stock biomass, fishing mortality, and recruits were compared to those from the base run.

3.6.1 Data Sources

The contributions of different fisheries-independent surveys were explored by removing the data from each survey one at a time. In each of these runs, the abundance index and length composition data (if applicable) from the survey under evaluation were removed by assigning a lambda weight of 0.0 to their likelihood components.

3.6.2 Initial Year

In the base model, the initial year was set to 1991 when the landing data started; however, the abundance index data were not available until 2003. With no abundance index data extending back to the initial year, the estimates for the early time period, especially the initial year, could become highly dynamic and uncertain. To examine the impact of the initial year on model outcomes, a sensitivity run with 2003 as the initial year was conducted.

3.6.3 Natural Mortality

In the base model, the annual average natural mortality was set to 0.6 based on a meta-analysis. Additionally, two sensitivity runs were performed to explore the impact of the annual average natural mortality on model outcomes, one run with a lower value of 0.4 and the other with a higher value of 0.8. A ratio of 2:1, the same as in the base model, was used to split this annual average natural mortality to the seasonal average natural mortalities for the winter and non-winter seasons in these two sensitivity runs.

3.6.4 Recreational Discards for Non-Winter Season 2018

In the base model, the input value for recreational discards in Season 1 (non-winter season) of 2018 was 1,863.527 thousands of fish. This input value was the highest across the whole assessment time period and approximately three times higher than the average (521.951 thousands of fish) discards within the previous five years (2013–2017). Removal from the recreational fishery dominates the total removal from the Spotted Seatrout stock. The input for 2018 may have affected the estimates for the terminal year 2019 and therefore its stock status determination. Thus, this extremely high input value for 2018 raised concerns over its impacts on model outcomes. A sensitivity run with a lower input value that equaled to 521.951 thousands of fish was conducted.

3.6.5 Time Block Fleet Selectivity

In the base model, no time blocks were set up for fleet selectivity due to no substantial shift in observed size distribution after the minimum size limit was changed in North Carolina in 2009. A sensitivity run with two time blocks was conducted to explore the impacts of time blocks on model outcomes. In the sensitivity run, for each fleet in a given season, its selectivity had two time blocks, i.e., the time block 1991–2008 during which the minimum size limit in North Carolina was 12 inches (304.8 mm) and the time block 2009–2019 during which the minimum size limit in North Carolina increased to 14 inches (355.6 mm). The same as in the base model, all selectivity parameters for landing fleets were free parameters to estimate, and all those for discard fleets were fixed input. The parameter setup for the first time block was the same as in the base model for the fleet in a given season. The parameter setup for the second time block was the same as the first time block except that the parameter controlling the location of the selectivity curve was increased by 50 mm to reflect the increase in minimum size limit. These parameters included the parameter for the length at 50% selection of a logistic curve for landing fleets and the parameter for the first peak of a double-normal curve for discard fleets.

3.7 Results

3.7.1 Base Model—Diagnostics

The base model was considered converged given an inverted Hessian matrix, no parameters hitting bounds or with excessively high variance, no high correlation between parameters, and a reasonably small convergence level of 0.0094. Although this convergence level was higher than the commonly used criteria (0.0001), a value less than one is typically deemed acceptable for such complex models with hundreds of parameters to estimate. Eighty-eight of the 100 jitter runs successfully converged. None of the converged jitter runs resulted in a total negative log-likelihood value that was significantly lower than the base model (Figure 3.1). Although 14 of the 100 jitter runs produced a slightly lower total negative log-likelihood value than the base model, the difference was less than three and thus was not considered statistically significant. This difference in the total negative log-likelihood values was contributed by a slightly better fit to the length compositions of the commercial and recreational landing fleets from these 14 runs. Most of the converged jitter runs predicted similar trends in SSB and F to the base model (Figure 3.2). Overall, the jitter analysis provides evidence that the base model converged to the global solution.

The base model fit the landings and discards well (Figures 3.3–3.6). The fits to the fisheries-independent survey indices were reasonable (Figures 3.7 and 3.8). The predicted indices captured the overall trends in the observed data. The runs test and the Shapiro-Wilk test on the residuals (log-scale) produced non-significant P-values for both P915NorthSpring and P915NorthFall indices at a significance level of 0.05 (Table 3.3). These results suggested the residuals were randomly distributed with no statistically significant temporal patterns or departures from a normal distribution.

The fits to the length compositions were reasonable for most of the fleets and surveys except for RecLanding Season 2 (Figures 3.9–3.14). The fits to the length compositions in individual years appeared reasonable for most of the years. The poor fits to the length compositions for RecLanding Season 2 and for some years in other fleets and surveys were likely due, in part, to the small effective sample size.

3.7.2 Base Model—Predicted Population Dynamics

The predicted selectivities for the landing fleets and the surveys were considered reasonable (Figures 3.15 and 3.16, 3.19 and 3.20). The selectivities for the discard fleets were fixed inputs (Figures 3.17 and 3.18). Overall, fish of the same size were more likely to be selected in Season 1 than Season 2 for most fleets except the recreational landing fleet. The fish smaller than 360 mm were more likely to be caught in Season 2 than Season 1.

Model predictions of annual fishing mortality showed a declining trend over time (Figure 3.21). The predicted fishing mortality was higher and more variable from 1991 through 2004. During this time period, a sharp decrease in fishing mortality estimates occurred in 1998. After 2004, the fishing mortality estimates decreased to a lower level with less variability compared to the earlier time period. An increase in fishing mortality was predicted for the terminal year 2019 with large uncertainty.

The size-averaged natural mortality estimates for the winter season showed great inter-annual variability (Figure 3.22). The model predicted high or rising winter natural mortality in years 1991, 1995, 1999–2000, 2002, 2006–2007, 2009–2010, 2013–2014, 2017, and 2019. This annual trend captured most of the identified cold-stun years except one year (2004). The size-specific natural mortality for individual years showed the winter season had higher natural mortality than the non-winter season and this seasonal difference became more evident for smaller fish (Figure 3.23).

The annual predicted recruitment varied among years and showed a general increasing trend over the assessment time period (Figure 3.24). The predicted recruitment was higher and more variable during the time period after 2004 (2005–2019). The annual predicted spawning stock biomass showed a general increasing trend over the assessment time period (Figure 3.25). Similar to recruitment, higher spawning stock biomass with greater variation was predicted for the time period after 2004. The predicted abundance also demonstrated strong year classes and high abundances through the years after 2004 (Figure 3.26).

The model predicted growth parameters varied moderately among years (Figures 3.27 and 3.28). The predicted L_∞ remained around 1,000 mm. The predicted K averaged around 0.2 with a slow decrease over time. Seasonal growth for individual years showed growth mostly occurred in the non-winter season and the difference in growth between seasons became more evident for smaller fish (Figure 3.29).

3.7.3 Retrospective Analysis

Retrospective analysis showed terminal year fishing mortality was consistently overestimated and terminal year spawning stock biomass was consistently underestimated (Table 3.4; Figure 3.30). The relative bias in terminal year fishing mortality and spawning stock biomass was low when peeling back to 2014, substantially increased when peeling back to 2015– 2017, and became larger when peeling back to 2018. Adding 2019 data seemed to have an essential impact on the predicted fishing mortality and spawning stock biomass, especially during the most recent five years (2015–2019). With 2019 data added, the fishing mortality estimates during 2015–2019 were substantially lowered and the spawning stock biomass estimates during this time period were greatly elevated. The Mohn's ρ values for fishing mortality and spawning stock biomass were 0.762 and -0.284, respectively. Both values are outside the recommended range of -0.22 to 0.3 for short-lived species and suggest a strong retrospective pattern.

3.7.4 Sensitivity Analyses

Removal of either P915NorthFall or P915NorthSpring survey data had minimal impact on predicted fishing mortality, spawning stock biomass, and recruitment (Figure 3.31). Initializing the base model from year 2003 when the survey data become available yielded higher fishing mortality estimates and lower spawning stock biomass estimates during 2004–2010 compared to the base model (Figure 3.32). Otherwise, the predicted fishing mortality and spawning stock biomass after 2010 and the predicted recruitment during the assessment period from this scenario were quite similar to those from the base model.

Changes in natural mortality led to similar trends in outcomes to the base model (Figure 3.33). Increased natural mortality led to lower fishing mortality estimates and higher spawning stock biomass and recruitment estimates.

Overall, a low input value of 2018 Season 1 recreational discards produced almost identical trends in outcomes compared to the base model (Figure 3.34). The predicted fishing mortality during 1999–2002 declined in this scenario compared to an increased trend in the base model.

This discrepancy was likely contributed by the difference in the trends of growth estimates during this time period between this scenario and the base model.

When two time blocks were set up for fleet selectivity, similar trends in outcomes were produced compared to the base model (Figure 3.35). The time block selectivity assumption led to lower fishing mortality estimates than the base model for the time period before 2009 and for the terminal year of 2019. The predicted fishing mortality during 2009–2018 from this scenario was almost identical to that from the base model. The time block selectivity assumption also resulted in higher spawning stock biomass estimates and slightly higher recruitment estimates during the entire assessment period.

3.8 Discussion of Results

Performance of the stock assessment model was considered reasonable in terms of predicting the observed data. The quality of the fits strongly depends on data quality that is reflected by the input variance and effective sample size. The fits to the observed landing and discard data were better than the fits to the survey indices, which was expected given the lower variance assumed for these data sources. The P915NorthFall index was fit better than the P915NorthSpring index due to its 33% smaller variance input on average. The model outcomes were insensitive to the removal of either survey's data, suggesting these two data sources share consistent information. The stock status determination for the terminal year was insensitive to the removal of either survey's data.

The stock assessment model was able to capture the signal from cold-stun events, which was a major concern from both the 2009 and 2015 NCDMF stock assessments and has been one of the major interests for this assessment. Without specifying cold-stun years as inputs in the model, the predicted natural mortality for the winter season was able to track the cold-stun signals for most years. The assumptions regarding the seasonal time step and nonstationary biological processes were essential to allow for the estimation of variation in winter natural mortality in this assessment. This type of modeling practice has not been successfully attempted in the previous assessments of this species or other state-managed species. This model can be easily applied to other species that experience strong seasonal dynamics in fishing and biological processes.

Developing an assessment model that can capture the cold-stun signal was a major interest in this assessment and thus, an extensive effort was attempted to explore alternative approaches. One of the approaches was to directly input the natural mortality estimates from a tagging model. The tagging model was fit externally to the tag-recapture data collected by North Carolina State University (NCSU) and NCDMF from 2008 to 2019. The tagging model was fit using a Bayesian approach and a three-month time step. Several attempts were made to incorporate the tagging model estimates including having tagging estimates as fixed input, incorporating tagging estimates as an environmental factor to guide the estimation of natural mortality deviation, and using tagging estimates to inform the seasonal average natural mortality; however, these attempts were unsuccessful. In these attempts, the assessment model yielded either unrealistic population estimates (e.g., extremely high L_∞ or K) or a collapsed population, which indicated there was conflicting information in the input or the assumptions. Natural mortality estimates for the winter season from the tagging model were extremely variable interannually and had large uncertainty, ranging from 0.002 to 2.346 with an average of 0.9 and a standard deviation of 0.9. These three-month estimates were also extremely high when compared to an annual scale estimate of 0.6 from a meta-analysis for this species. Given such high values of natural mortality and high variability, the population in the model would be difficult to sustain.

The tagging model and this assessment model have different assumptions and use different data sources. For example, the tagging data for Spotted Seatrout covered less than half of the whole assessment time period and only involved fish of certain sizes (280 mm–760 mm). Therefore, the estimated trends from these two types of models may be more comparable than their absolute values. The trends in the winter natural mortality from these two models were consistent. Given that tagging data could provide valuable auxiliary information in stock assessments, future effort may focus on integrating the tagging model as a sub-model into the stock assessment model so that both tagging data and assessment data can inform the population dynamics at the same scale in a coherent system.

Other approaches explored with an attempt to model cold-stun events was to use winter water temperature (cumulative degree days below 5ºC, CDD). One approach was to directly use the CDD as an environmental factor to guide the estimation of natural mortality deviation. Another approach was to predict the natural mortality value for a given winter water temperature based on a linear regression relationship developed by Ellis et al. (2017a) and then use these predicted values as fixed input in the model. These approaches predicted extremely variable and high values of natural mortality and suffered the same problem as with the tagging estimates. Predicting natural mortality solely based on water temperature may not be appropriate because the natural mortality in the model is often a result of a combination of multiple factors, among which cold winter temperature is only one single factor. Other factors may include predation, intra- and inter-species competition, resource availability, habitat quality, and environmental stochasticity such as hurricanes and salinity change. Also, the severity of cold-stun events is variable with some affecting large geographic range and others being more localized and acute (within 24 hours), and thus its impact at population level and annual time scale is still largely unknown and likely variable.

Due to different model structure, assumptions, and data input, it is not possible to compare results from this assessment with the 2015 assessment. The recreational harvest and discards input in this assessment were three times higher than those in the 2015 assessment due to the new MRIP calibration process. Regardless of the differences between these two assessments, the stock status determination for 2012—the terminal year in 2015 assessment—was consistent. The 2012 stock was not overfished, and overfishing was not occurring, but was approaching the threshold.

Trends in predicted fishing mortality, recruitment, spawning stock biomass, and abundance showed a shift in population dynamics around the year of 2004 when the index survey data became available. For example, the fishing mortality shifted from a high level during a time period around 1991–2004 to a low level during a time period around 2005–2019. In this assessment, the model was informed by both fishery and survey data after 2003, before which the model was probably heavily informed by the fishery data only. The fishery data in this assessment, especially the discard data and the recreational landing data, showed such a shift corresponding to the shift in these model results.

Among numerous sensitivity runs, including those in this report, stock status for the terminal year consistently indicates that overfishing is occurring. Although the stock status of being not overfished was determined in most of sensitivity runs, there were a few scenarios suggesting the opposite. For example, in the scenario with initial year of 2003 (Ini2003), the terminal year stock was determined overfished, although the 2019 spawning stock biomass estimate (2,475.647 metric tons) was fairly close to the threshold (2,701.429 metric tons). In the base model, a longer time series of landing and discard data were used, and these data showed a shift around 2004 as discussed above. Excluding these fishery data during the early time period in the Ini2003 scenario led to the data time series being lack of contrast and the model being incapable of capturing the potential shift in population dynamics, and further resulted in different outcomes (e.g., difference in estimated growth, fishing mortality, spawning stock biomass, and stock status).

Although the retrospective analysis in this assessment showed strong retrospective patterns in the predicted fishing mortality and spawning stock biomass, it is less concerning in terms of management risk in this assessment. Based on the results, this assessment model was consistently overestimating fishing mortality and underestimating spawning stock biomass. Thus, theoretically, a lower estimate of fishing mortality and a higher estimate of spawning stock biomass would be expected for 2019 after adding future data, and the management based on this assessment would be more conservative. Management risk caused by strong retrospective patterns has often been more of a concern in cases where the assessment model is consistently underestimating fishing mortality and overestimating spawning stock biomass. In these cases, the stock is most likely to collapse and least likely to meet the management goals if management practices are made based on the results without adjustment for the retrospective patterns (Huynh et al. 2022). Various approaches have been proposed to inform management decisions when strong retrospective patterns emerge in stock assessment, such as the model averaging (Stewart and Hicks 2018) and the adjustment for Mohn's ρ (Miller and Legault 2017); however, the performances of these approaches are mixed on a case-by-case basis (Huynh et al. 2022). Identifying causes of retrospective patterns is challenging due to multiple confounding factors (e.g., nonstationary processes and selectivity assumptions) and insufficient data (Legault 2020; Huynh et al. 2022). The strong retrospective patterns in this assessment were likely partially caused by 2019 data. Before adding 2019 data, the relative biases in the predicted fishing mortality and spawning stock biomass from the other retrospective runs were quite small. The input data showed the recreational harvest for 2019 were historically the highest, and the abundance index values for 2019 were also among the highest values. Given that this fishery is heavily dominated by recreational fishing, such high input values for the 2019 recreational fishery may have led to the high estimate of spawning stock biomass in 2019 even though the stock is undergoing overfishing.

In this type of seasonal, size-structured model, the model behaviors might be complicated by the interaction among the nonstationary natural mortality, the nonstationary growth, size-based selectivity, and the interaction in the dynamics between seasons. Exploratory runs indicate the model could become more robust and predictable with the estimation of growth parameters stabilized and less variable. In this assessment, a small value of 0.04 was selected for the standard deviation of the annual deviation of the time-varying growth parameters through a likelihood profiling, in which a series of values ranging from 0.01 to 0.2 were tested. With such a small value, the estimated growth patterns were able to vary over time while still remaining within a biological meaningful range and make scenarios more comparable.

4 STATUS DETERMINATION CRITERIA

The General Statutes of North Carolina define overfished as "the condition of a fishery that occurs when the spawning stock biomass of the fishery is below the level that is adequate for the recruitment class of a fishery to replace the spawning class of the fishery" (NCGS § 113-129). The General Statues define overfishing as "fishing that causes a level of mortality that prevents a fishery from producing a sustainable harvest."

The North Carolina Spotted Seatrout FMP defines the stock's thresholds in terms of 20% spawning potential ratio (SPR; NCDMF 2012b). Targets for the stock are based on 30% SPR. These reference points were adopted in this assessment. The base model was used to estimate reference points and to determine the stock status for the stock. The stock is overfished if $SSB/SSB_{20\%}$ is less than one, and overfishing is occurring if $F/F_{20\%}$ is greater than one. In this assessment, the benchmarks are conditional on the estimated selectivity patterns and biological parameters. The selectivity pattern used here was the average selectivity at size across fleets.

Due to the large uncertainty in the terminal year (2019) estimates in this assessment, a weighted average of the estimates over the most recent three years (2017–2019) was used to best represent the terminal year estimate for determination of stock status. The estimates of 2017–2019 from the base model were weighted by the inverse of their CV values before calculating the average. The threshold and target values for the terminal year were also averaged over 2017–2019. The resulting estimated F threshold, $F_{20\%}$, and the F target, $F_{30\%}$, were 0.60 and 0.38 respectively, and the estimated terminal year F was 0.75 (all based on 2017–2019 averages). Thus, the estimated $F/F_{20\%}$ for the terminal year is greater than one (1.3), suggesting the stock is currently experiencing overfishing (Figures 4.1 and 4.2). The stock has been centering around the overfishing threshold from 2007 through 2019. In the base model, the estimated SSB threshold ($SSB_{20\%}$) and the SSB target ($SSB_{30\%}$) for the terminal year (based on 2017–2019 averages) were 1,143 and 1,714 metric tons respectively, and the estimated terminal year SSB was 2,259 metric tons (based on 2017–2019 average). Therefore, the estimated $SSB/SSB_{20\%}$ for the terminal year is greater than one (2.0), suggesting the stock is not currently overfished. The stock has not been overfished since 2007. Overall, results showed the stock had consistently been overfished and overfishing had been occurring until 2007 and has greatly improved since then.

5 SUITABILITY FOR MANAGEMENT

Stocks assessments performed by the NCDMF in support of management plans are subject to an extensive review process. External reviews are designed to provide an independent peer review and are conducted by experts in stock assessment science and experts in the biology and ecology of the species. The goal of the external review is to ensure the results are based on sound science and provide a valid basis for management.

The review workshop allows for discussion between the working group and review panel, enabling the reviewers to ask for and receive timely updates to the models as they evaluate the sensitivity of the results to different model assumptions. The workshop also allows the public to observe the peer review process and better understand the development of stock assessments.

The external peer review panel met with the working group in person August 30–September 1, 2022. The external peer review panel recommended the base model (i.e., the seasonal size-structured model) as the best scientific information available and suitable for management advice for the next five years. The reviewers agreed the determination of the spotted seatrout stock status concurs with professional opinion and observations and suggested using an average of the most recent three years as the best representation of the terminal-year estimates for fishing mortality and spawning stock biomass. The reviewers also agreed that: (1) the justification of inclusion and exclusion of data sources are appropriate; (2) the data sources used in this assessment are appropriate; (3) the base model is a step forward for incorporating nonstationary natural mortality and seasonal variability to capture the cold-stun signal; (4) determination of stock status is overall robust to model assumptions and configurations that have been explored in sensitivity analyses and during the peer-review workshop. The reviewers expressed concerns over the potential overparameterization of the nonstationary growth assumption, the constant live-release mortality assumption for the recreational fishery, and the fixed constant CV input for recreational landings and discards fleets, and the reviewers recommended further investigation in the future. The reviewers also recommended: (1) integration of tagging data in the assessment model being given high priority; (2) exploration of potentially incorporating the P120 juvenile survey data and age composition data in the assessment model; (3) conducting a continuity run with the age-structured model (Stock Synthesis) to compare with this new size-structured base model; (4) improving understanding of live-release mortality and size structure of discards; (5) validating model with existing data. Detailed comments from the external peer reviewers are provided in Appendix.

6 RESEARCH RECOMMENDATIONS

The following research recommendations are offered (ranked by priority) to improve the next assessment of the North Carolina and Virginia Spotted Seatrout stock:

High

- Test and validate the newly developed size-structured model with known data sets and a simulation study that compares this size-structured model with an age-structured model
- Collect data to characterize annual length distributions of commercial discards and recreational releases to inform selectivity parameterization
- Develop a fishery-independent survey for Virginia waters
- Develop a winter-season survey to capture population dynamics in that period, including collection of length composition data
- Integrate tagging data into stock assessment model so both tagging data and other data sources can work together to give a better picture of the population
- Implement a year-round, fisheries-independent juvenile survey
- Improve estimates of recreational discard mortality

Medium

- Conduct a detailed analysis of the existing Program 915 data to determine the extent to which late fall and spring provide insights into overwinter changes in abundance; this analysis could also provide insights into the magnitude of cold-stun events, which could explain differences in the effects observed in tagging and telemetry studies versus survey and fishery monitoring

- Incorporate empirically estimated errors for the recreational landings and live releases, if possible
- Compare maturity ogives between North Carolina and Virginia
- Develop estimates of commercial discards for runaround nets

Low

- Conduct additional work to evaluate more fully the utility of the Program 120 survey; including the recruitment index data may require a higher variance to accommodate the large fluctuations observed in the survey
- Improve estimates of commercial discard mortality
- Conduct an age validation study

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8 TABLES

Table 1.1. Estimated parameter values of the von Bertalanffy age-length model fit to Spotted Seatrout data from this and previous studies, where length is measured in millimeters.

Location	Collection Dates	Gear	Structure	Sex	n	L_∞	K	t_0	Reference
Galveston Bay, Texas	October 1981–September 1982	exp gill nets (most) and hook and line	sectioned otoliths	Female		687	0.512	-0.260	Maceina et al. 1987
Galveston Bay, Texas	October 1981–September 1982	exp gill nets (most) and hook and line	sectioned otoliths	Male		664	0.179	1.939	Maceina et al. 1987
Charlotte Harbor, Florida	February 1986–January 1988	hook and line, seine, gill and trammel nets	sectioned otoliths	Female	1,102	698	0.363	0.39	Murphy and Taylor 1994
Indian River Lagoon, Florida	February 1986–January 1988	hook and line, seine, gill and trammel nets	sectioned otoliths	Female	1,195	839	0.362	0.74	Murphy and Taylor 1994
Apalachicola Bay, Florida	March 1986–January 1988	hook and line, seine, gill and trammel nets	sectioned otoliths	Female	797	818	0.350	0.68	Murphy and Taylor 1994
Virginia/North Carolina	1991–2013	various	sectioned otoliths	Female	10,914	794	0.341	-0.588	NCDMF 2015
Virginia/North Carolina	1991–2013	various	sectioned otoliths	Male	6,764	669	0.314	-0.938	NCDMF 2015
Virginia/North Carolina	1991–2019	various	sectioned otoliths	Female + unknown	14,664	868	0.263	-0.856	This study
Virginia/North Carolina	1991–2019	various	sectioned otoliths	Male + unknown	9,014	677	0.293	-1.11	This study
Virginia/North Carolina	1991–2019	various	sectioned otoliths	Pooled	24,386	885	0.217	-0.975	This study

Table 1.2. Estimated parameter values of the length-weight function fit to Spotted Seatrout data from this and previous studies, where length is measured in millimeters and weight is measured in grams.

Location	Collection Dates	Gear	Sex	n	Length Type	*a*	*b*	Reference
Indian River Lagoon, Florida	February 1986–January 1988	hook and line, seine, gill and trammel nets	Female	1,194	TL	5.75E-06	3.12	Murphy and Taylor 1994
Indian River Lagoon, Florida	February 1986–January 1988	hook and line, seine, gill and trammel nets	Male	605	TL	4.76E-06	3.17	Murphy and Taylor 1994
Apalachicola Bay, Florida	March 1986–January 1988	hook and line, seine, gill and trammel nets	Female	1,229	TL	1.47E-05	2.86	Murphy and Taylor 1994
Apalachicola Bay, Florida	March 1986–January 1988	hook and line, seine, gill and trammel nets	Male	608	TL	1.68E-05	2.81	Murphy and Taylor 1994
southeastern Louisiana coastal areas	January 1975–December 1978	trawl, cast net, hook and line, hoop net, gill net, seine, and trammel net	All	1,208	TL	5.40E-06	3.15	Hein et al. 1980
Virginia/North Carolina	1991–2013	various	Female	10,242	FL	1.07E-05	3.00	NCDMF 2015
Virginia/North Carolina	1991–2013	various	Male	6,909	FL	8.59E-06	3.05	NCDMF 2015
Virginia/North Carolina	1991–2019	various	Female	13,264	FL	1.18E-05	2.98	This study
Virginia/North Carolina	1991–2019	various	Male	9,249	FL	7.79E-06	3.04	This study
Virginia/North Carolina	1991–2019	various	Pooled	50,612	FL	1.23E-05	2.98	This study

Table 1.3. Table of seasonal estimates of median natural mortality (*M*), lower and upper credibility intervals from the working group's tag-return model (2021). Greyed-out rows below represent time steps in which no tags were released.

Season (time step)	Lower CI	Median *M*	Upper CI
Autumn 2008	0.000057	0.0035	0.29
Winter 2008	0.00014	0.46	0.94
Spring 2009	0.000068	0.072	0.86
Summer 2009	0.000058	0.0048	0.40
Autumn 2009	0.000055	0.0027	0.24
Winter 2009	0.94	1.5	2.1
Spring 2010	0.000056	0.0037	0.34
Summer 2010	0.000054	0.0017	0.12
Autumn 2010	1.6	2.3	3.1
Winter 2010	0.00021	0.58	1.3
Spring 2011	0.000058	0.0050	0.40
Summer 2011	0.0013	0.34	0.63
Autumn 2011	0.000056	0.0037	0.23
Winter 2011	0.000058	0.0055	0.36
Spring 2012	0.28	0.82	1.2
Summer 2012	0.000072	0.18	1.3
Autumn 2012	0.000063	0.023	1.6
Winter 2012	0.000061	0.020	1.9
Spring 2013	0.000062	0.022	2.1
Summer 2013	0.000060	0.017	2.2
Autumn 2013	0.000060	0.013	2.2
Winter 2013	0.000060	0.012	2.0
Spring 2014	0.000058	0.0079	1.5

Table 1.3. (*continued*) Table of seasonal estimates of median natural mortality (M), lower and upper credibility intervals from the working group's tag-return model (2021). Greyed-out rows below represent time steps in which no tags were released.

Season (time step)	**Lower CI**	**Median *M***	**Upper CI**
Summer 2014	0.000057	0.0058	1.0
Autumn 2014	0.000057	0.0031	0.30
Winter 2014	0.000080	0.48	1.5
Spring 2015	0.000059	0.0095	0.95
Summer 2015	0.000059	0.010	0.97
Autumn 2015	0.000058	0.0067	0.58
Winter 2015	0.00070	1.7	2.6
Spring 2016	0.000068	0.12	2.1
Summer 2016	0.000082	0.24	0.95
Autumn 2016	0.000059	0.010	0.49
Winter 2016	0.000062	0.023	0.79
Spring 2017	0.0028	0.73	1.2
Summer 2017	0.000054	0.0015	0.090
Autumn 2017	0.000071	0.19	1.3
Winter 2017	0.0035	1.7	2.5
Spring 2018	0.000061	0.015	1.4
Summer 2018	0.000055	0.0023	0.19
Autumn 2018	0.58	0.97	1.4
Winter 2018	0.000054	0.0022	0.15
Spring 2019	0.42	0.80	1.1
Summer 2019	0.000071	0.077	0.50
Autumn 2019	0.000058	0.0071	0.33
Winter 2019	0.000063	0.036	2.3

Table 1.4. Total mortality of Spotted Seatrout in commercial gill nets by mesh size reported in Price and Gearhart (2002).

Mesh Size (in)	n	Mortality
2.5	48	90.0%
3.0	70	90.0%
3.5	71	77.0%
4.0	57	67.0%
4.5	29	66.0%

Table 1.5. Total, at-net, and delayed mortality of Spotted Seatrout in commercial small-mesh gill nets by season reported in Price and Gearhart (2002).

	Spring/Summer	Fall/Winter
Total Mortality	82.7%	73.8%
At-Net Mortality	76.2%	61.7%
Delayed Mortality	28.9%	31.7%

Table 1.6. At-net mortality of Spotted Seatrout caught in Program 915 (mesh sizes 3–4.5" combined) by month reported in NCDMF (2012a).

Month	Mortality	n
February	20.0%	15
March	35.0%	31
April	40.0%	95
May	53.0%	185
June	75.0%	134
July	76.0%	110
August	74.0%	99
September	87.0%	224
October	64.0%	198
November	37.0%	186
December	17.0%	63
Total	60.0%	1,340

Table 1.7. Delayed mortality rates of Spotted Seatrout for high salinity (Outer Banks) and low salinity (rivers) areas reported in Price and Gearhart (2002).

	Outer Banks	**Rivers**
Spring/Summer	41.7%	23.1%
Fall/Winter	36.4%	26.3%

Table 1.8. Summary of recreational fishery release mortality estimates from a review of the literature.

Location	**Mortality Estimate**	**Notes**	**Reference**
Texas	up to 55.6%	artificial and natural baits	Matlock and Dailey 1981
Texas	7.30%	artificial and natural baits	Matlock et al. 1993
Texas	37.0%	artificial and natural baits	Hegen et al. 1983
Texas	11.0%	artificial and natural baits	Stunz and McKee 2006
Florida	4.60%	hook and line	Murphy et al. 1995
Louisiana	17.5%	artificial and natural baits	Thomas et al. 1997
Alabama	14.1%	treble hooks (1994)	Duffy 2002
Alabama	16.3%	single hooks (1994)	Duffy 2002
Alabama	9.10%	treble hooks (1995)	Duffy 2002
Alabama	14.6%	single hooks (1995)	Duffy 2002
North Carolina (River & Outer Banks sites in Pamlico, Core, & Roanoke sounds)	14.8%	artificial and natural baits	Gearhart 2002
North Carolina (Neuse River)	25.2%	artificial and natural baits	Brown 2007

Table 2.1. Number of Spotted Seatrout lengths sampled from Virginia's commercial fisheries by season, 1991–2019. Season 1 is March through November and season 2 is December through February.

Fishing Year	Season 1	Season 2
1991	864	4
1992	311	0
1993	254	0
1994	680	8
1995	257	0
1996	71	9
1997	194	1
1998	537	28
1999	1,379	21
2000	181	2
2001	174	33
2002	491	0
2003	97	0
2004	184	0
2005	228	0
2006	698	114
2007	284	0
2008	205	0
2009	347	1
2010	231	0
2011	483	19
2012	776	0
2013	253	241
2014	646	616
2015	342	10
2016	852	4
2017	1,383	18
2018	876	13
2019	2,104	0

Table 2.2. Number of Spotted Seatrout lengths sampled from North Carolina's commercial fisheries by season, 1991–2019. Season 1 is March through November and season 2 is December through February.

Fishing Year	Season 1	Season 2
1991	1,098	332
1992	1,681	347
1993	1,039	116
1994	598	435
1995	1,328	162
1996	630	30
1997	3,098	362
1998	3,649	698
1999	4,314	1,091
2000	1,701	233
2001	1,142	353
2002	2,575	958
2003	1,032	335
2004	1,638	638
2005	1,324	168
2006	3,969	2,005
2007	4,322	1,692
2008	3,463	740
2009	4,471	2,148
2010	1,546	354
2011	926	200
2012	2,866	2,235
2013	3,041	862
2014	1,758	1,071
2015	885	440
2016	2,237	530
2017	1,543	404
2018	434	99
2019	2,046	996

Table 2.3. Annual commercial fishery landings (metric tons) of Spotted Seatrout by state and season, 1991–2019.

Fishing Year	North Carolina		Virginia		Combined	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1991	245.1	89.78	9.28	0.77	254.4	90.55
1992	172.8	45.92	3.93	0.08	176.7	46
1993	152.8	68.34	16.62	0.56	169.5	68.9
1994	123.3	94.07	19.75	0.54	143.1	94.62
1995	141.8	103.6	11.9	1.19	153.7	104.8
1996	45.53	19.21	1.83	0.13	47.36	19.34
1997	77.86	26.09	5.05	0.25	82.91	26.34
1998	114.8	54.29	9.21	0.8	124.0	55.09
1999	161.1	145.1	16.83	0.67	178.0	145.8
2000	57.03	30.12	8.81	0.02	65.84	30.13
2001	29.73	11.04	8.87	0.51	38.6	11.55
2002	54.22	46.77	3.88	0.06	58.1	46.82
2003	42.67	22.68	2.39	0.03	45.07	22.71
2004	38.4	19.4	4.75	0.05	43.15	19.46
2005	40.25	15.97	7.31	0.51	47.56	16.48
2006	101.1	73.79	21.14	1.96	122.2	75.75
2007	105.7	41.82	16.11	0.78	121.8	42.6
2008	90.27	54.16	20.3	0.33	110.6	54.49
2009	93.99	70.57	10.9	0.5	104.9	71.06
2010	38.54	12.58	8.64	0.13	47.18	12.71
2011	24.04	14	6.89	0.71	30.93	14.71
2012	89.17	53.77	52.56	0.01	141.7	53.78
2013	115.3	49.83	17.11	9.89	132.4	59.72
2014	59.87	42.83	30.77	1.63	90.63	44.46
2015	30.89	21.52	2.06	0.13	32.95	21.65
2016	80.55	43.66	7.17	0.06	87.73	43.72
2017	86.07	31.6	24.94	0.38	111.0	31.98
2018	34.25	34.56	7.05	0.97	41.31	35.53
2019	111.3	89.94	45.37	0.44	156.7	90.38

Table 2.4. Numbers of Spotted Seatrout sampled and measured by MRIP by state and season, 1991–2019.

Fishing Year	North Carolina n Sampled	North Carolina n Measured	Virginia n Sampled	Virginia n Measured
1991	1,306	745	52	46
1992	924	543	59	57
1993	668	485	89	69
1994	1,545	1,076	263	195
1995	1,299	853	170	152
1996	637	307	84	72
1997	897	622	144	109
1998	920	551	48	46
1999	920	699	115	97
2000	512	330	82	75
2001	462	326	18	18
2002	396	283	27	23
2003	204	130	110	80
2004	578	294	77	71
2005	1,051	664	21	17
2006	1,492	706	47	30
2007	1,304	521	168	103
2008	1,133	790	152	108
2009	1,054	779	56	45
2010	444	336	42	32
2011	754	638	86	67
2012	1,418	939	164	85
2013	1,032	865	79	57
2014	546	381	56	45
2015	192	154	6	6
2016	841	647	106	102
2017	1,385	864	202	143
2018	376	274	133	114
2019	2,264	1,574		

Table 2.5. Annual recreational fishery statistics of Spotted Seatrout in North Carolina and Virginia in season 1 (March–November), 1991–2019.

Fishing Year	Harvest (A+B1)				Released Alive (B2)		Dead Discards
	Number	PSE[Num]	Metric Tons	PSE[Mt]	Number	PSE[Num]	Number
1991	1,127,571	11	728	6.77	650,402	13	65,040
1992	1,010,921	15	728	11.03	482,724	27	48,272
1993	788,468	13	589	9.6	576,261	21	57,626
1994	956,829	11	672	7.74	897,975	22	89,798
1995	853,501	13	583	7.03	1,009,116	20	100,912
1996	697,510	22	444	11.21	1,038,455	16	103,846
1997	810,741	13	587	8.71	510,047	13	51,005
1998	755,707	15	566	11.08	258,222	14	25,822
1999	1,311,626	13	1,101	10.34	882,511	20	88,251
2000	846,779	17	616	11.41	528,706	12	52,871
2001	501,885	14	318	10.09	655,730	16	65,573
2002	770,225	25	456	14.28	1,694,938	22	169,494
2003	477,748	14	346	8.49	864,791	24	86,479
2004	492,830	12	307	7.79	889,658	10	88,966
2005	1,381,561	41	724	22.09	3,147,563	34	314,756
2006	1,330,493	18	870	11.97	1,706,549	21	170,655
2007	1,191,955	13	934	7.3	2,038,182	16	203,818
2008	1,407,530	15	1,101	11.86	2,788,068	17	278,807
2009	1,651,295	17	1,158	11.16	4,003,605	29	400,361
2010	634,770	26	587	18.67	8,373,833	13	837,383
2011	920,058	17	833	14.35	7,932,476	15	793,248
2012	1,657,128	9.7	1,256	7.56	4,837,791	8.4	483,779
2013	1,073,405	9.8	877	7.52	3,911,490	11	391,149
2014	629,683	14	512	9.07	3,533,416	14	353,342
2015	203,825	21	164	14.34	3,215,331	17	321,533
2016	1,039,799	10	862	8.79	8,445,350	13	844,535
2017	1,123,038	12	907	8.04	6,991,950	11	699,195
2018	566,162	15	350	10.21	18,635,273	38	1,863,527
2019	2,149,484	12	1,769	8.64	7,850,741	13	785,074

Table 2.6. Annual recreational fishery statistics of Spotted Seatrout in North Carolina and Virginia in season 2 (December–February), 1991–2019.

Fishing Year	Harvest (A+B1)				Released Alive (B2)		Dead Discards
	Number	PSE[Num]	Metric Tons	PSE[Mt]	Number	PSE[Num]	Number
1991	41,005	61	33	35	50,028	99	5,003
1992	1,087	0	0.60	0	3,261	0	326
1993	27,883	0	23	0	19,362	0	1,936
1994	98,823	43	79	29	55,785	62	5,579
1995	217,622	15	177	11	147,337	34	14,734
1996	7,389	23	6.2	8.5	5,889	0	589
1997	105,912	40	89	23	15,050	37	1,505
1998	27,781	0	23	0	6,623	0	662
1999	67,402	26	69	18	90,540	66	9,054
2000	14,245	9.9	18	14	4,256	0	426
2001	26,273	36	10	19	46,462	2.3	4,646
2002	1,802	0	1.5	0	2,859	0	286
2003	41,135	50	23	43	22,454	85	2,245
2004	182,668	35	125	23	135,967	47	13,597
2005	233,449	19	134	10	383,235	21	38,324
2006	181,319	32	145	25	41,727	68	4,173
2007	414,157	19	352	13	840,604	28	84,060
2008	202,212	47	128	18	342,387	12	34,239
2009	266,973	38	197	27	1,008,131	19	100,813
2010	65,895	49	49	32	1,895,812	74	189,581
2011	482,267	8.6	490	6.3	3,110,866	24	311,087
2012	401,412	18	311	13	1,238,806	21.1	123,881
2013	135,866	34	183	33	1,381,484	15	138,148
2014	192,199	14	165	9.1	1,084,535	18	108,454
2015	21,940	47	11	33	3,004,582	40	300,458
2016	254,412	33	207	23	1,363,890	17	136,389
2017	103,749	30	89	21	688,599	34	68,860
2018	122,938	28	83	20	2,246,592	21	224,659
2019	862,336	21	716	13	2,065,385	18	206,539

Table 2.7. Number of length samples collected in Program 915, 2003–2019.

Fishing Year	Spring	Fall
2003		74
2004	23	65
2005	21	58
2006	115	204
2007	124	127
2008	113	166
2009	216	197
2010	62	126
2011	17	84
2012	129	177
2013	146	144
2014	103	134
2015	47	80
2016	49	152
2017	91	153
2018	35	103
2019	215	358

Table 3.1. Input data overview.

Data	Unit	CV/SE	Availability	Length composition	State
Landings					
ComLanding	Number	0.05	1991–2019	1991–2019	NC and VA
RecLanding	Number	0.1	1991–2019	1991–2019	NC and VA
Discards					
ComDiscard	Number	0.25	1991–2019	NA	NC
RecDiscard	Number	0.25	1991–2019	NA	NC and VA
Indices					
P915NorthSpring	Number per unit effort	Estimated	2004–2019	2004–2019	NC
P915NorthFall	Number per unit effort	Estimated	2003–2019	2003–2019	NC

Table 3.2. Overview of the sensitivity analyses.

Scenario	Configurations
P915Srm	P915NorthSpring survey index and length composition were removed
P915Frm	P915NorthFall survey index and length composition were removed
Ini2003	Initial year was set to 2003
LowM	Annual average natural mortality was set to 0.4, lower than the base model (0.6)
HighM	Annual average natural mortality was set to 0.8, higher than the base model (0.6)
Low2018	Season 1 (non-winter, March-November) recreational discards was set to the average of the previous five years (2013–2017; 521.951 thousands of fish), lower than the base model (1,863.527 thousands of fish)
Block	Two time blocks were set up for fleet selectivity, 1991–2008 and 2009–2019

Table 3.3. Results of the runs test for randomness and the Shapiro-Wilk test for normality applied to the residuals of the fits to the fishery-independent survey indices from the base model of the stock assessment. The significance level was set at 0.05.

Survey	Runs test		Shapiro-Wilk	
	Statistic	P-value	Statistic	P-value
P915NorthSpring	-1.553	0.121	0.916	0.148
P915NorthFall	-1.035	0.301	0.954	0.531

Table 3.4. Predicted fishing mortality (per year) and spawning stock biomass (metric tons) from the base model (Base) and the retrospective runs (Retro), the relative bias (RelBias), and the Mohn's ρ value from the retrospective analysis in which the model started with the data from 1991 to 2014, and added one additional year of data at a time up to 2019.

Year	Base	Retro	RelBias
Fishing mortality (per year)			
2014	0.541	0.592	0.094
2015	0.241	0.427	0.772
2016	0.578	1.060	0.835
2017	0.656	0.920	0.402
2018	0.434	1.175	1.706
Mohn's ρ			0.762
Spawning stock biomass (metric tons)			
2014	1,851.341	1,849.510	-0.001
2015	1,870.260	1,314.664	-0.297
2016	2,298.879	1,439.140	-0.374
2017	2,141.867	1,668.463	-0.221
2018	2,350.865	1,117.150	-0.525
Mohn's ρ			-0.284

9 FIGURES

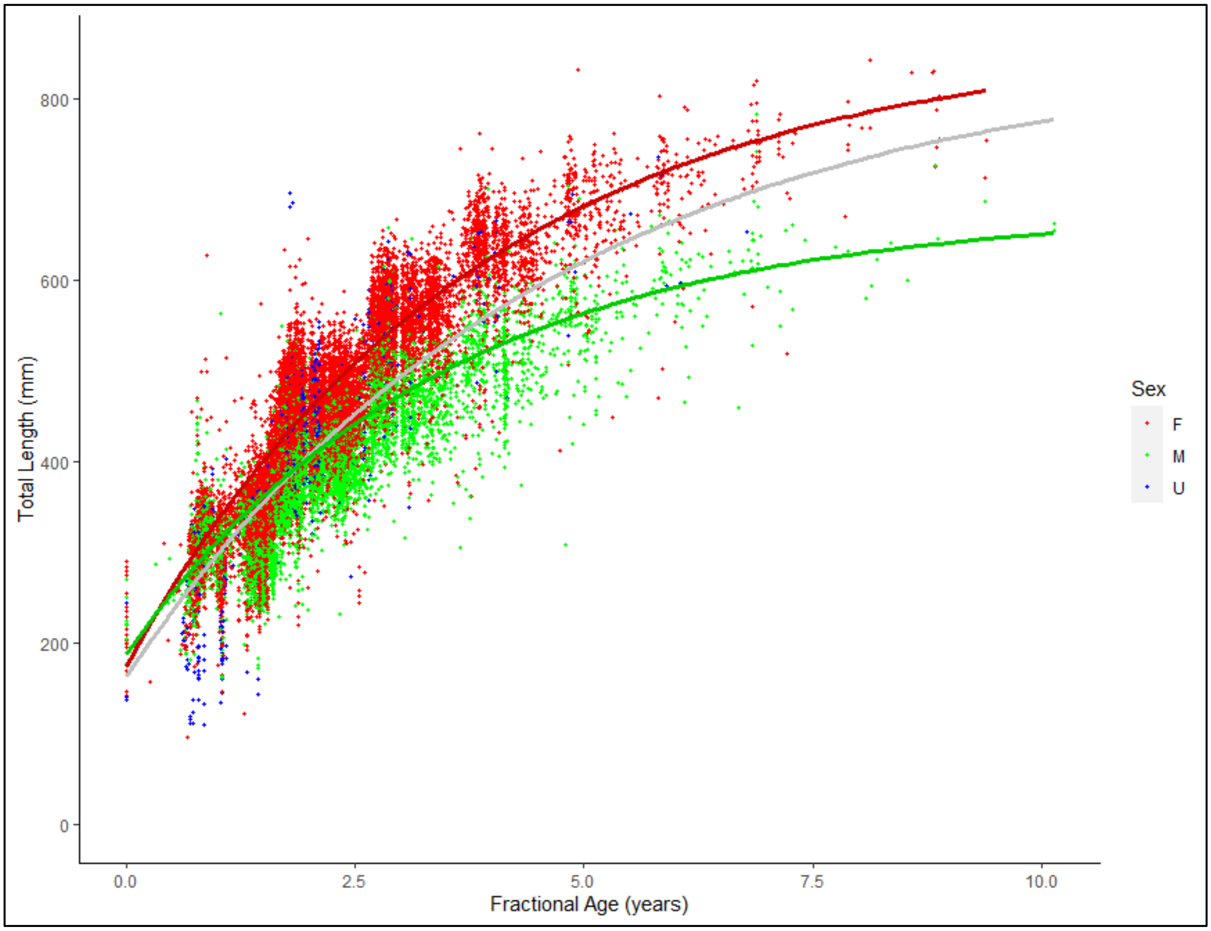

Figure 1.1. Fit of the length-at-age function to available age data for females (red line, n=14,664), males (green line, n = 9,014), and sex-aggregated (grey line, n=24,386) Spotted Seatrout data from Virginia and North Carolina.

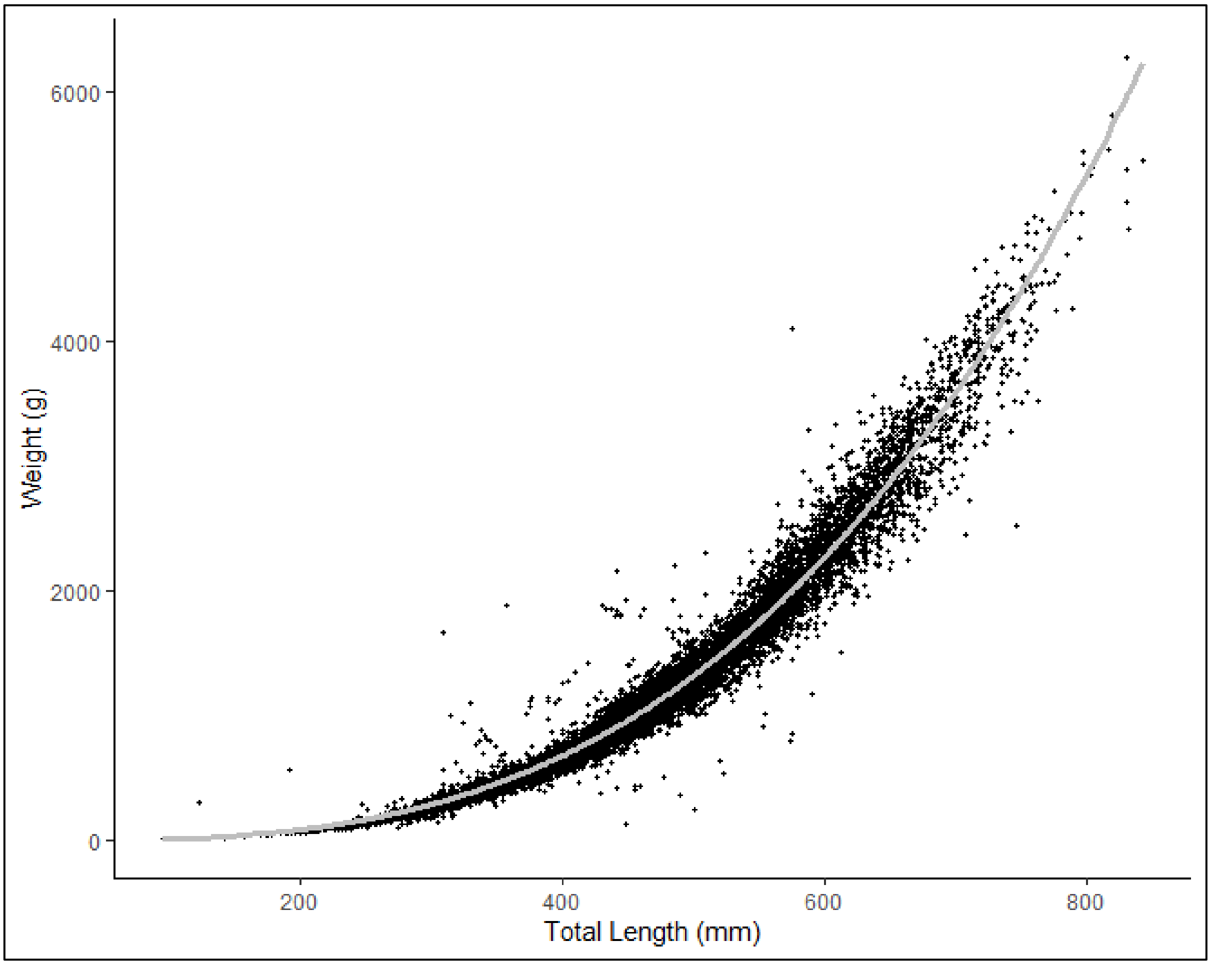

Figure 1.2. Fit of the length-weight function to available biological data for female Spotted Seatrout from Virginia and North Carolina (n = 13,264).

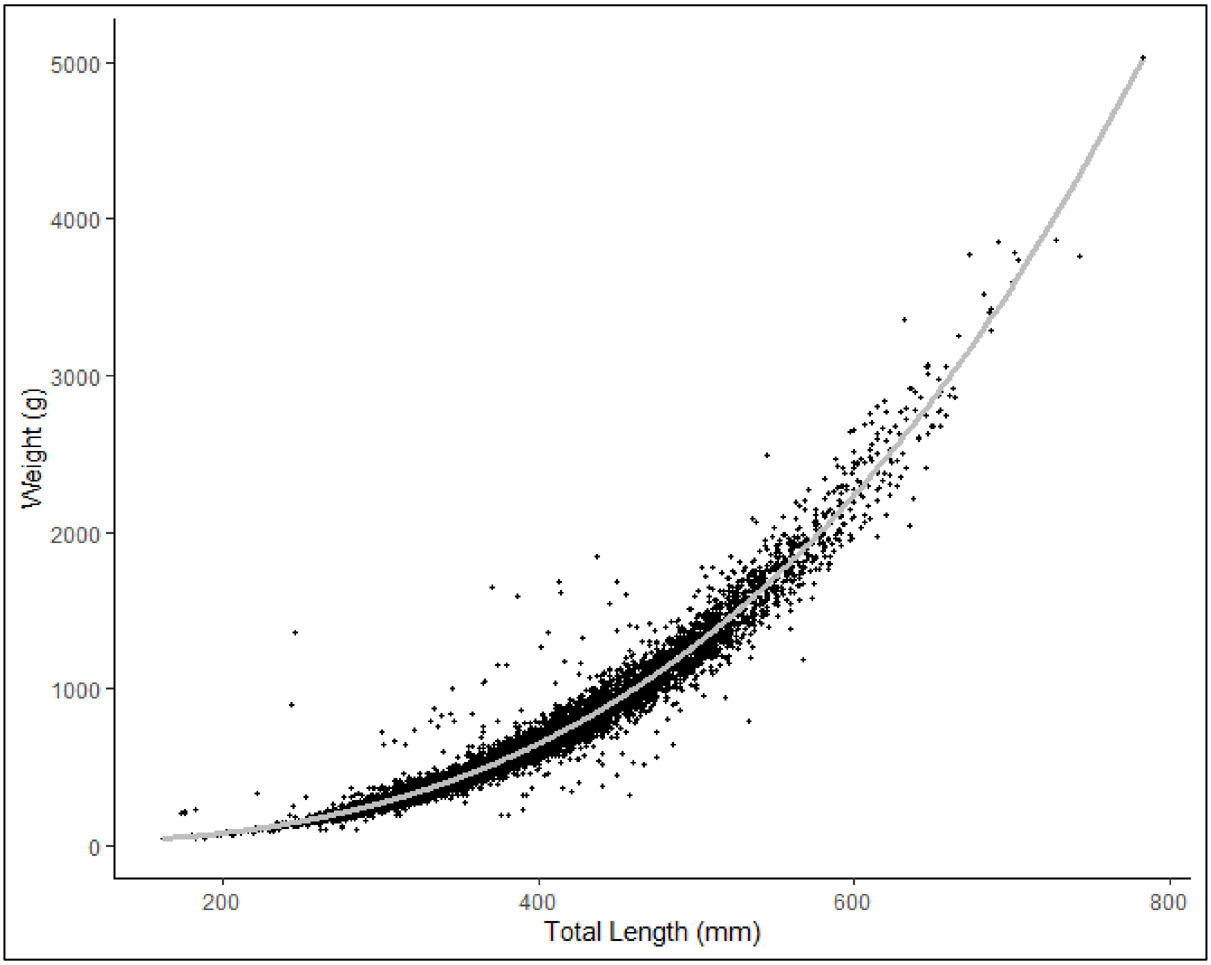

Figure 1.3. Fit of the length-weight function to available biological data for male Spotted Seatrout from Virginia and North Carolina (n = 9,249).

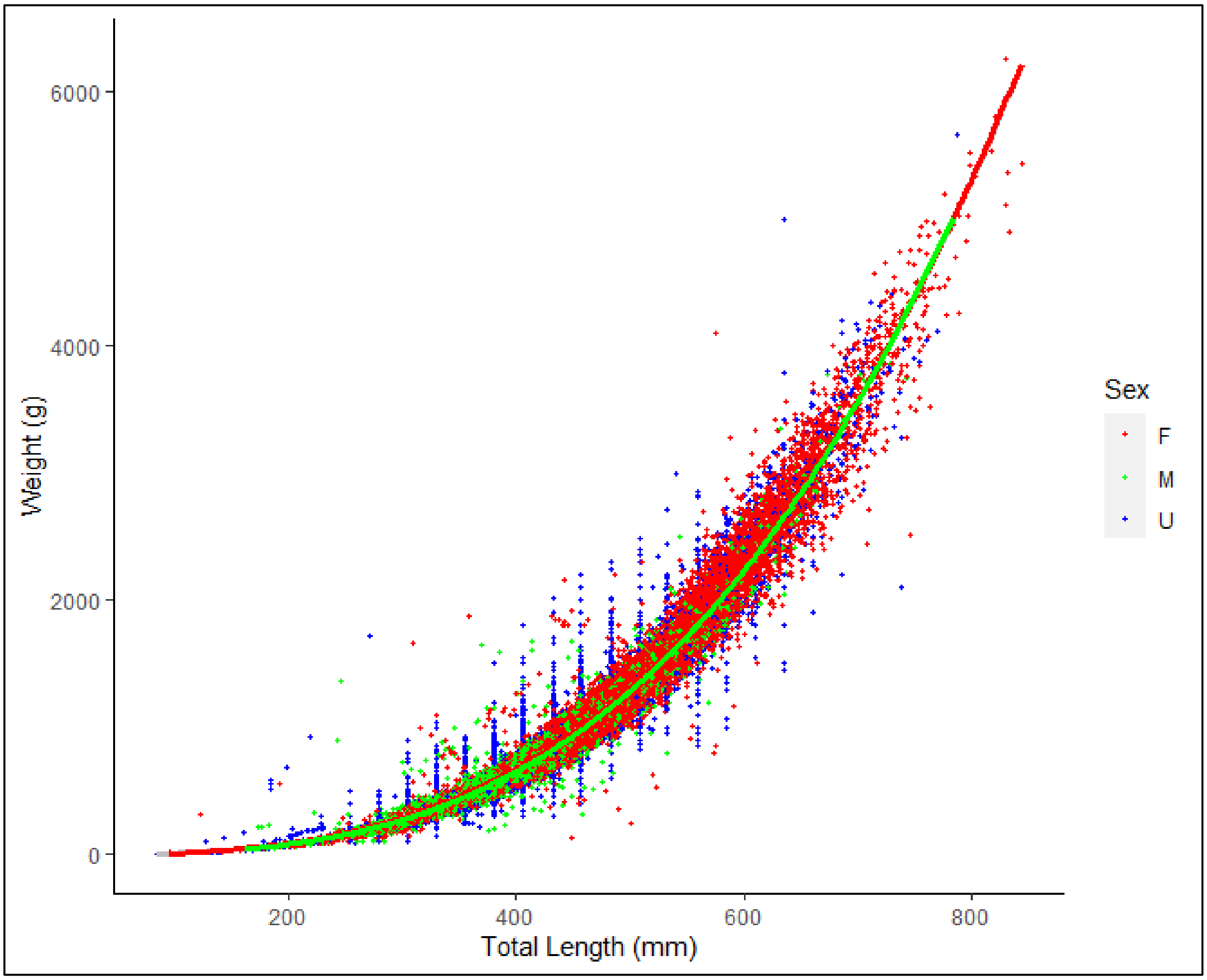

Figure 1.4. Fit of the length-weight function to available biological data for females (red line, n = 13,264), males (green line, n = 9,249), and sex-aggregated including unknown (grey line, n = 50,612) of Spotted Seatrout from Virginia and North Carolina. Sex categories of individual data points include female (F), male (M), and unknown (U).

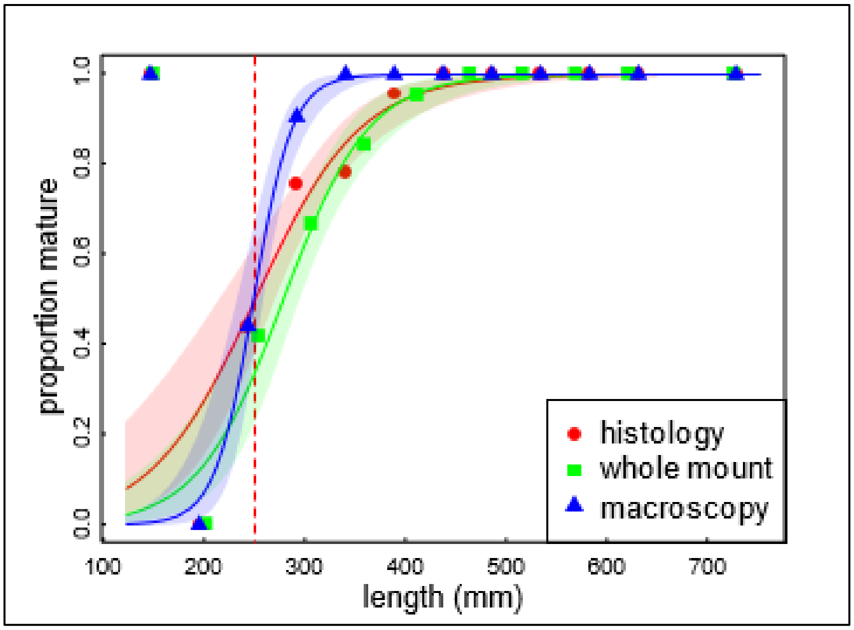

Figure 1.5. Fit of maturity curves to female Spotted Seatrout data collected in North Carolina for three maturity staging methods. The solid lines represent the best-fitting logistic regression and the shaded area represent the 95% confidence bands. The vertical dashed lines represent the predicted length at 50% maturity, L_{50}. The points represent the observed data. (Source: NCDMF 2021.)

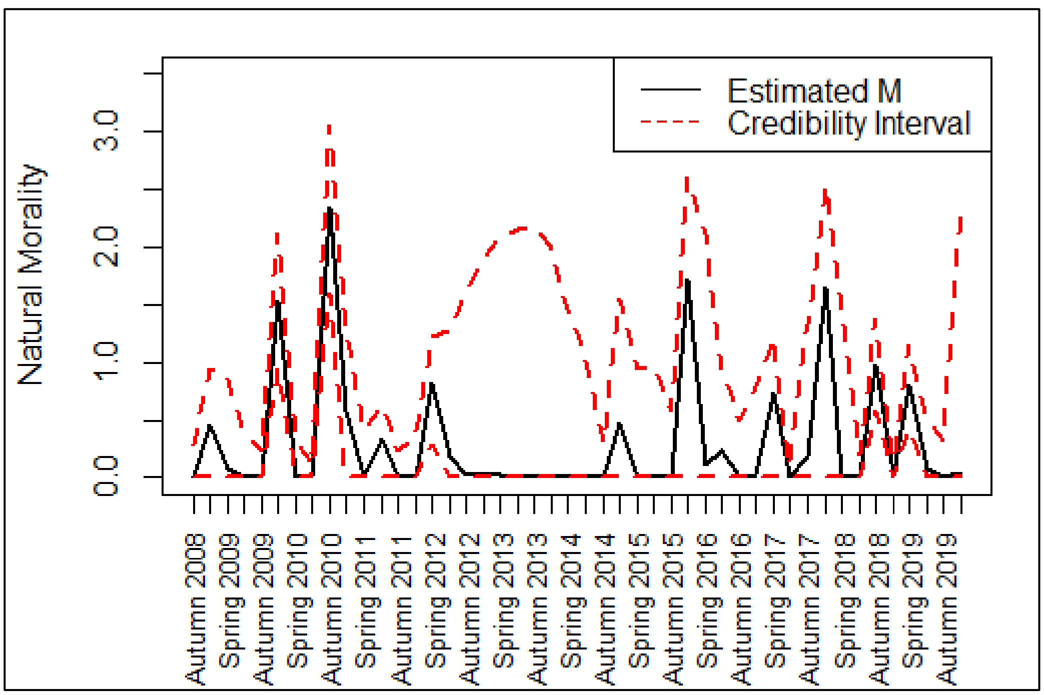

Figure 1.6. Time series plot of seasonal estimates of median natural mortality (black line) and lower and upper credibility intervals (red dashed line) from the working group's tag-return model (2021) from autumn 2008 until winter 2019.

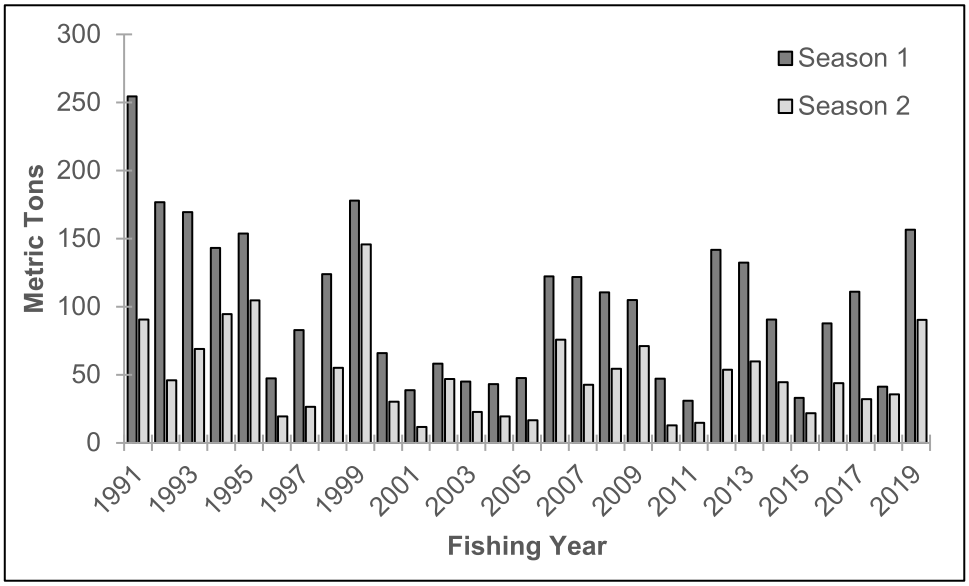

Figure 2.1. Annual commercial landings of Spotted Seatrout in Virginia and North Carolina by season, 1991–2019.

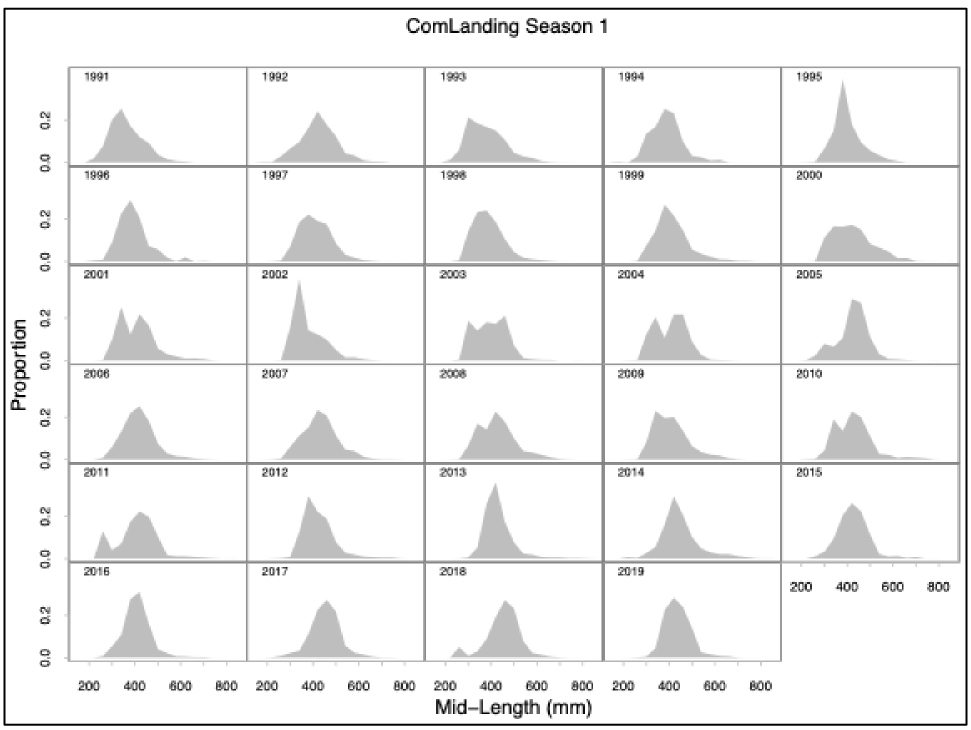

Figure 2.2. Length composition of commercial landings of Spotted Seatrout in Virginia and North Carolina in Season 1 (non-winter season, March–November), 1991–2019.

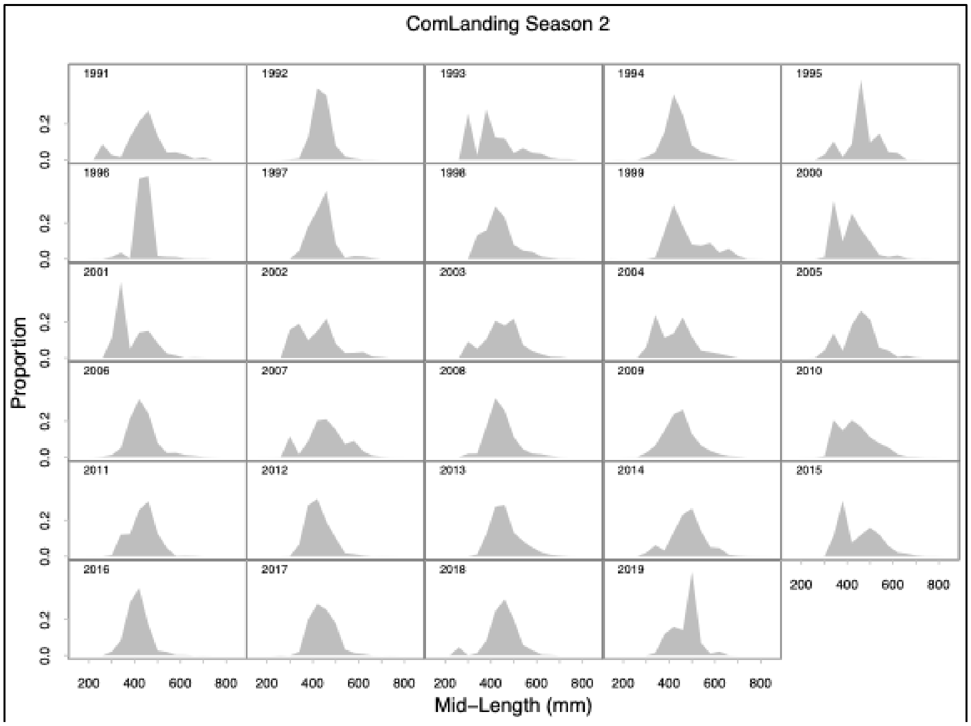

Figure 2.3. Length composition of commercial landings of Spotted Seatrout in Virginia and North Carolina in Season 2 (winter season, December–February), 1991–2019.

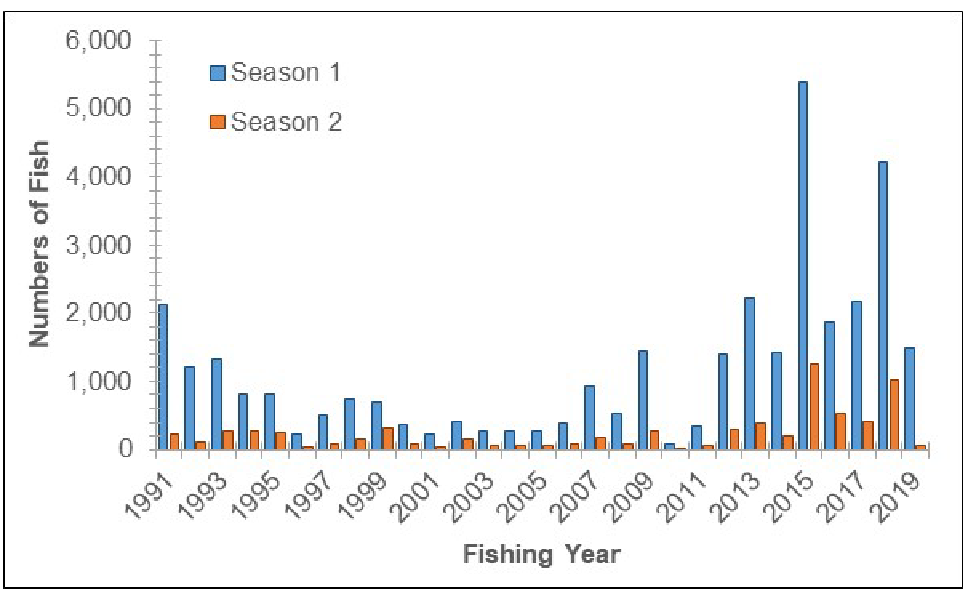

Figure 2.4. Annual commercial gill-net fishery dead discards of Spotted Seatrout in North Carolina by season, 1991–2019.

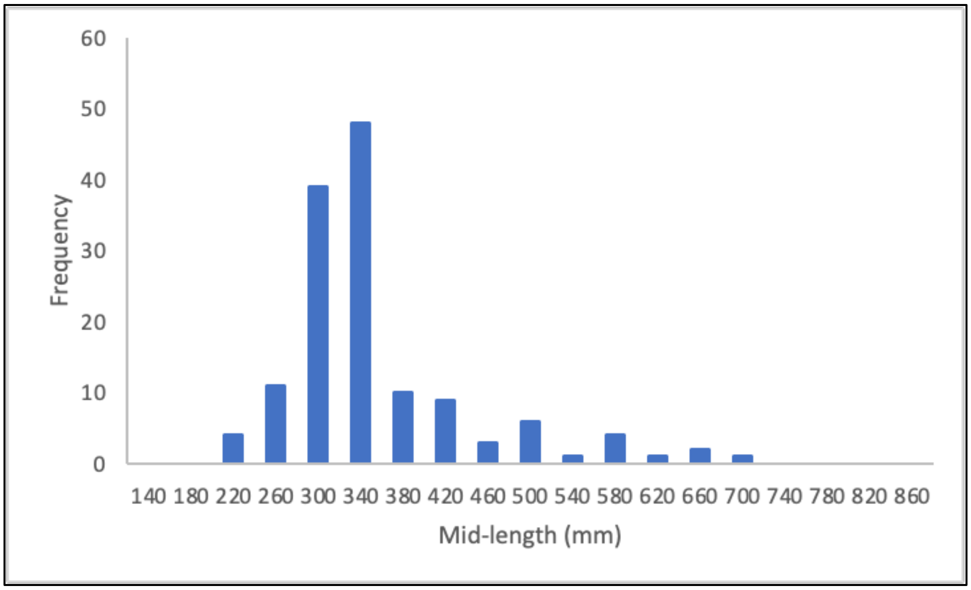

Figure 2.5. Annual length-frequency distributions of Spotted Seatrout sampled from North Carolina commercial gill-net estuarine fishery discards (pooled over years and seasons), 2004–2019.

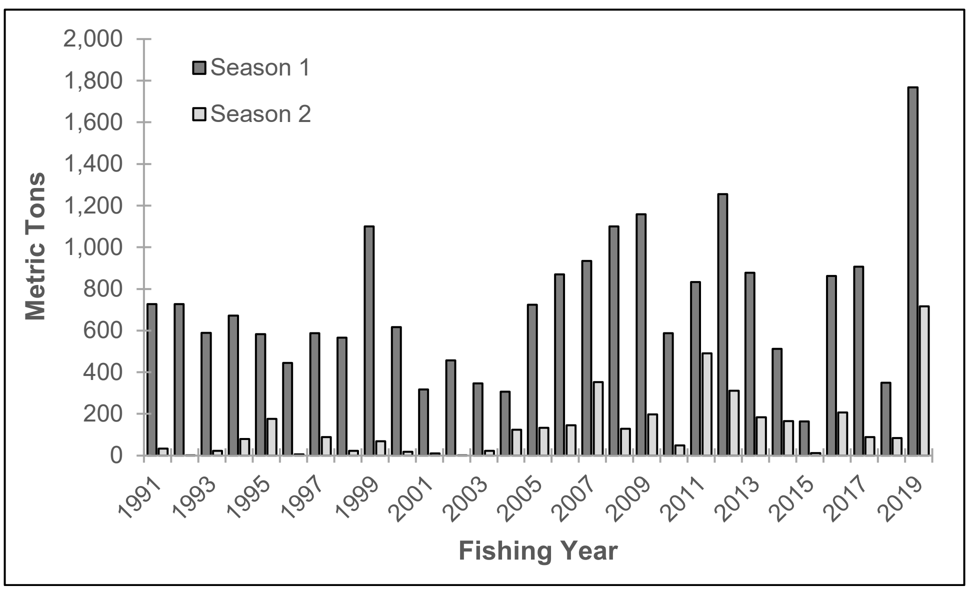

Figure 2.6. Annual recreational harvest (Type A+B1) in weight of Spotted Seatrout in Virginia and North Carolina by season, 1991–2019.

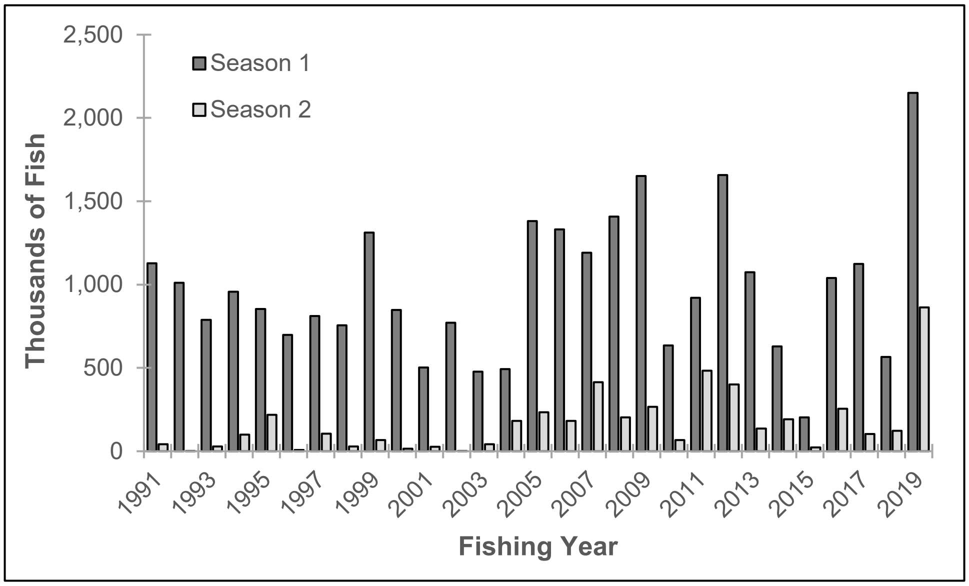

Figure 2.7. Annual recreational harvest (Type A+B1) in numbers of Spotted Seatrout in Virginia and North Carolina by season, 1991–2019.

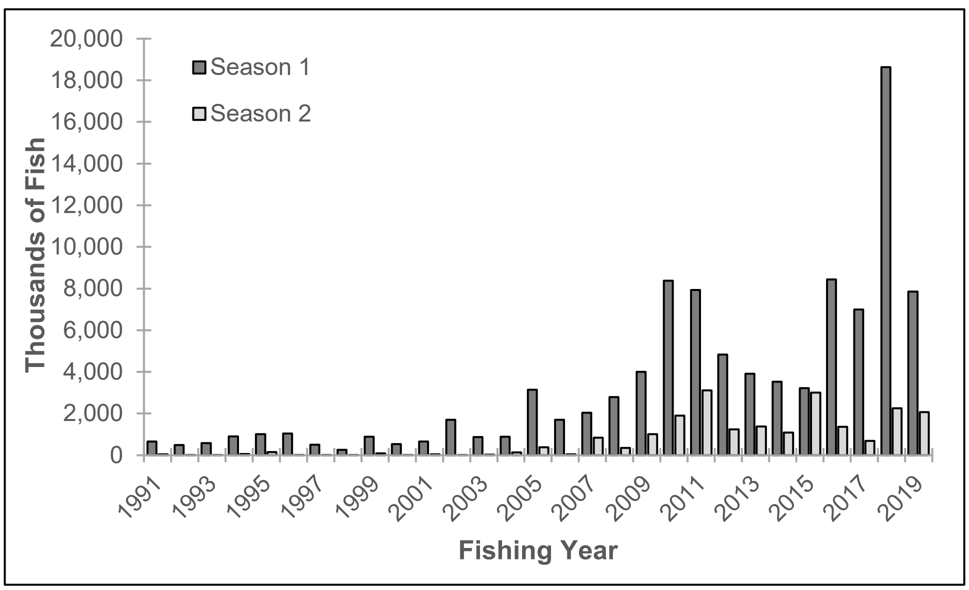

Figure 2.8. Annual recreational live releases (Type B2) in numbers of Spotted Seatrout in Virginia and North Carolina by season, 1991–2019.

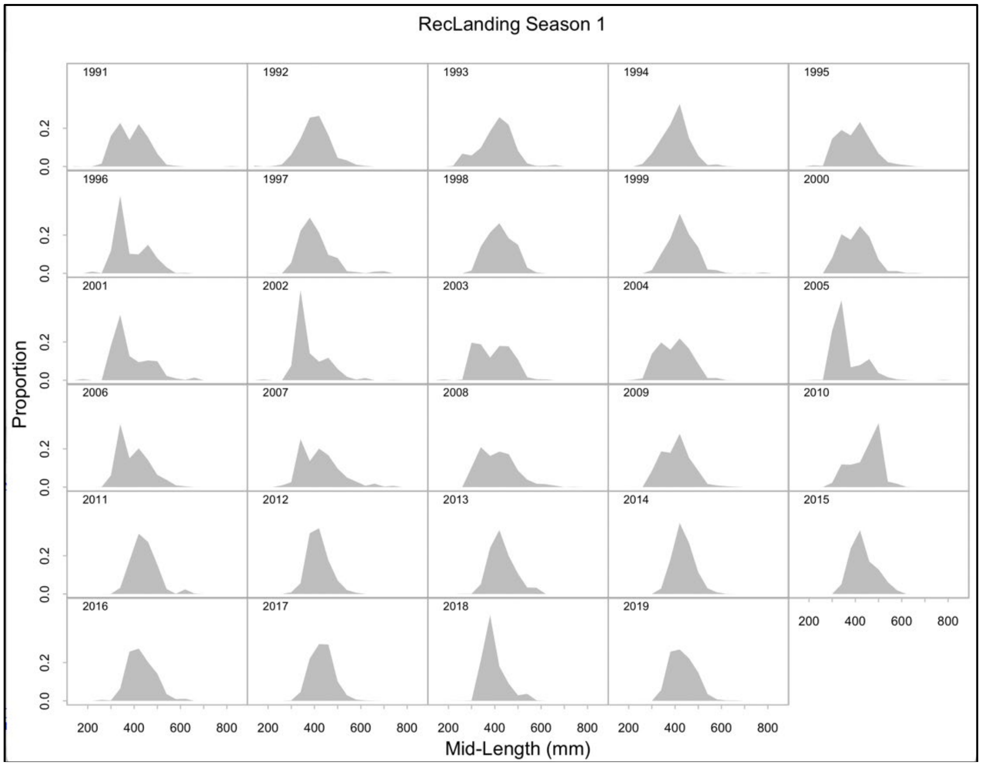

Figure 2.9. Length composition of recreational landings of Spotted Seatrout in Virginia and North Carolina in Season 1 (non-winter season, March–November), 1991–2019.

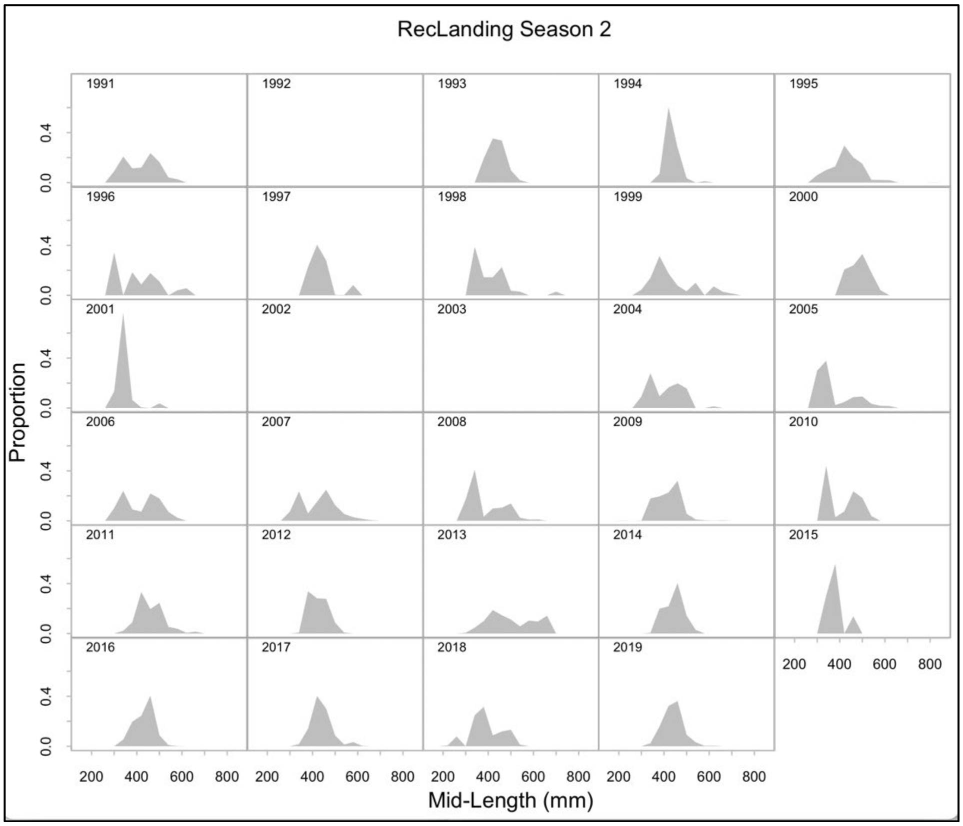

Figure 2.10. Length composition of recreational landings of Spotted Seatrout in Virginia and North Carolina in Season 2 (winter season, December–February), 1991–2019.

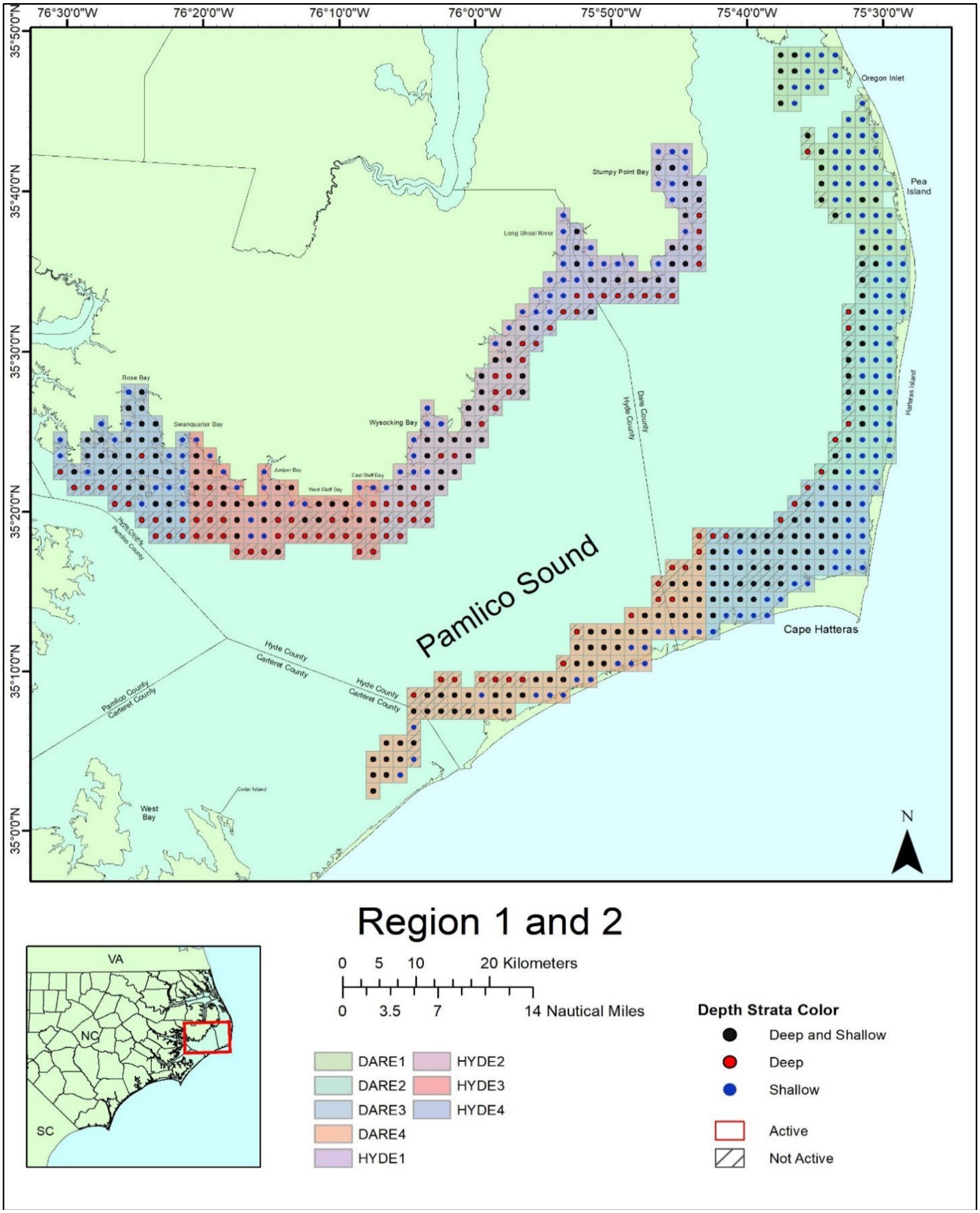

Figure 2.11. The sample regions and grid system for the Pamlico Sound portion of Program 915.

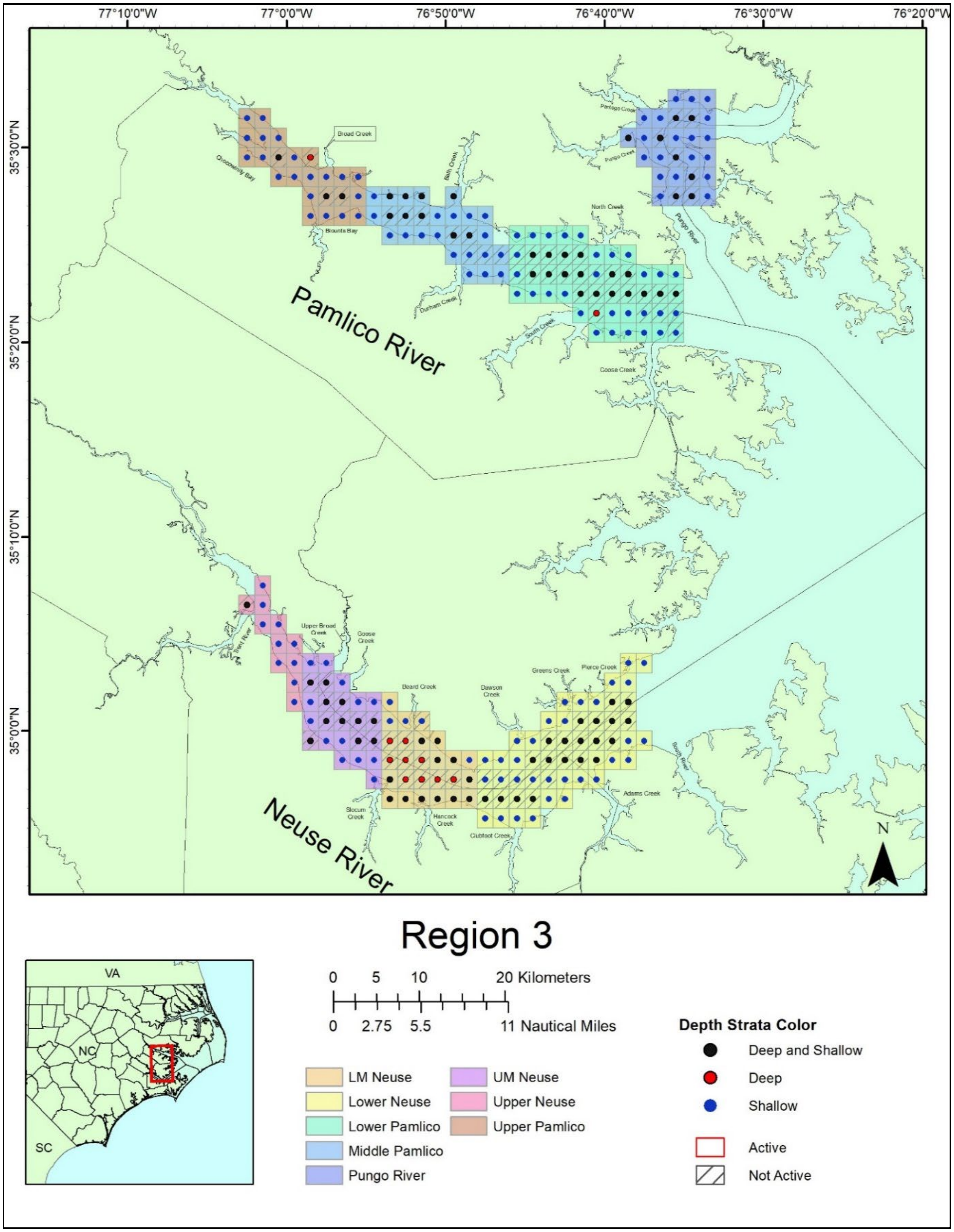

Figure 2.12. The sample regions and grid system for the Neuse, Pamlico, and Pungo rivers portion of Program 915.

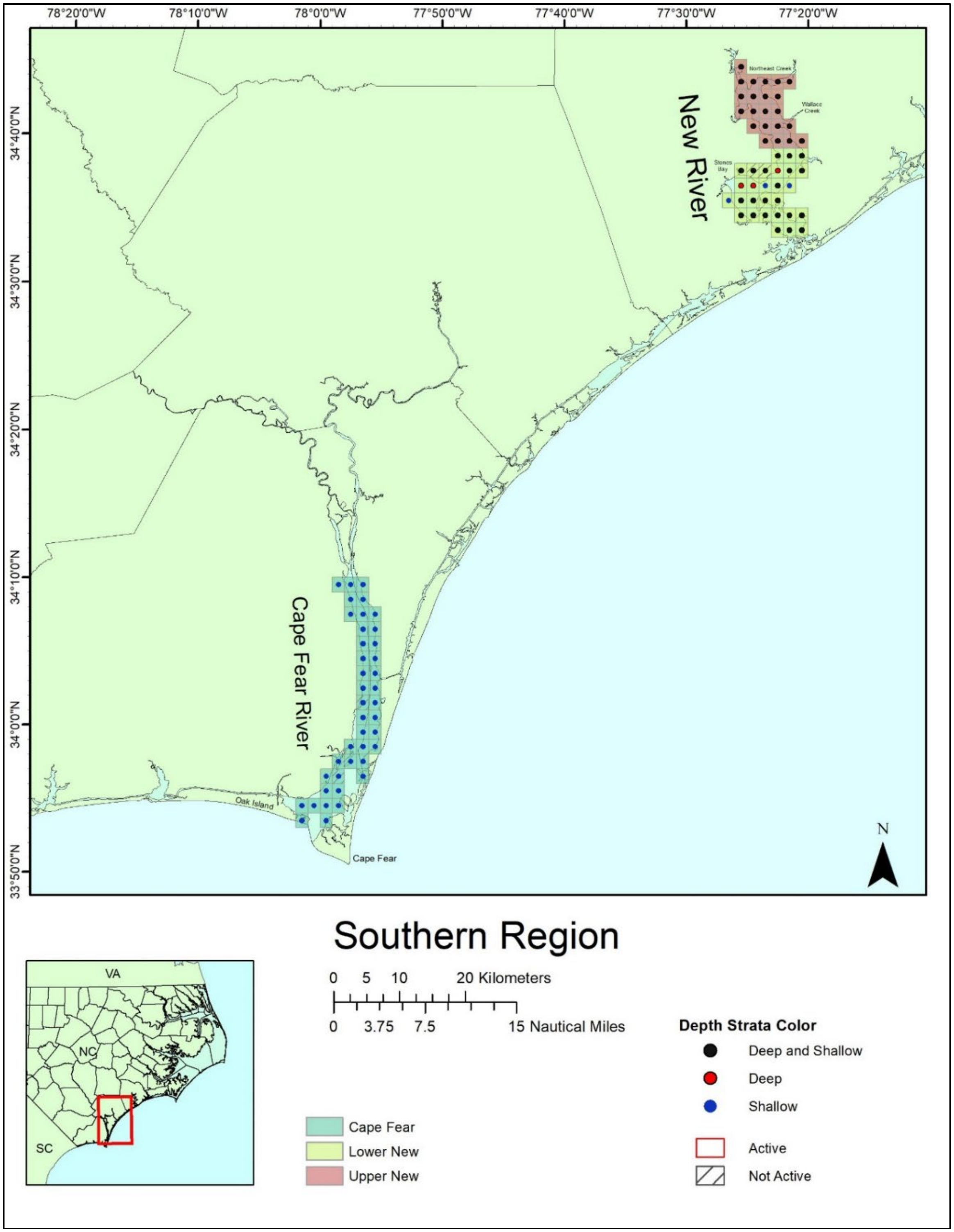

Figure 2.13. The sample regions and grid system for the New and Cape Fear rivers portion of Program 915.

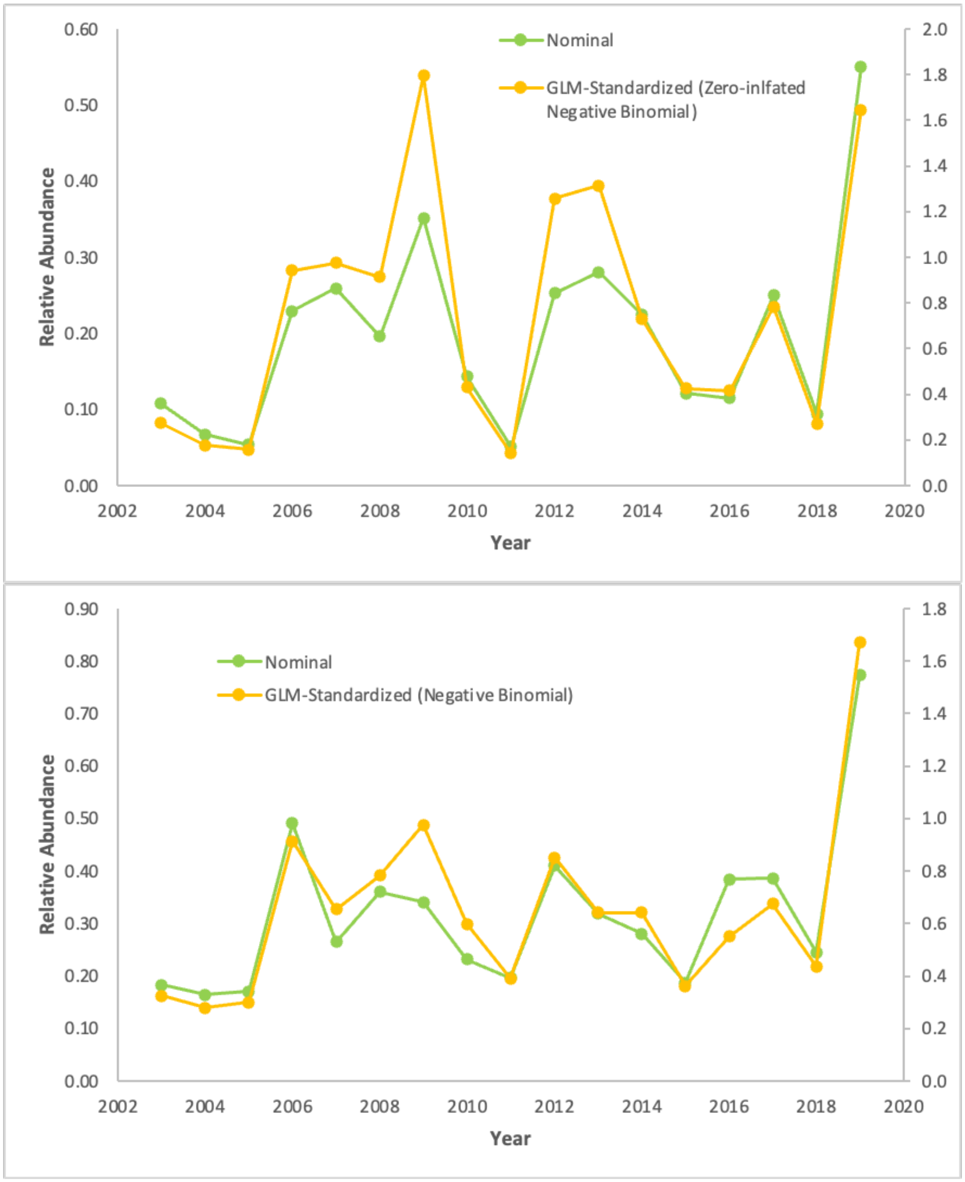

Figure 2.14. Nominal and standardized abundance indices of Program 915 spring (top) and fall (bottom) surveys, 2003–2019.

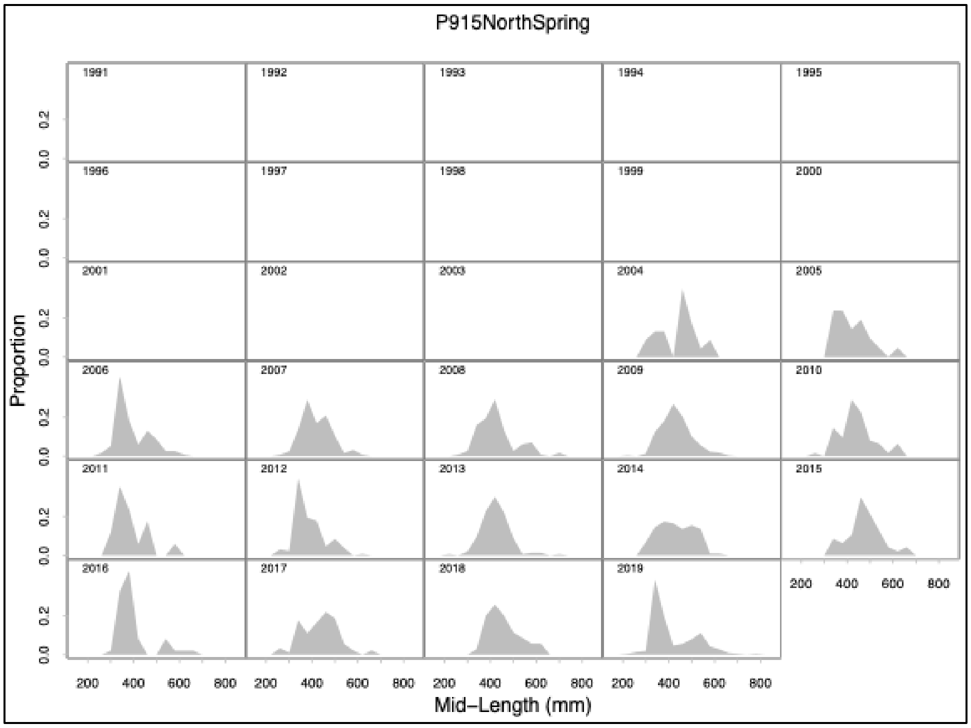

Figure 2.15. Length composition of Program 915 spring survey of Spotted Seatrout, 2004–2019.

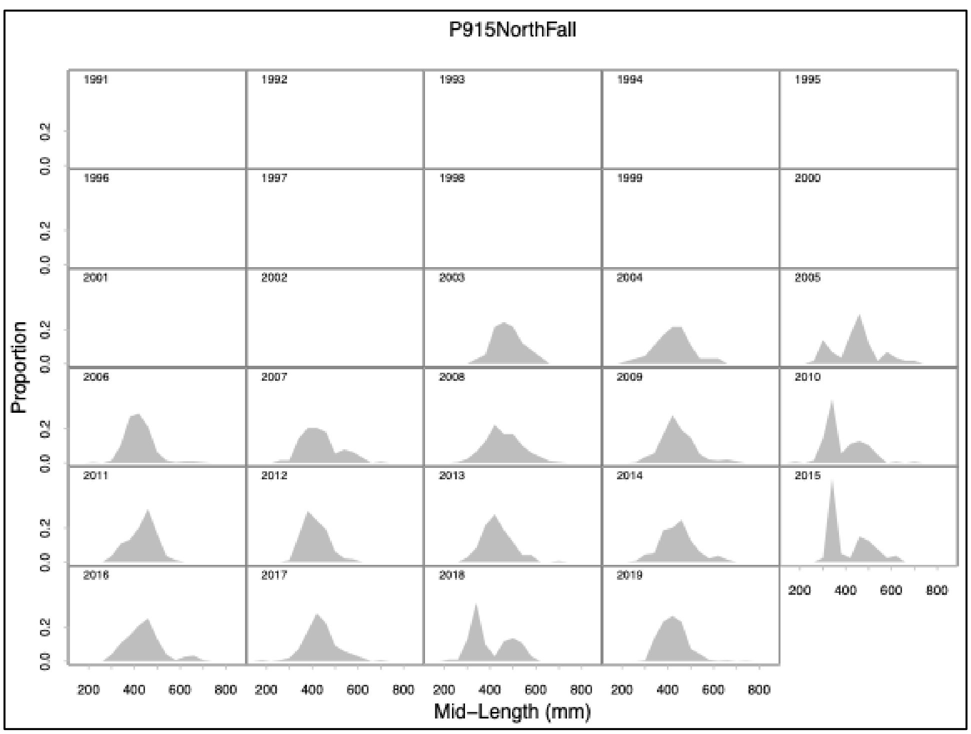

Figure 2.16. Length composition of Program 915 fall survey of Spotted Seatrout, 2003–2019.

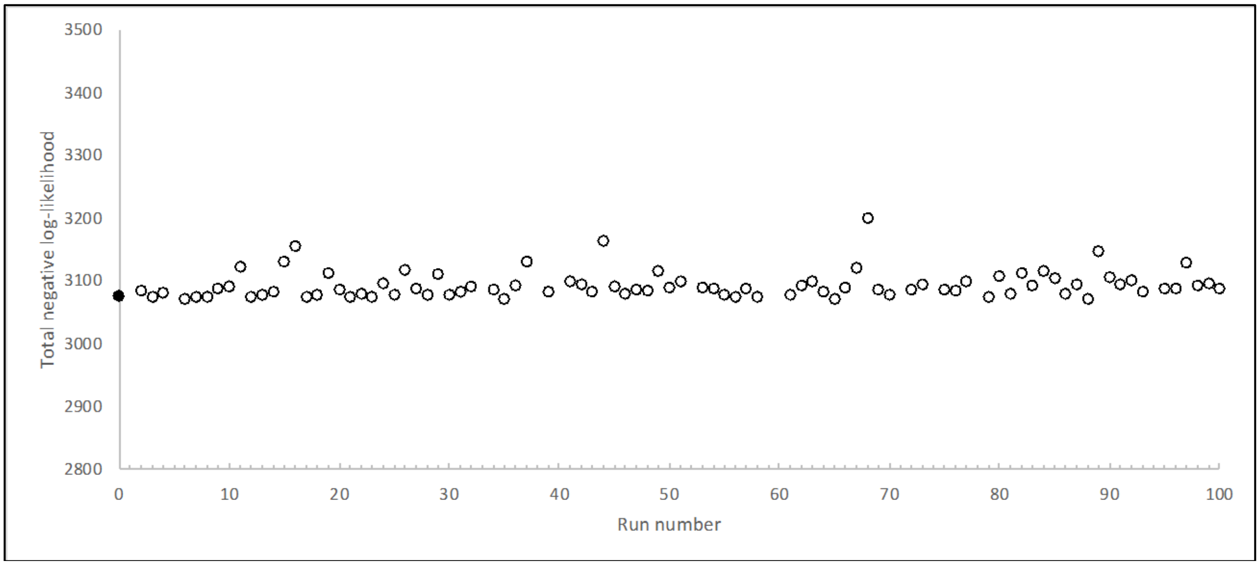

Figure 3.1. Negative log-likelihood values produced from the 100 jitter runs in which initial parameter values were jittered by 10%. The solid black circle is the value from the base model. Figure only shows values from the converged runs.

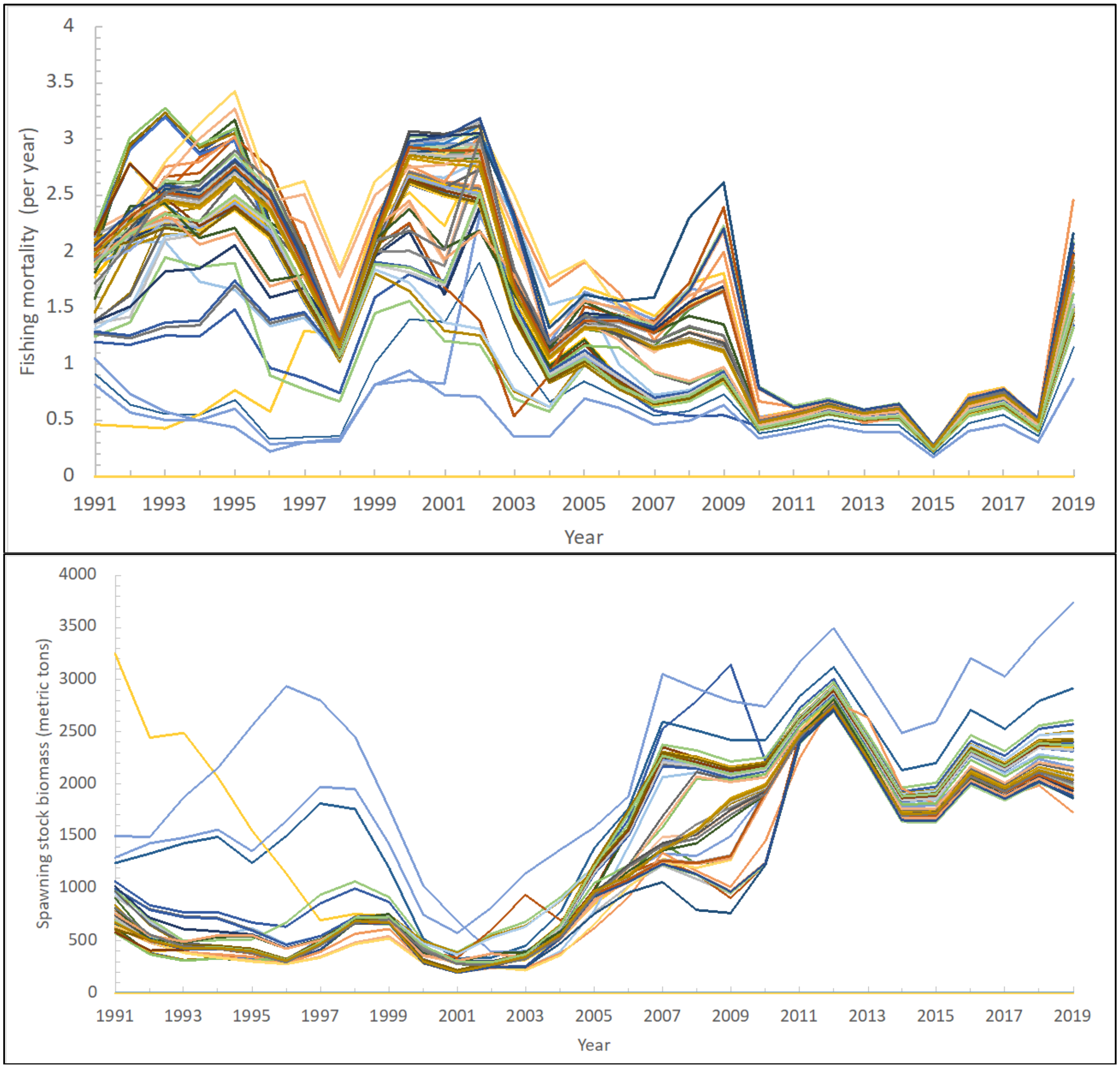

Figure 3.2. Predicted fishing mortality (per year; top panel) and spawning stock biomass (metric tons; bottom panel) from the converged jitter runs in which initial parameter values were jittered by 10%.

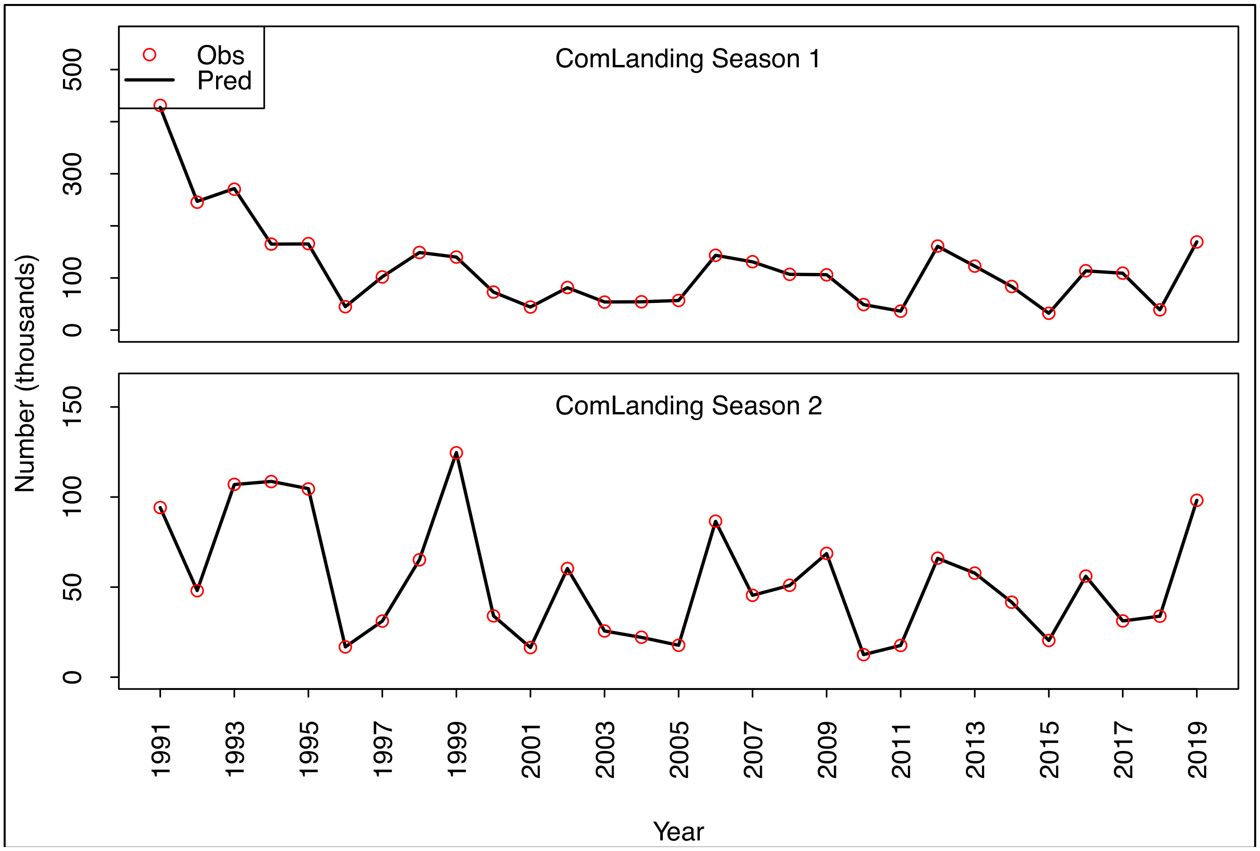

Figure 3.3. Predicted (line) and observed (circle) commercial landings (thousands of fish) of Spotted Seatrout from the base model of the stock assessment, 1991–2019. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

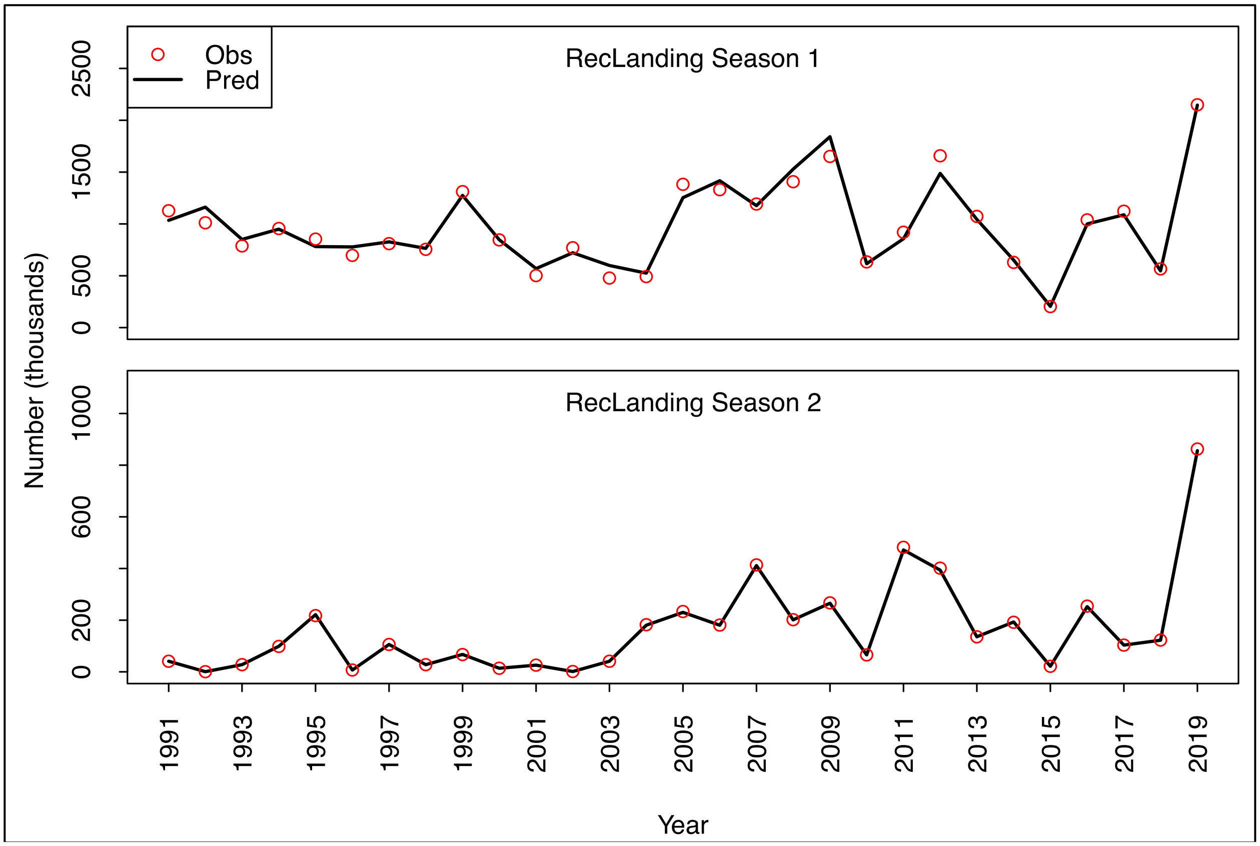

Figure 3.4. Predicted (line) and observed (circle) recreational landings (thousands of fish) of Spotted Seatrout from the base model of the stock assessment, 1991–2019. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

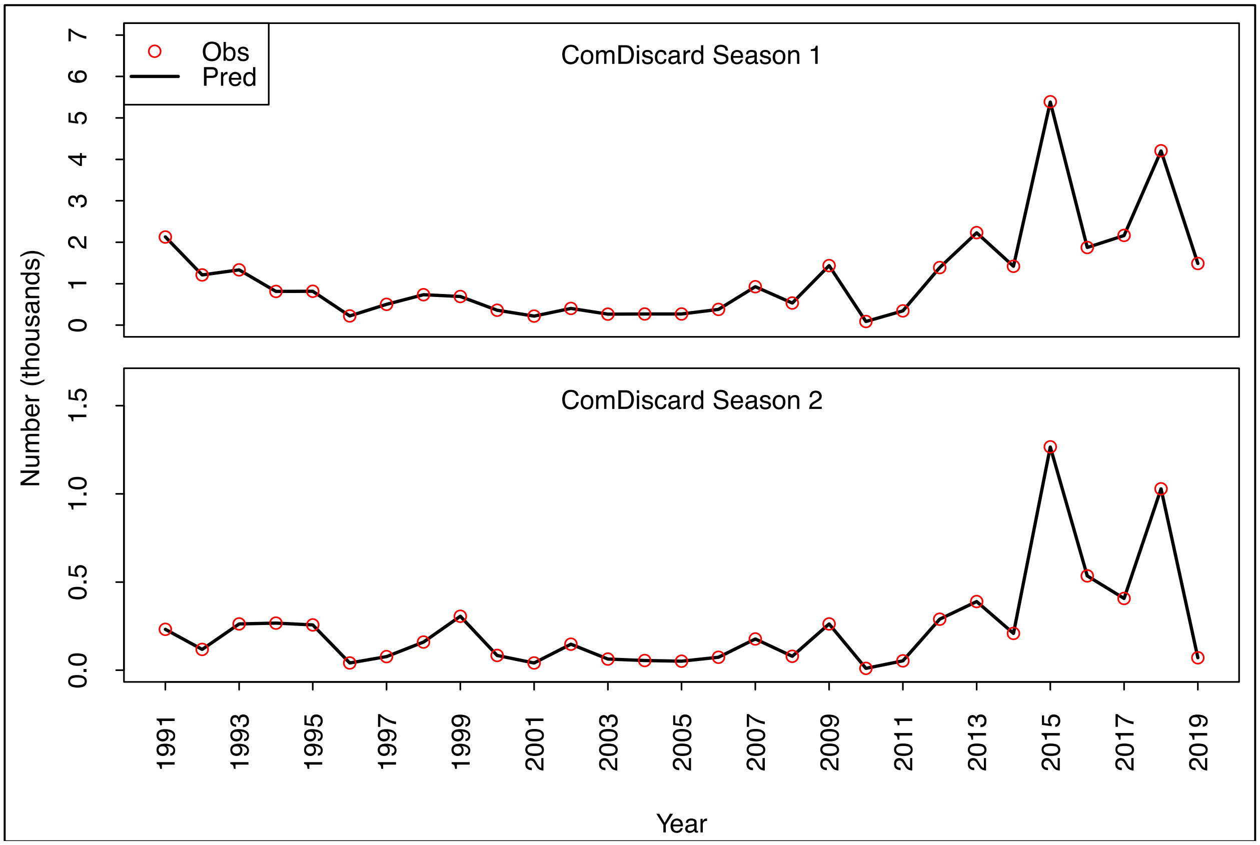

Figure 3.5. Predicted (line) and observed (circle) commercial discards (thousands of fish) of Spotted Seatrout from the base model of the stock assessment, 1991–2019. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

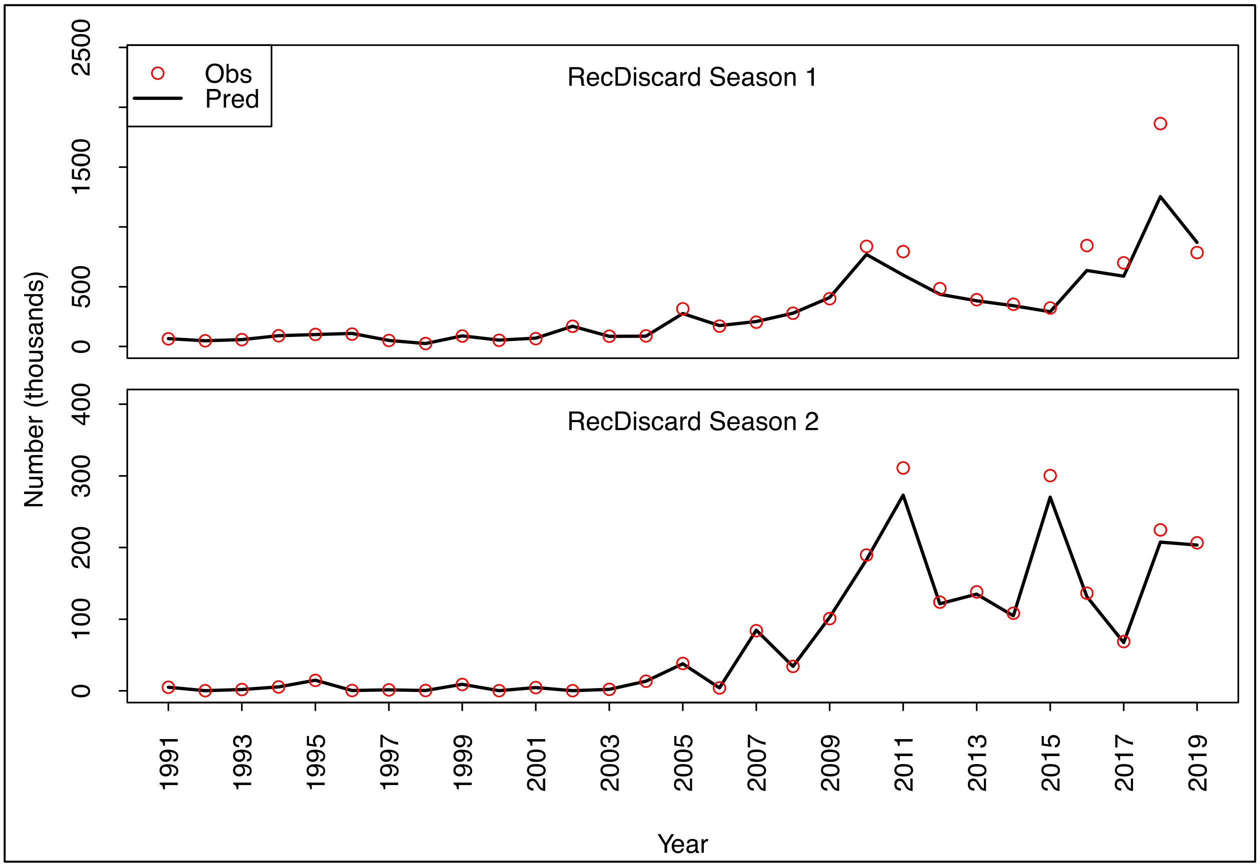

Figure 3.6. Predicted (line) and observed (circle) recreational discards (thousands of fish) of Spotted Seatrout from the base model of the stock assessment, 1991–2019. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

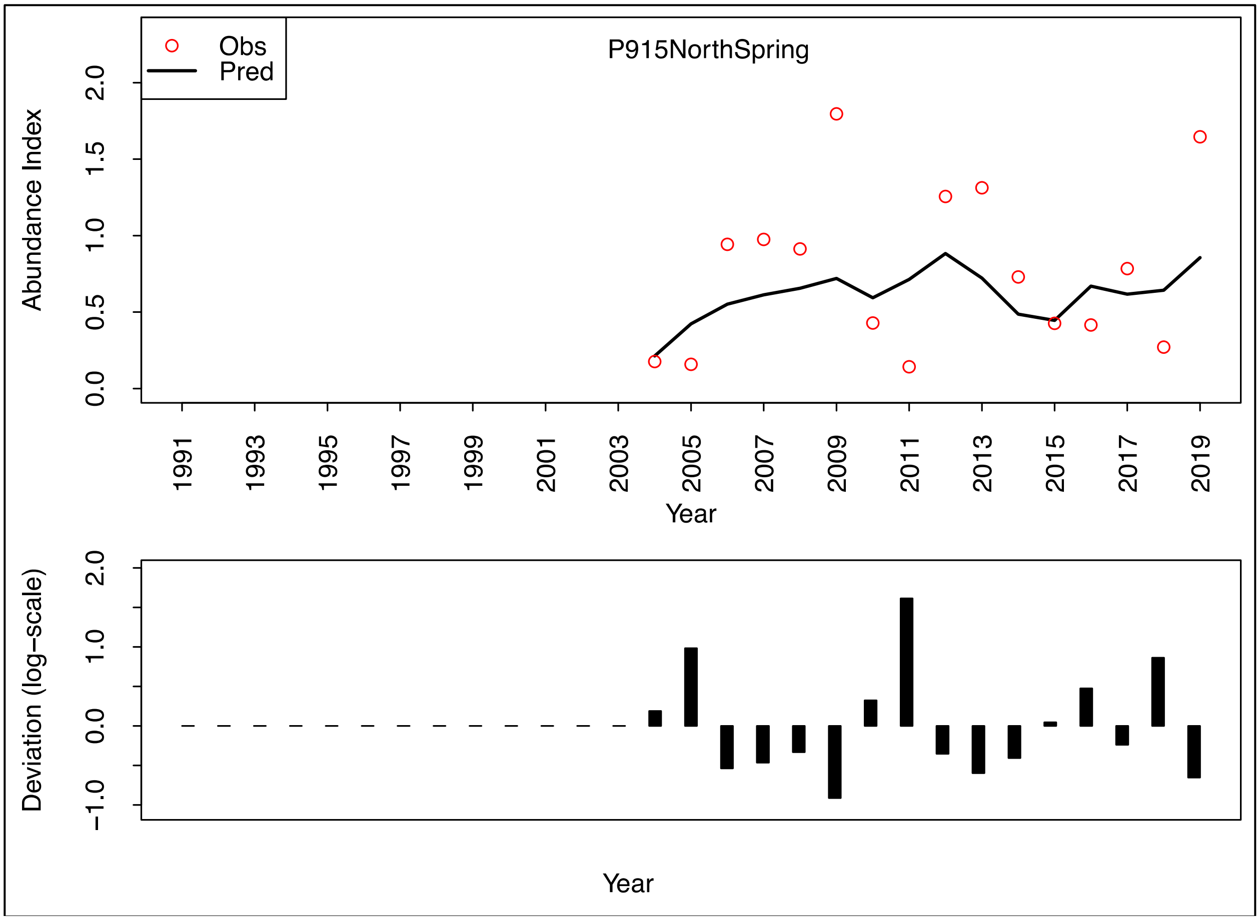

Figure 3.7. Predicted (line) and observed (circle) abundance index (top panel) and residuals (log-scale; bottom panel) for the P915NorthSpring survey from the base model of the stock assessment, 2004–2019.

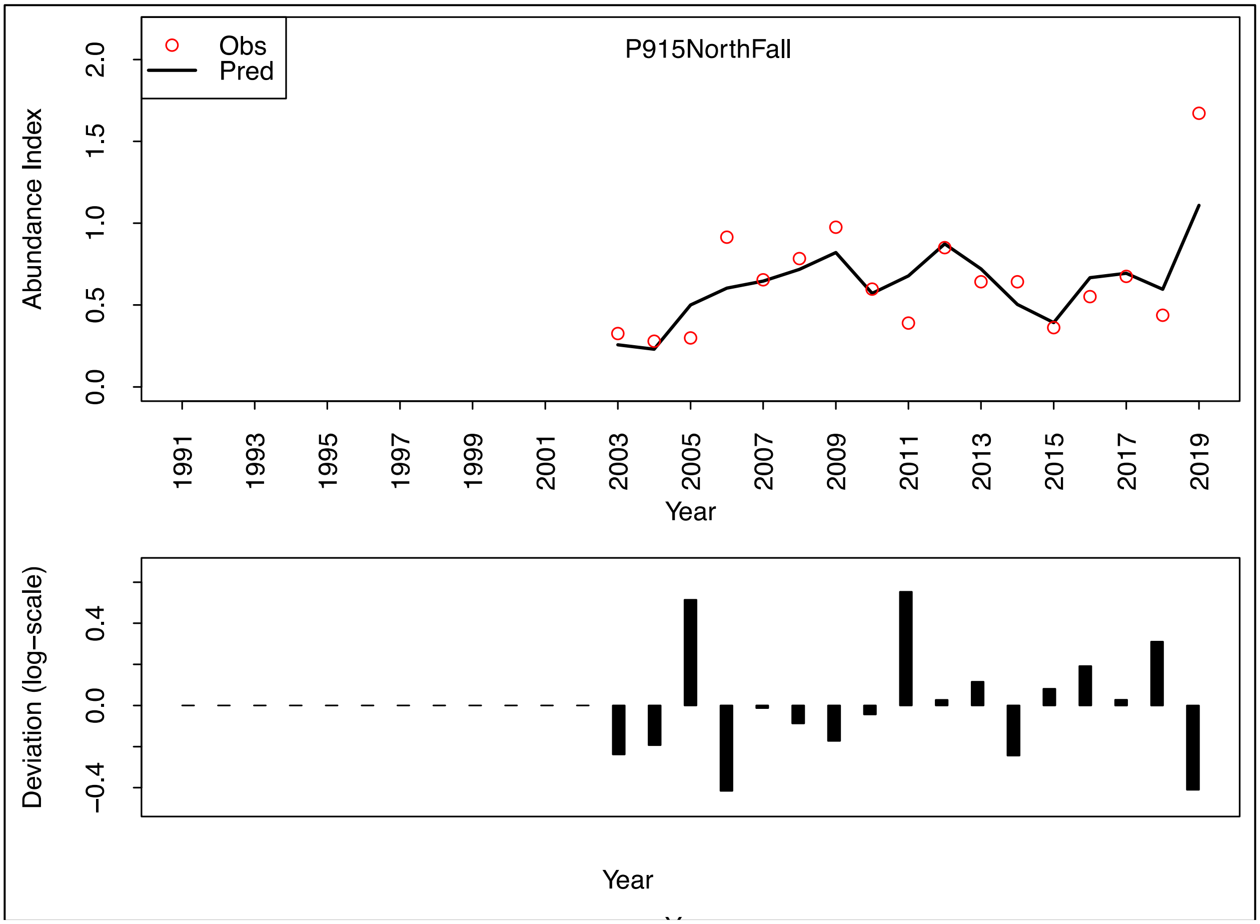

Figure 3.8. Predicted (line) and observed (circle) abundance index (top panel) and residuals (log-scale; bottom panel) for the P915NorthFall survey from the base model of the stock assessment, 2003–2019.

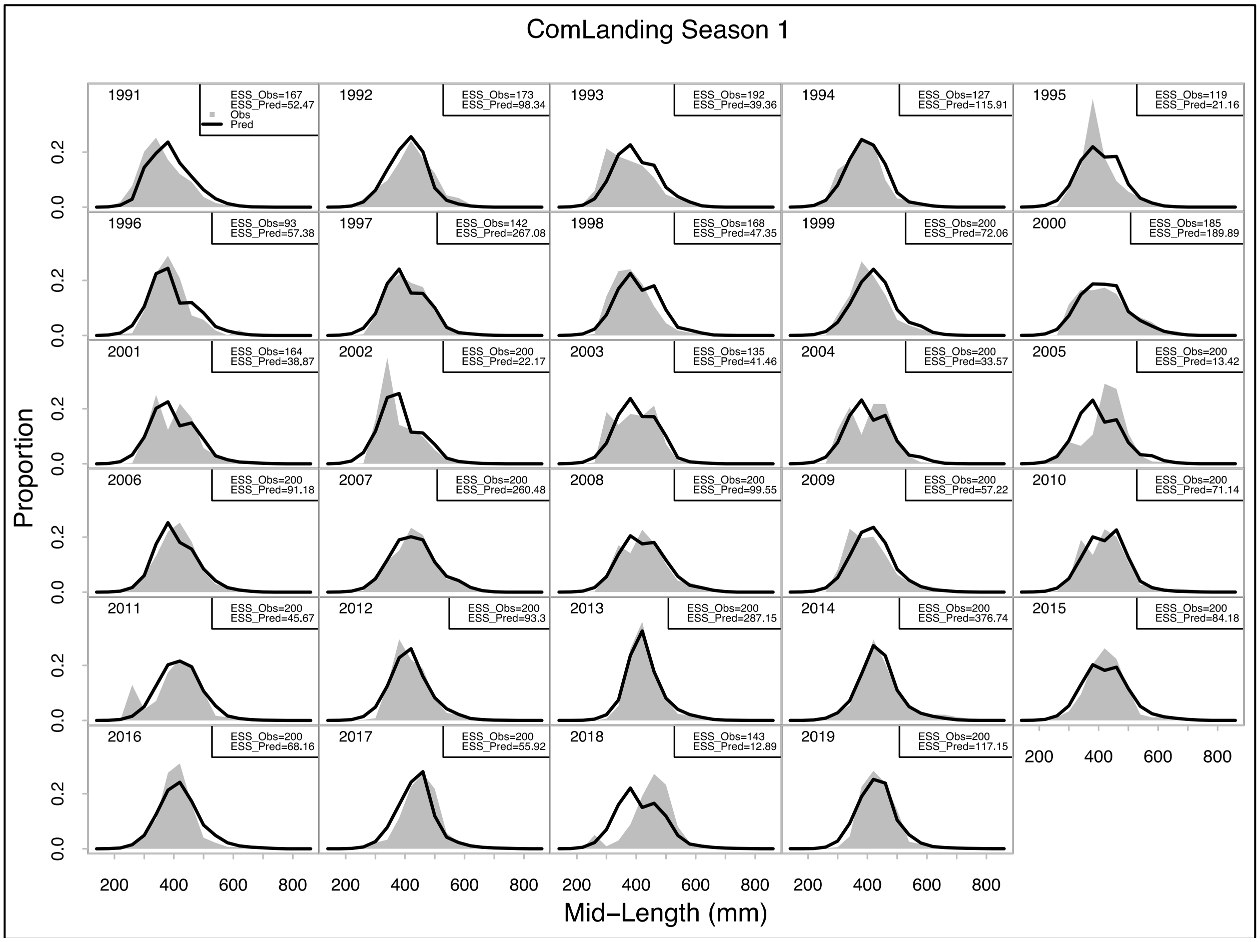

Figure 3.9. Predicted (line) and observed (shaded area) length composition for commercial landings of Spotted Seatrout from the base model of the stock assessment, 1991–2019, for Season 1 (non-winter season, March–November). ESS = effective sample size.

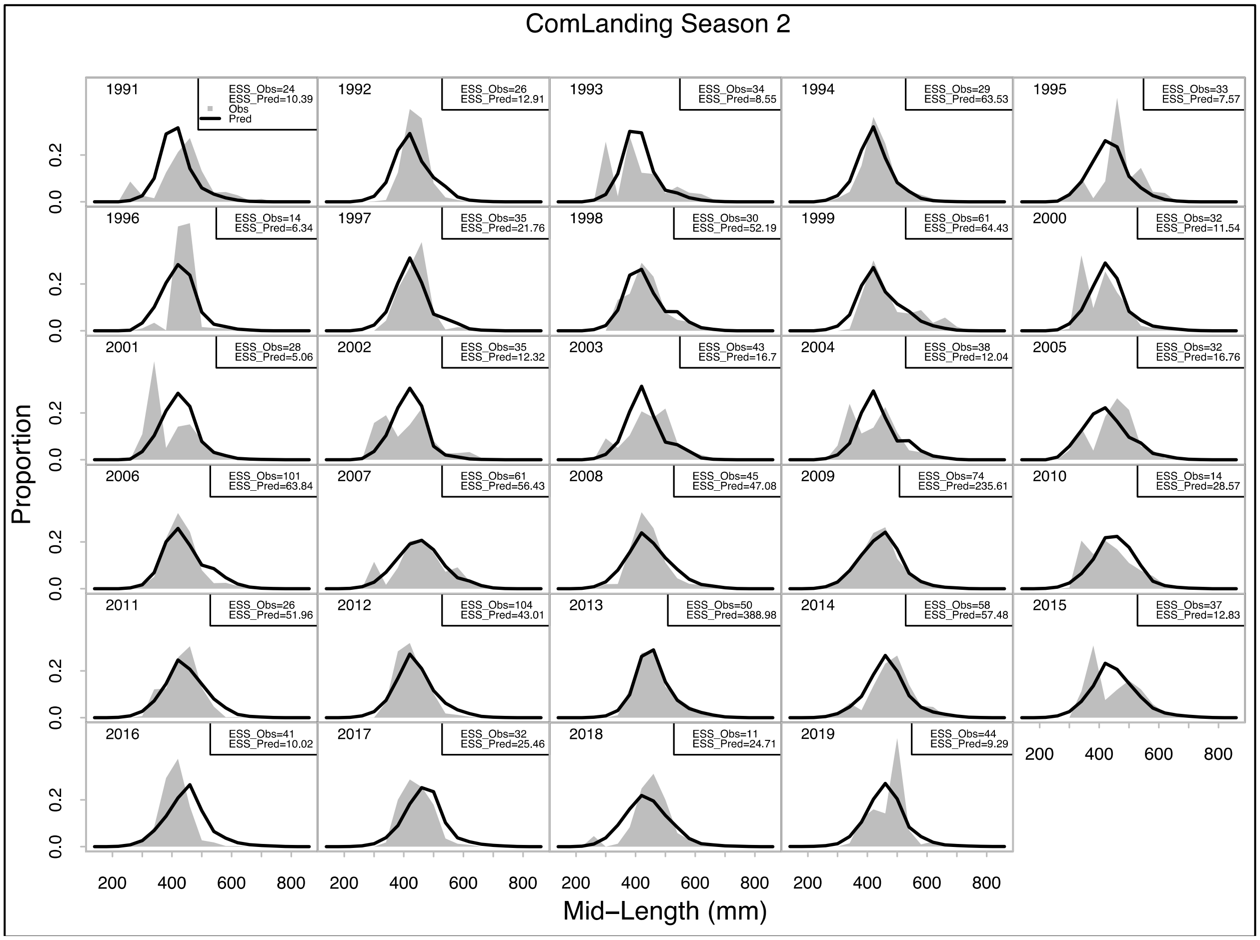

Figure 3.10. Predicted (line) and observed (shaded area) length composition for commercial landings of Spotted Seatrout from the base model of the stock assessment, 1991–2019, for Season 2 (winter season, December–February). ESS = effective sample size.

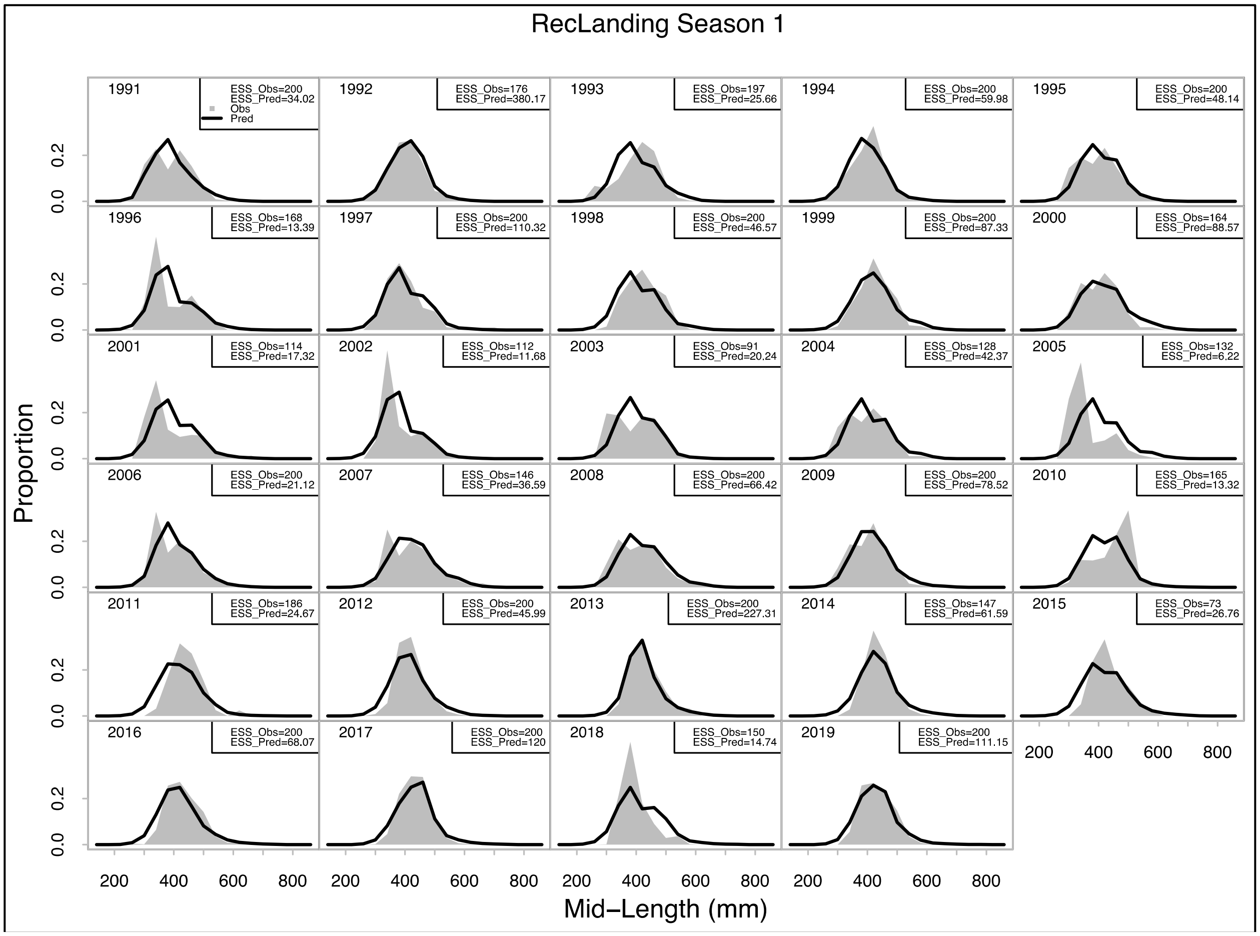

Figure 3.11. Predicted (line) and observed (shaded area) length composition for recreational landings of Spotted Seatrout from the base model of the stock assessment, 1991–2019, for Season 1 (non-winter season, March–November). ESS = effective sample size.

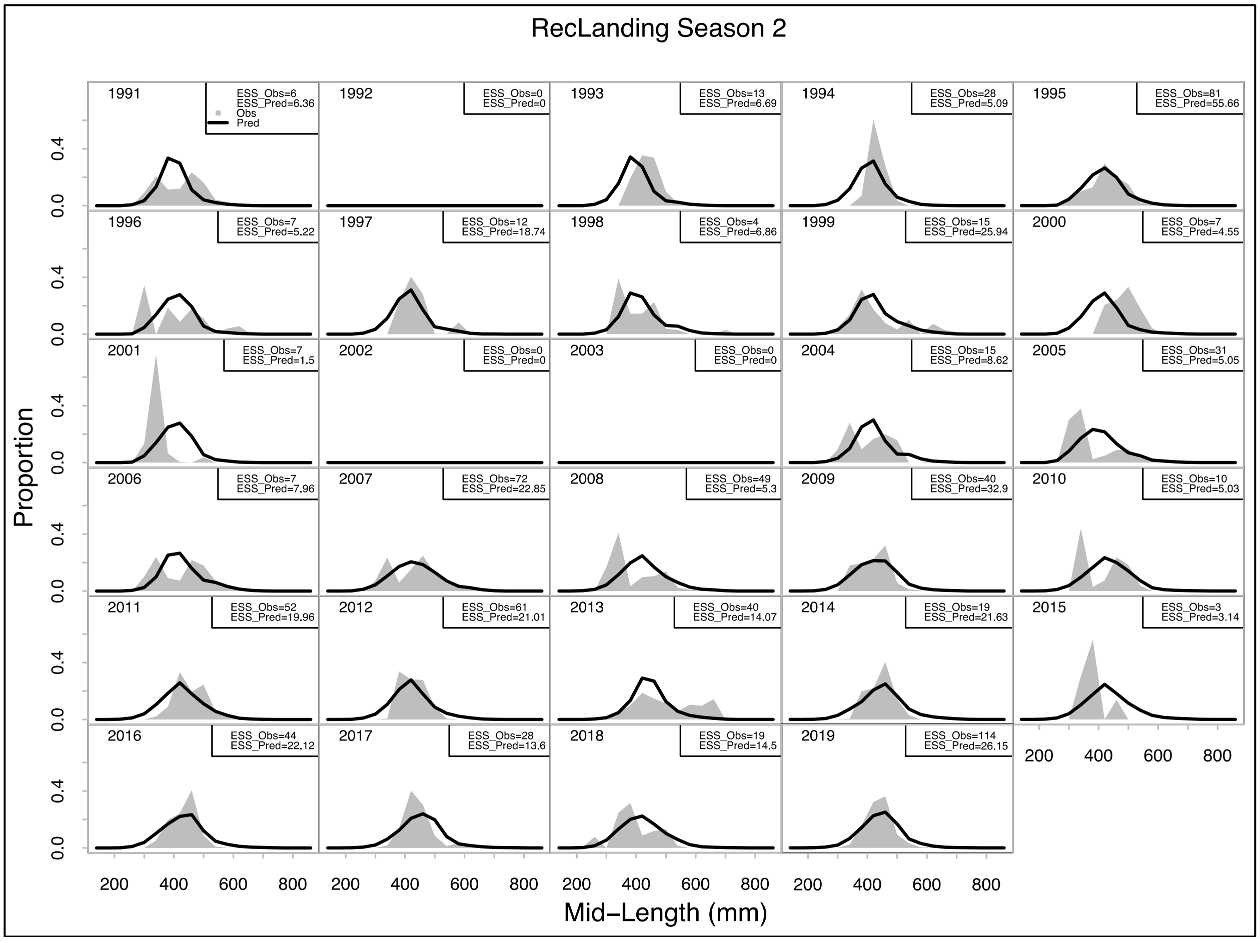

Figure 3.12. Predicted (line) and observed (shaded area) length composition for recreational landings of Spotted Seatrout from the base model of the stock assessment, 1991–2019, for Season 2 (winter season, December–February). ESS = effective sample size. The data in 1992, 2002 and 2003 were removed due to extremely small effective sample size (< 2).

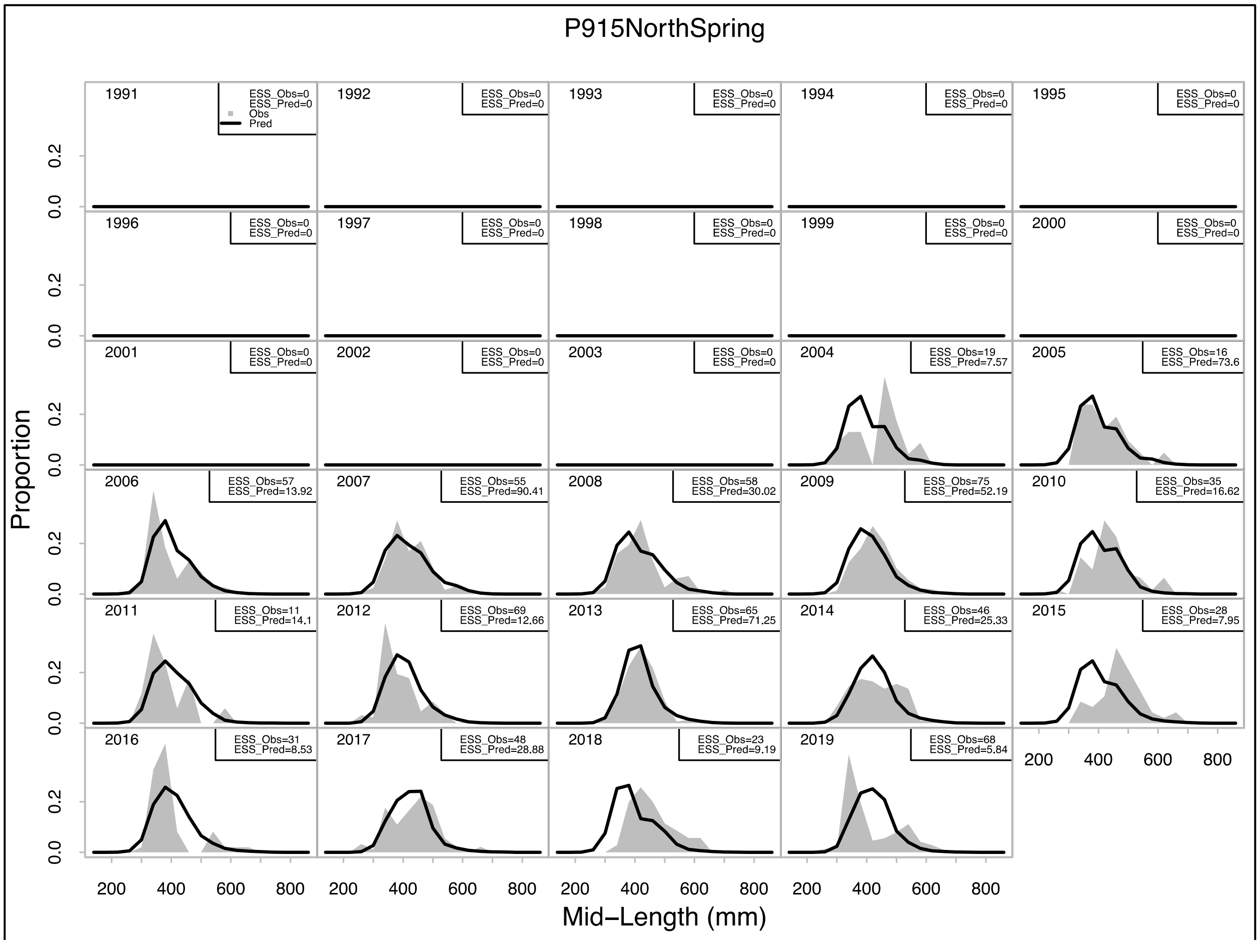

Figure 3.13. Predicted (line) and observed (shaded area) length composition for the P915NorthSpring survey from the base model of the stock assessment, 2004–2019. ESS = effective sample size.

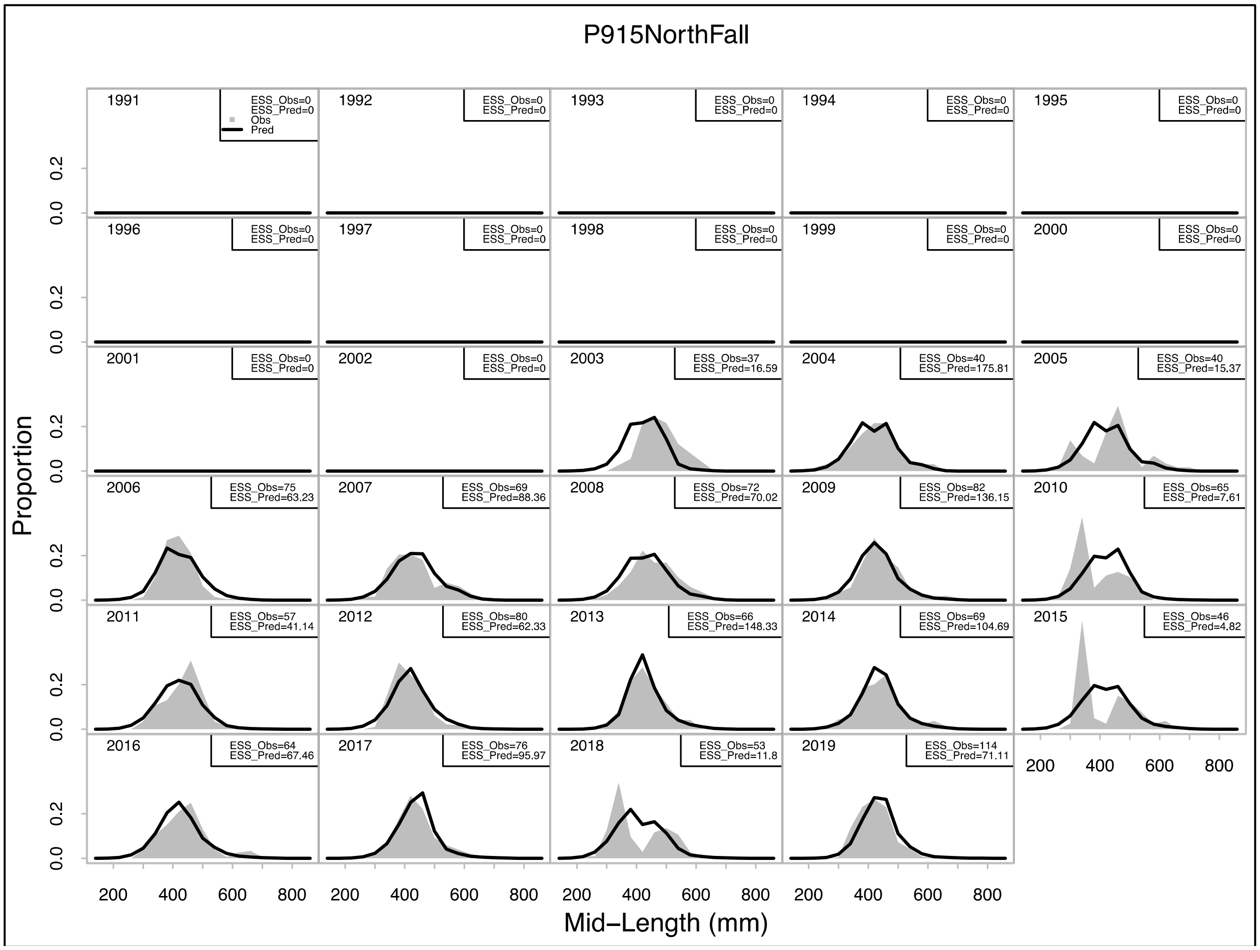

Figure 3.14. Predicted (line) and observed (shaded area) length composition for the P915NorthFall survey from the base model of the stock assessment, 2003–2019. ESS = effective sample size.

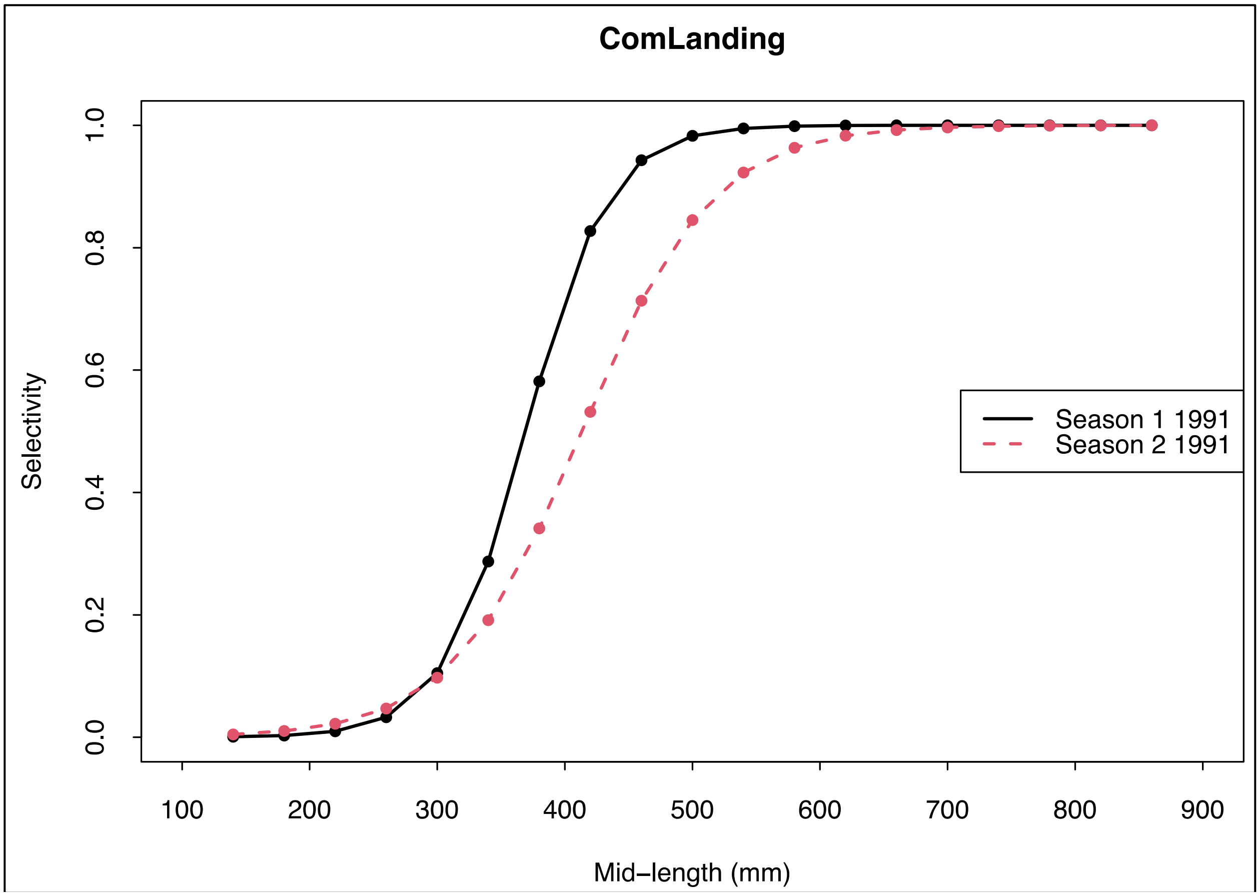

Figure 3.15. Predicted length-based selectivity for the commercial landing fleet from the base model of the stock assessment. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

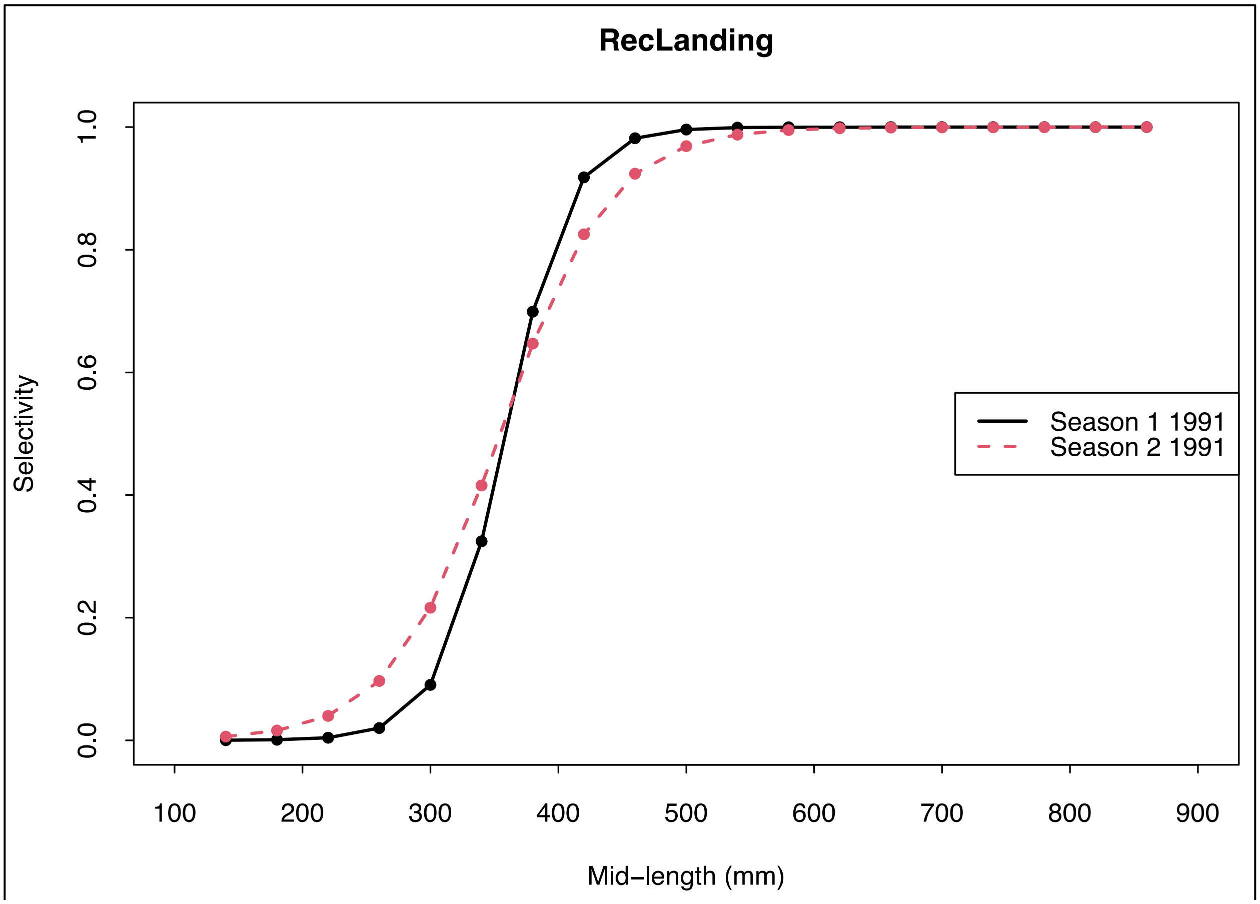

Figure 3.16. Predicted length-based selectivity for the recreational landing fleet from the base model of the stock assessment. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

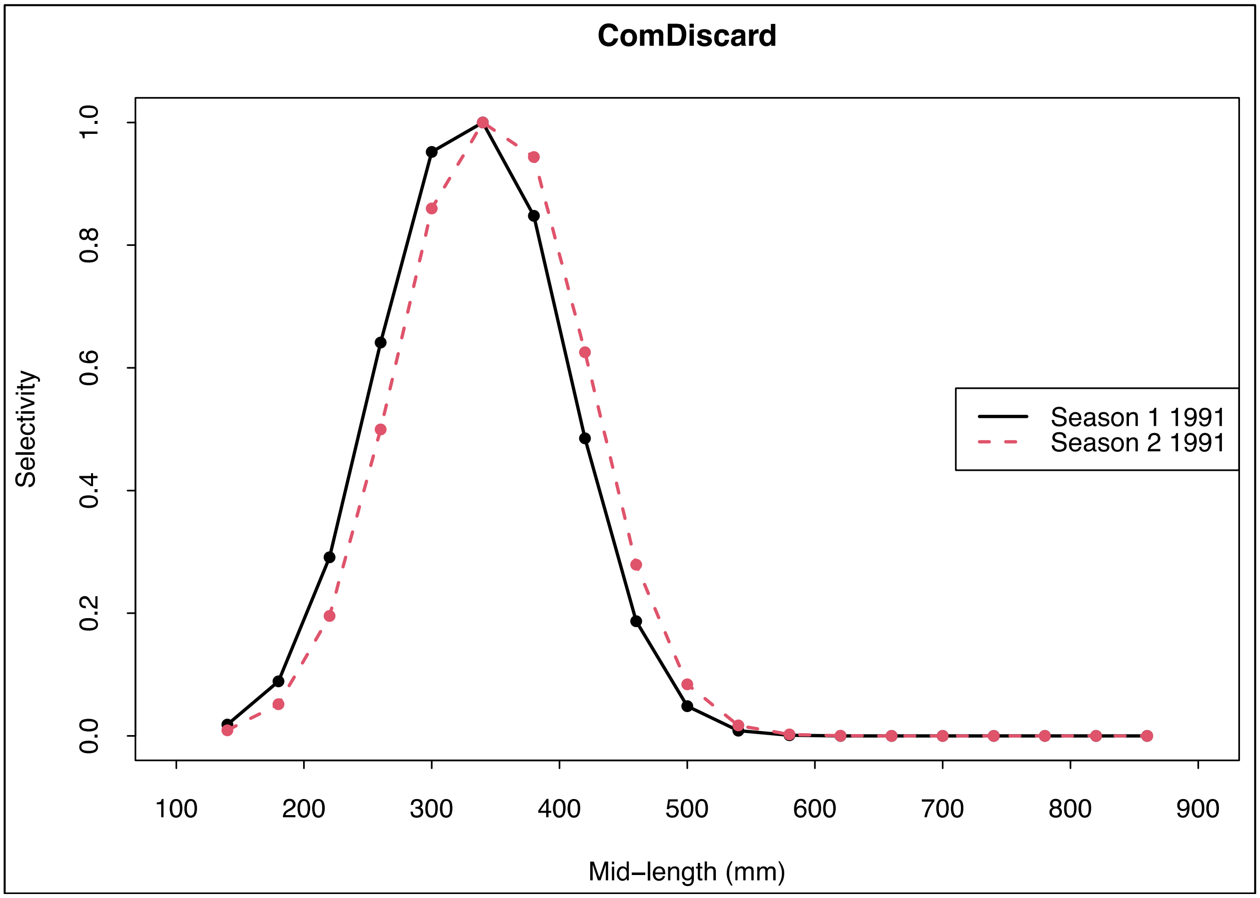

Figure 3.17. Predicted length-based selectivity for the commercial discard fleet from the base model of the stock assessment. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

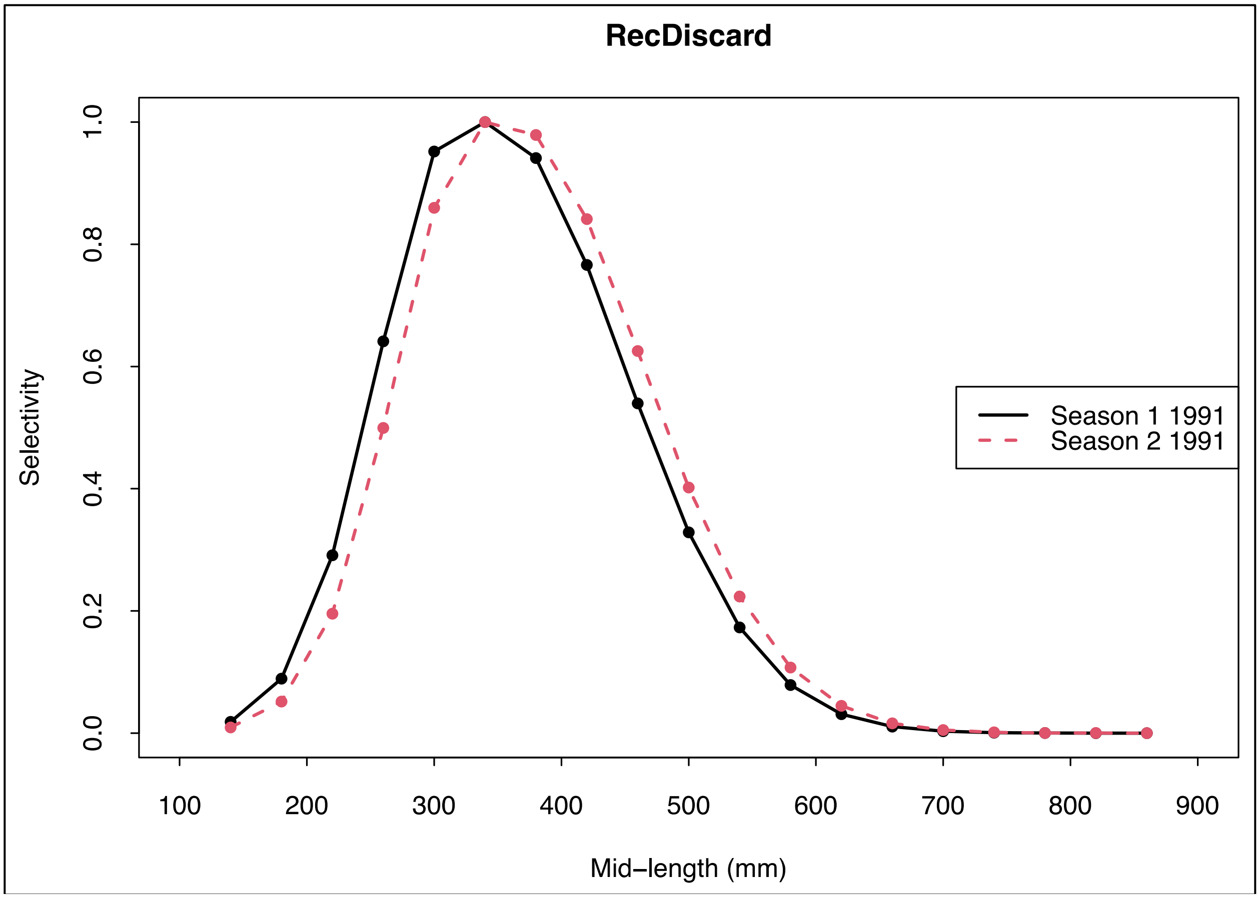

Figure 3.18. Predicted length-based selectivity for the recreational discard fleet from the base model of the stock assessment. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

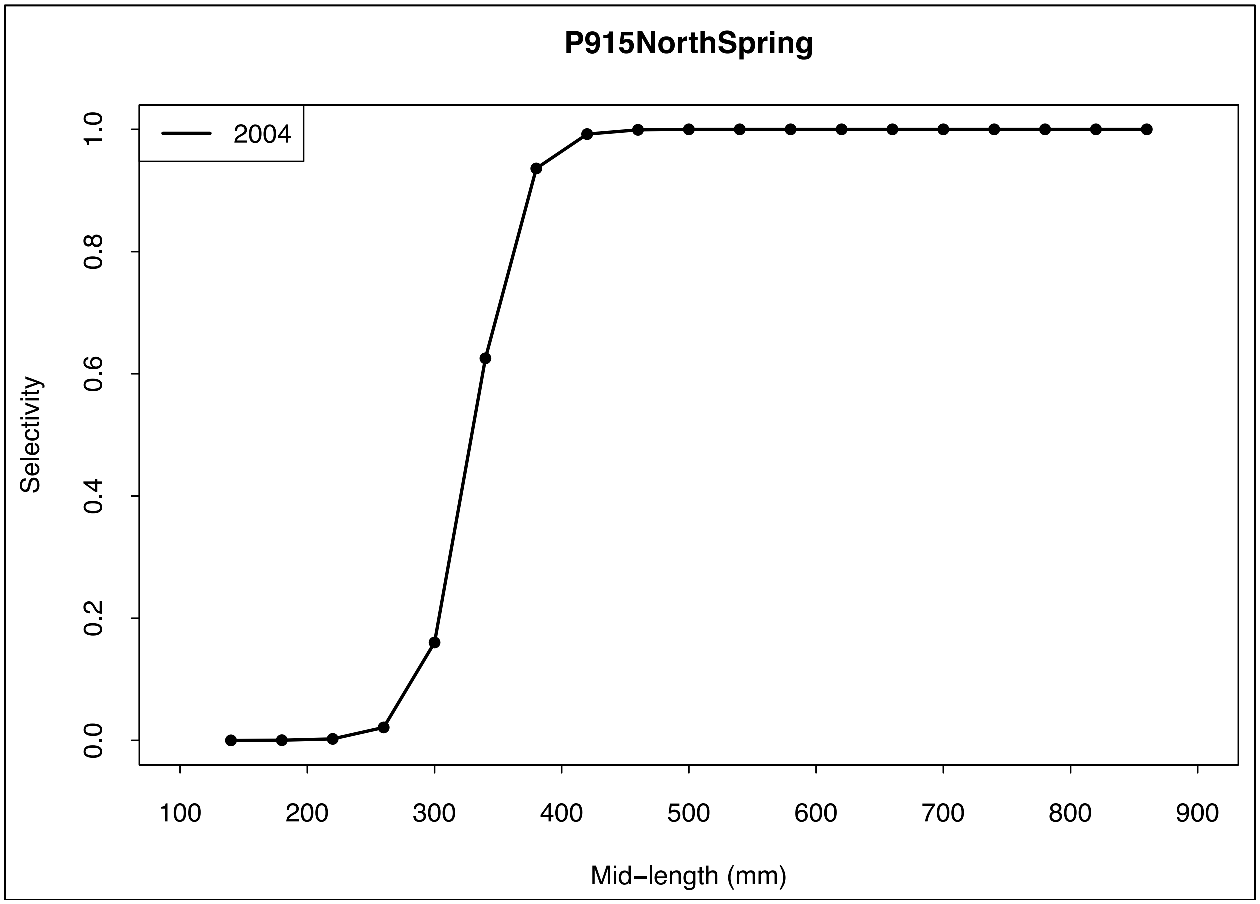

Figure 3.19. Predicted length-based selectivity for the P915NorthSpring survey from the base model of the stock assessment.

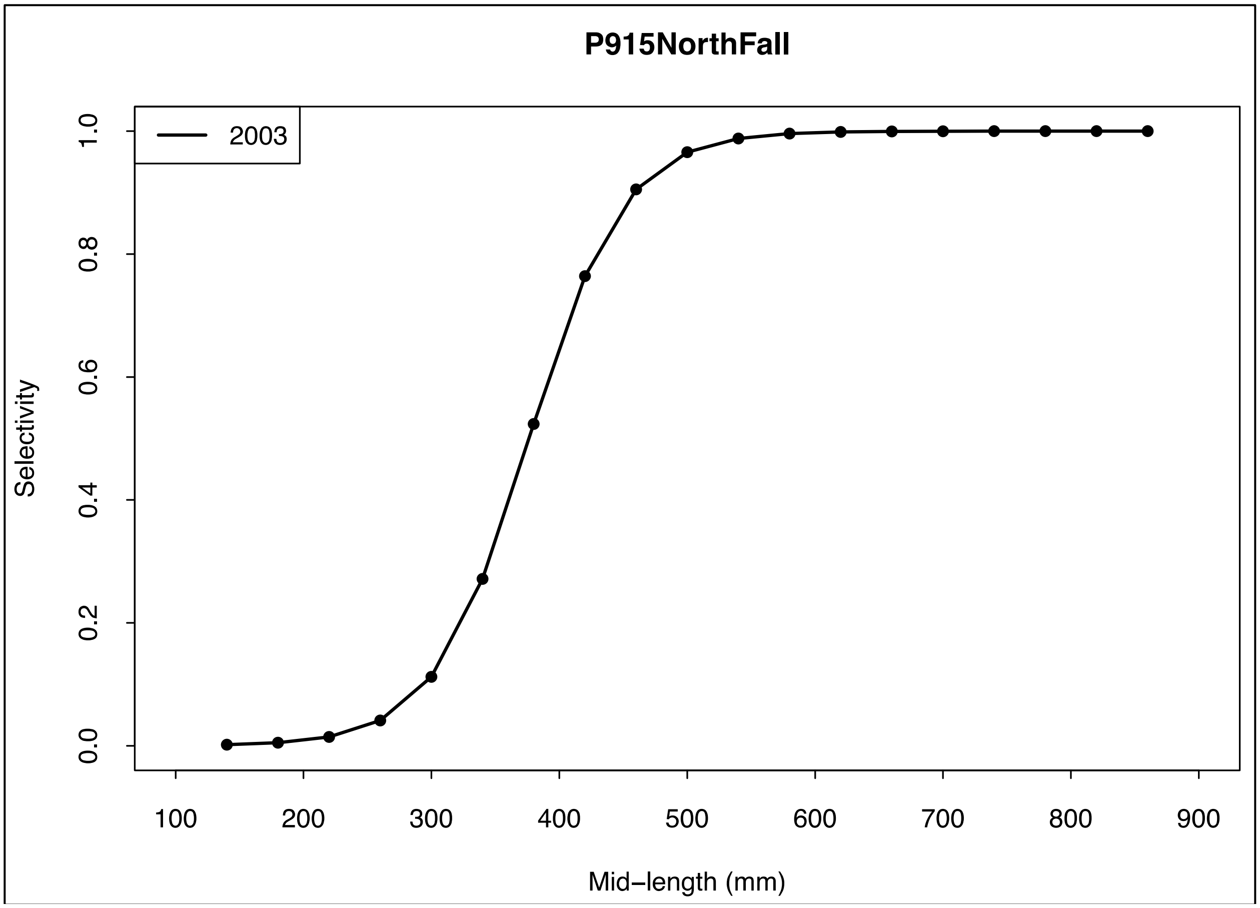

Figure 3.20. Predicted length-based selectivity for the P915NorthFall survey from the base model of the stock assessment.

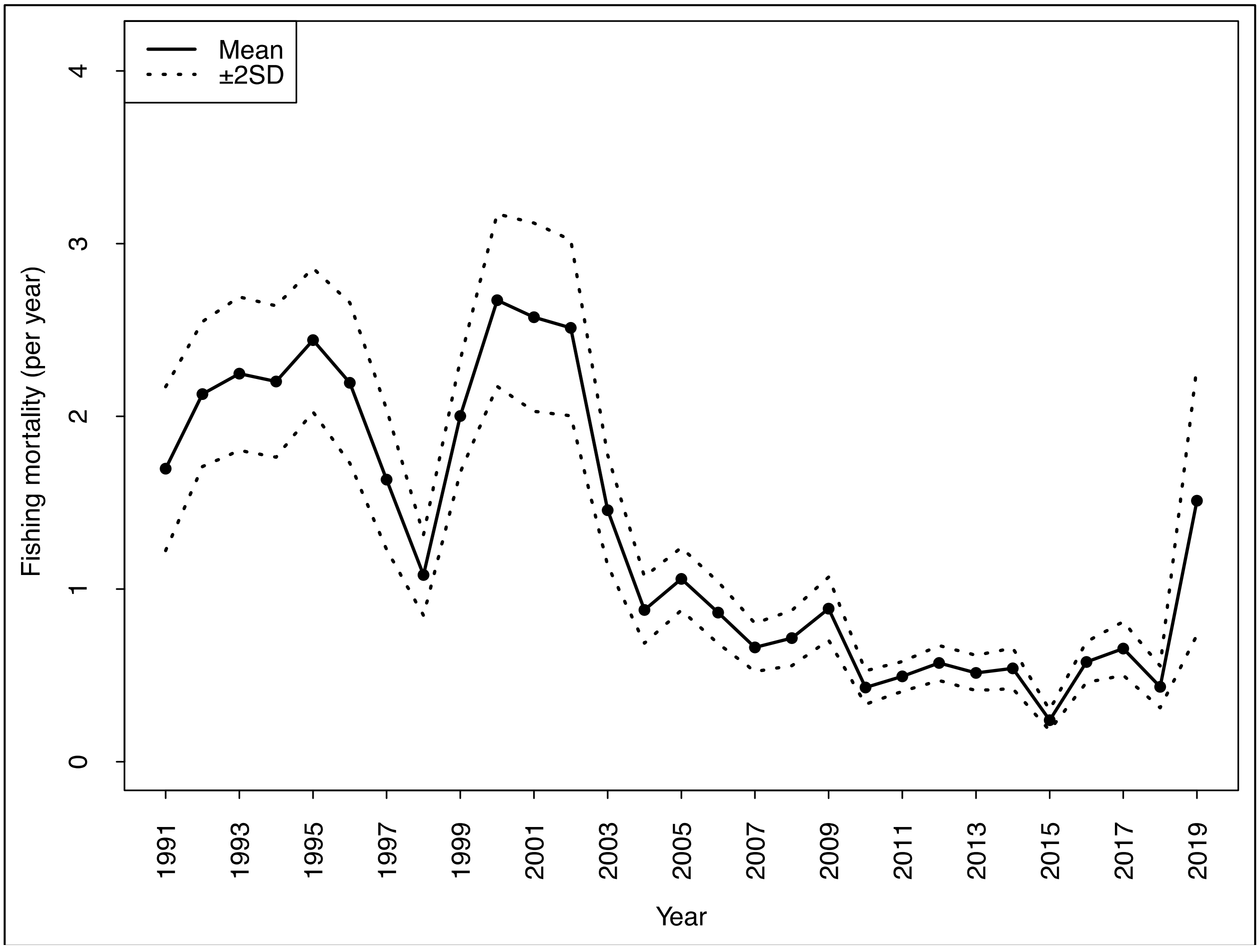

Figure 3.21. Predicted fishing mortality (per year) from the base model of the stock assessment, 1991–2019.

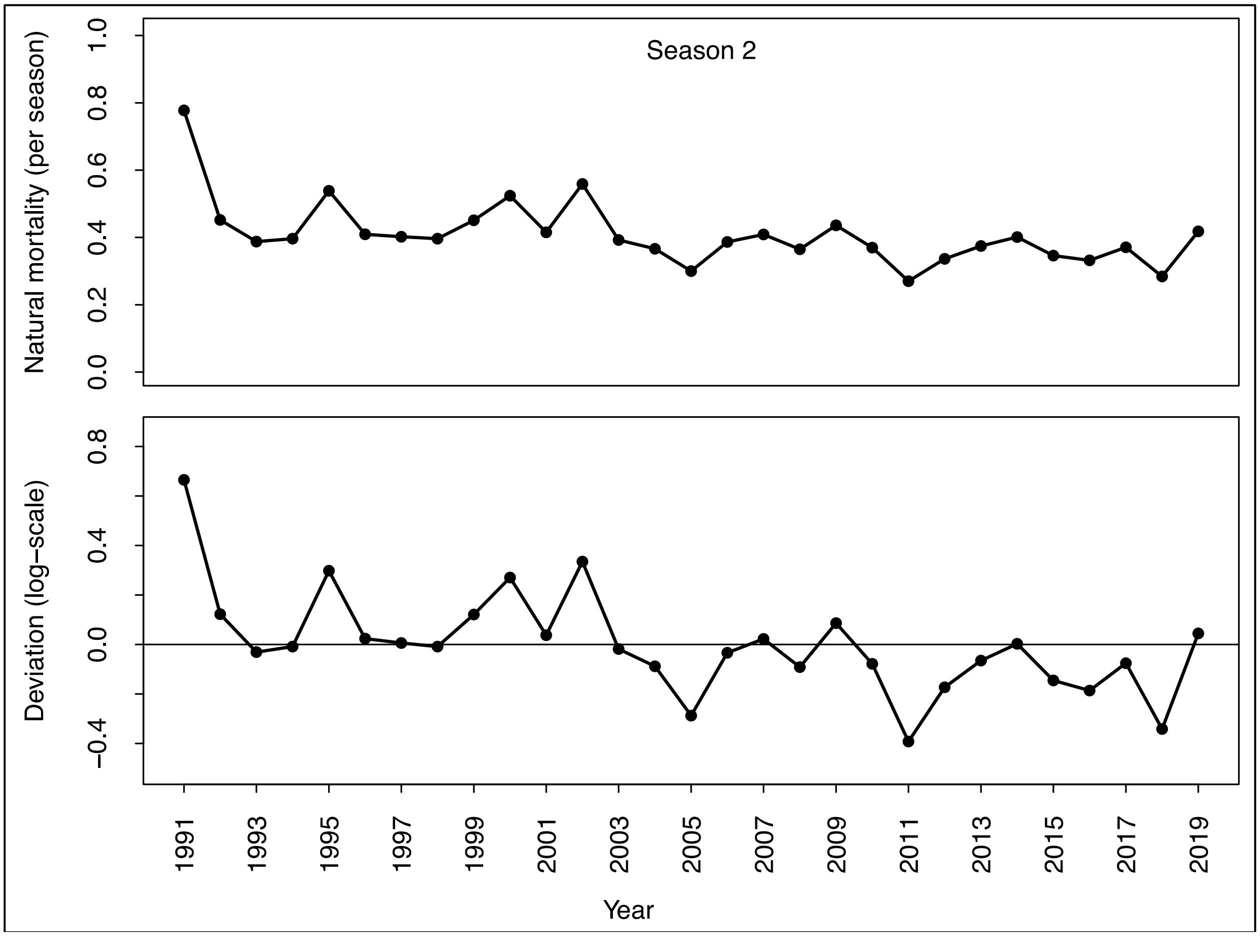

Figure 3.22. Predicted mean natual mortality (per season; top panel) and deviation (log-scale; bottom panel) for Season 2 (winter season, December–February) from the base model of the stock assessment, 1991–2019.

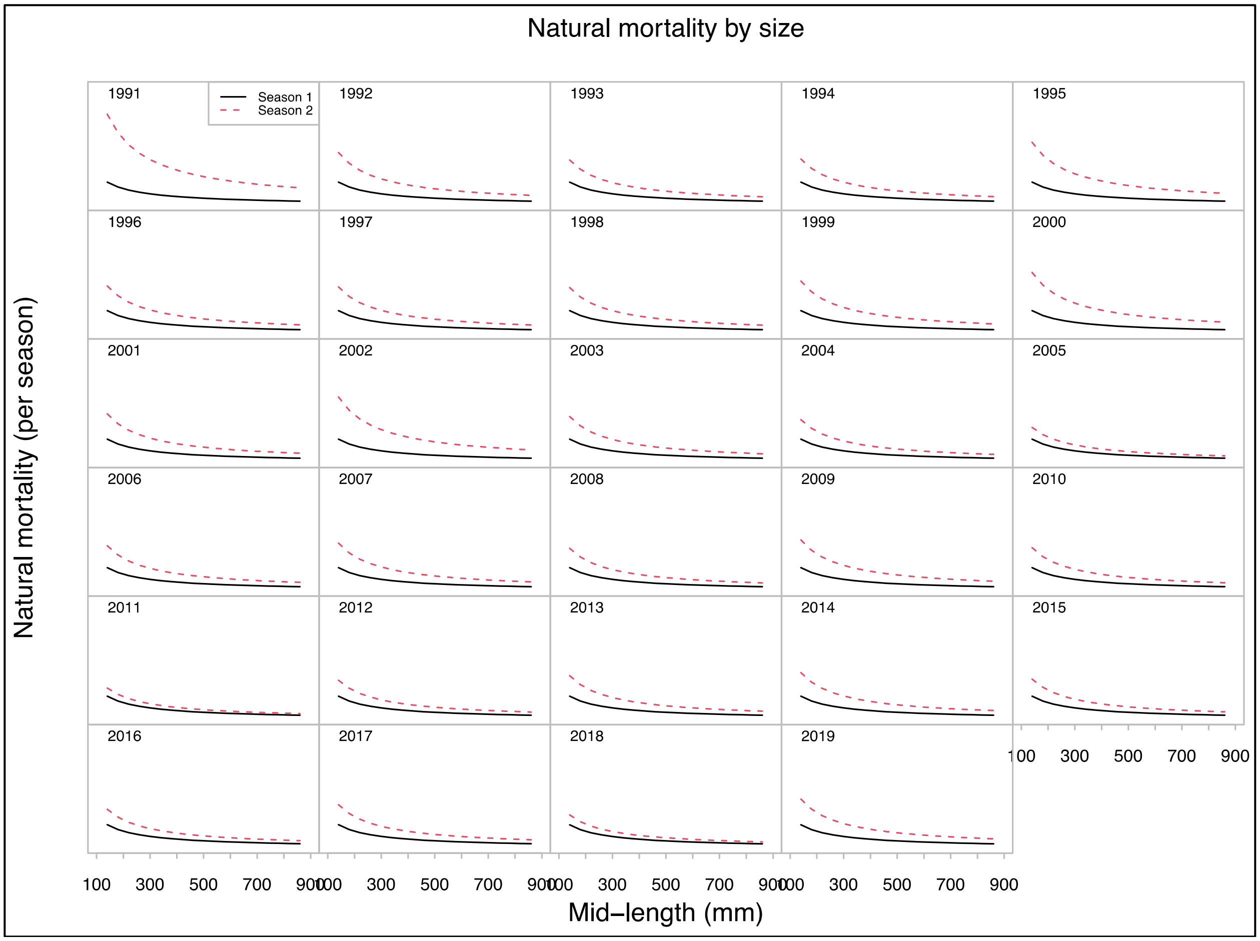

Figure 3.23. Predicted length-based natual mortality (per season) from the base model of the stock assessment, 1991–2019. Season 1—non-winter season, March–November; Season 2—winter season, December–February.

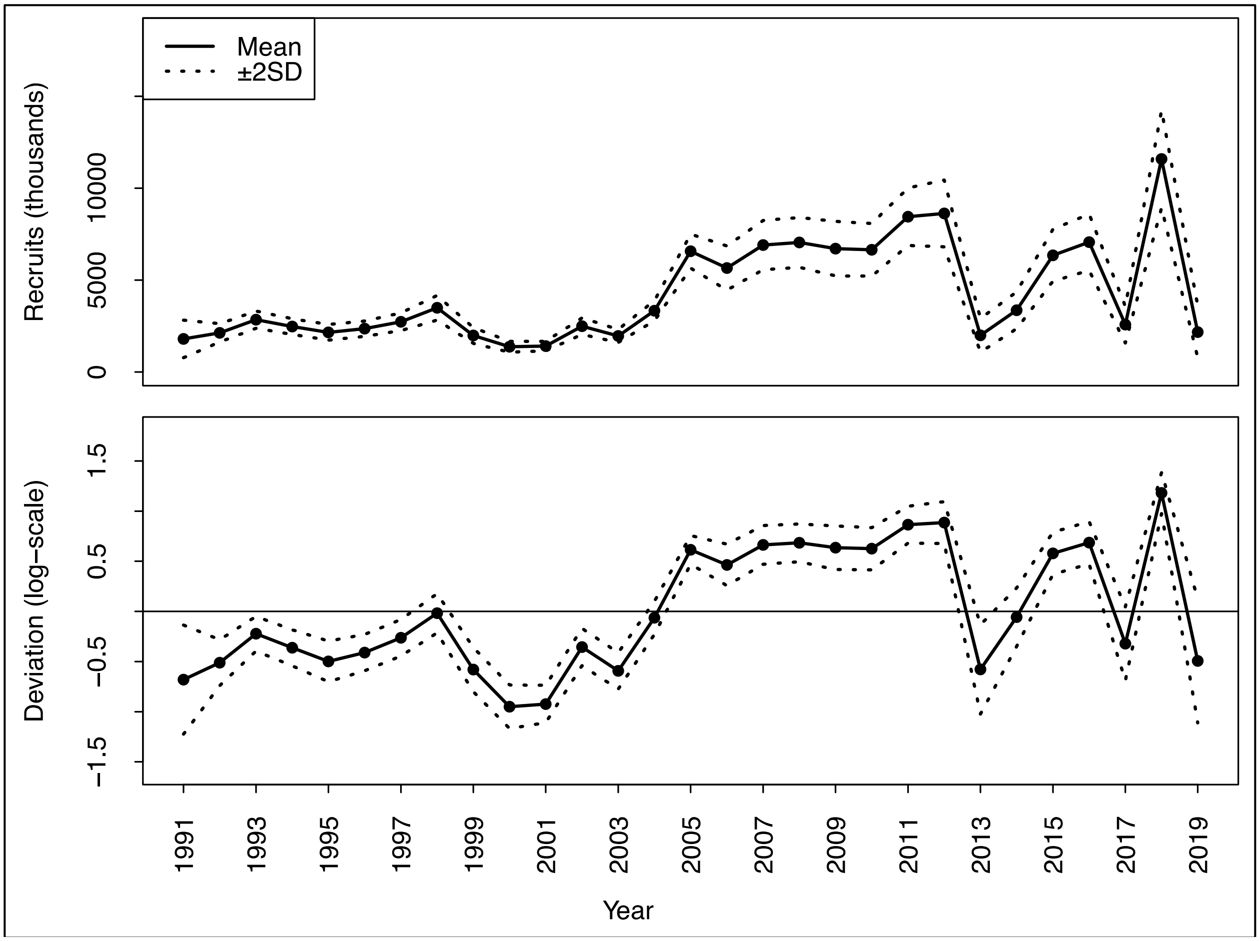

Figure 3.24. Predicted recruits (thousands of fish; top panel) and deviation (log-scale; bottom panel) from the base model of the stock assessment, 1991–2019.

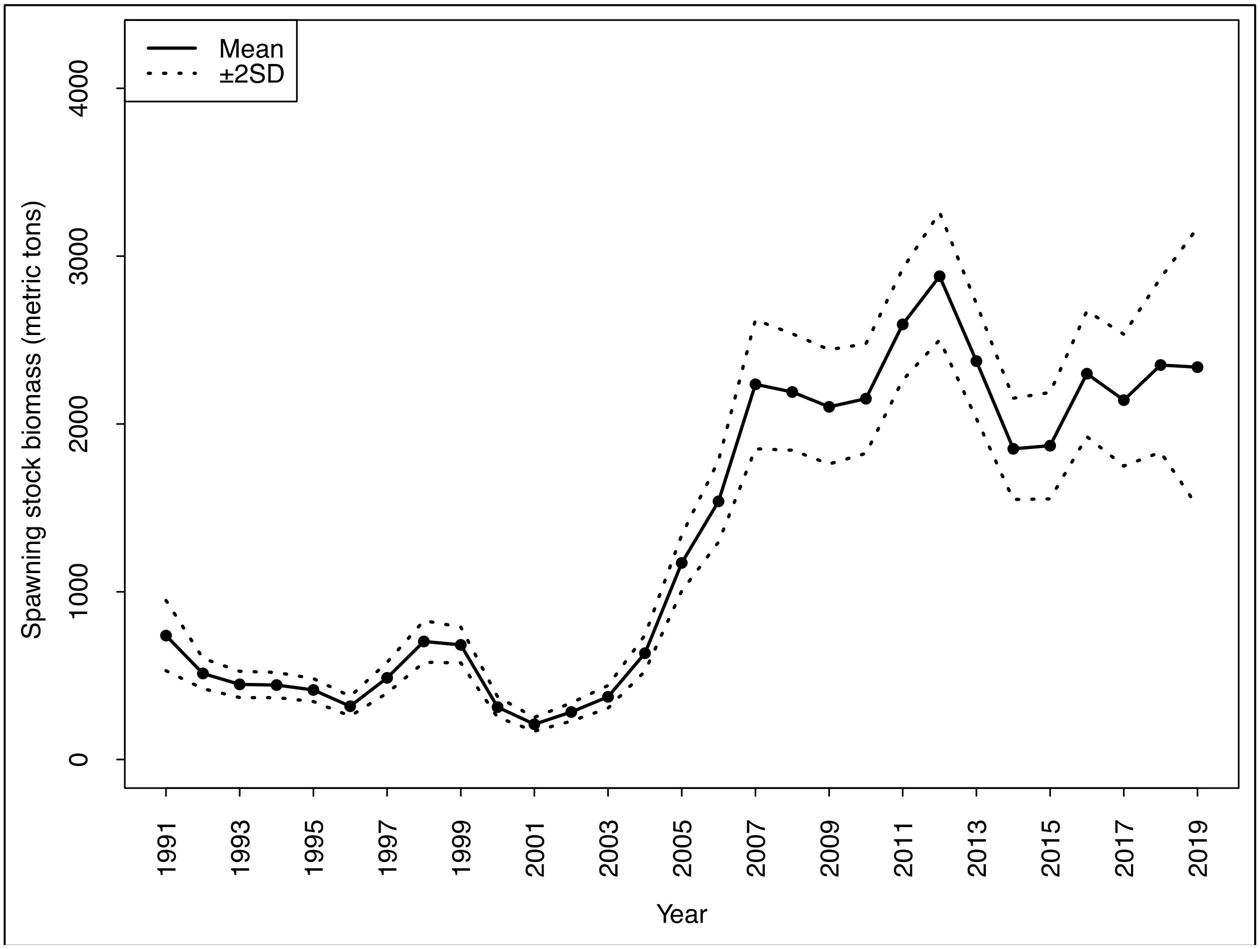

Figure 3.25. Predicted spawning stock biomass (metric tons) from the base model of the stock assessment, 1991–2019.

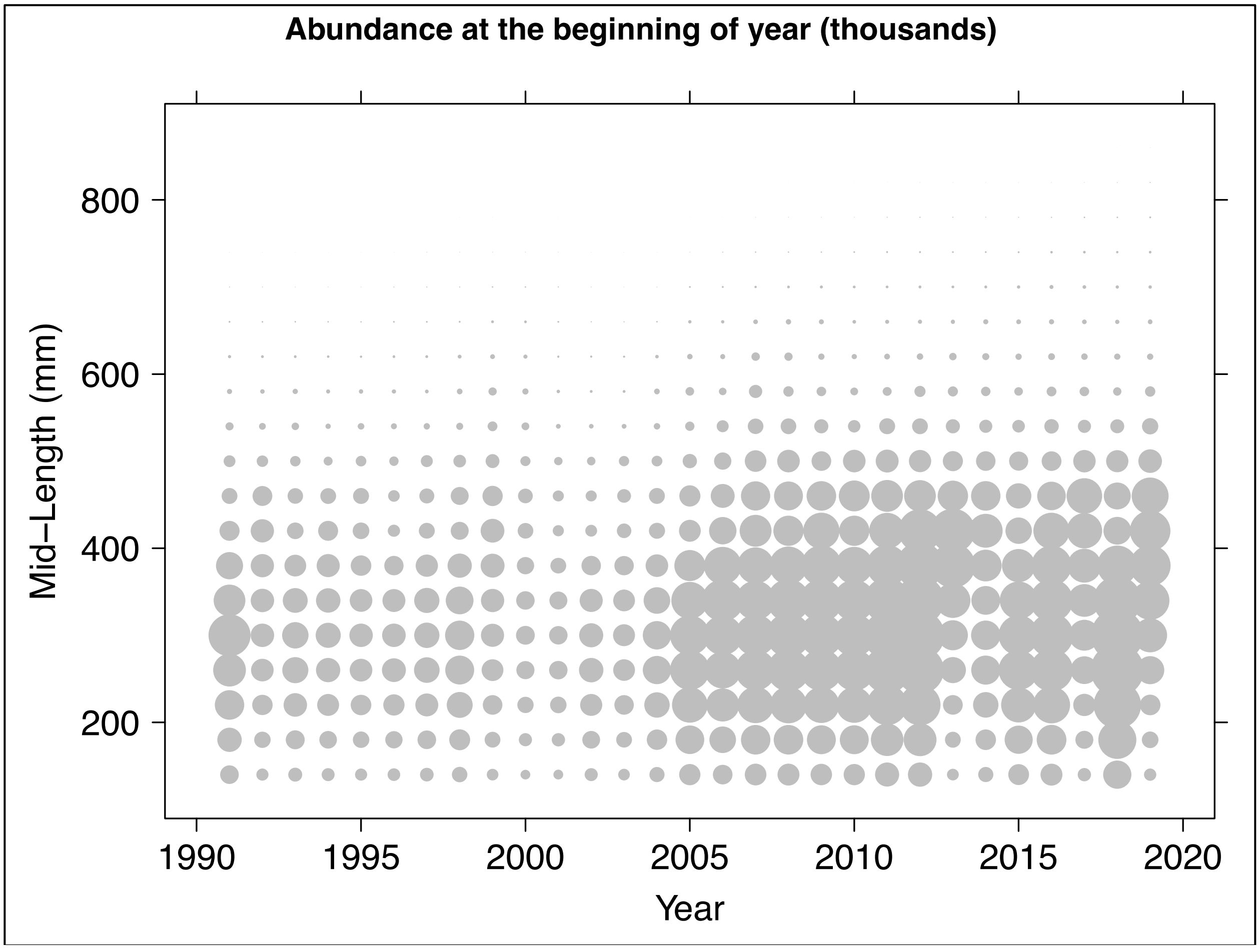

Figure 3.26. Predicted abundance at the beginning of year from the base model of the stock assessment, 1991–2019. The size of the bubble is proportional to the predicted abundance (thousands of fish).

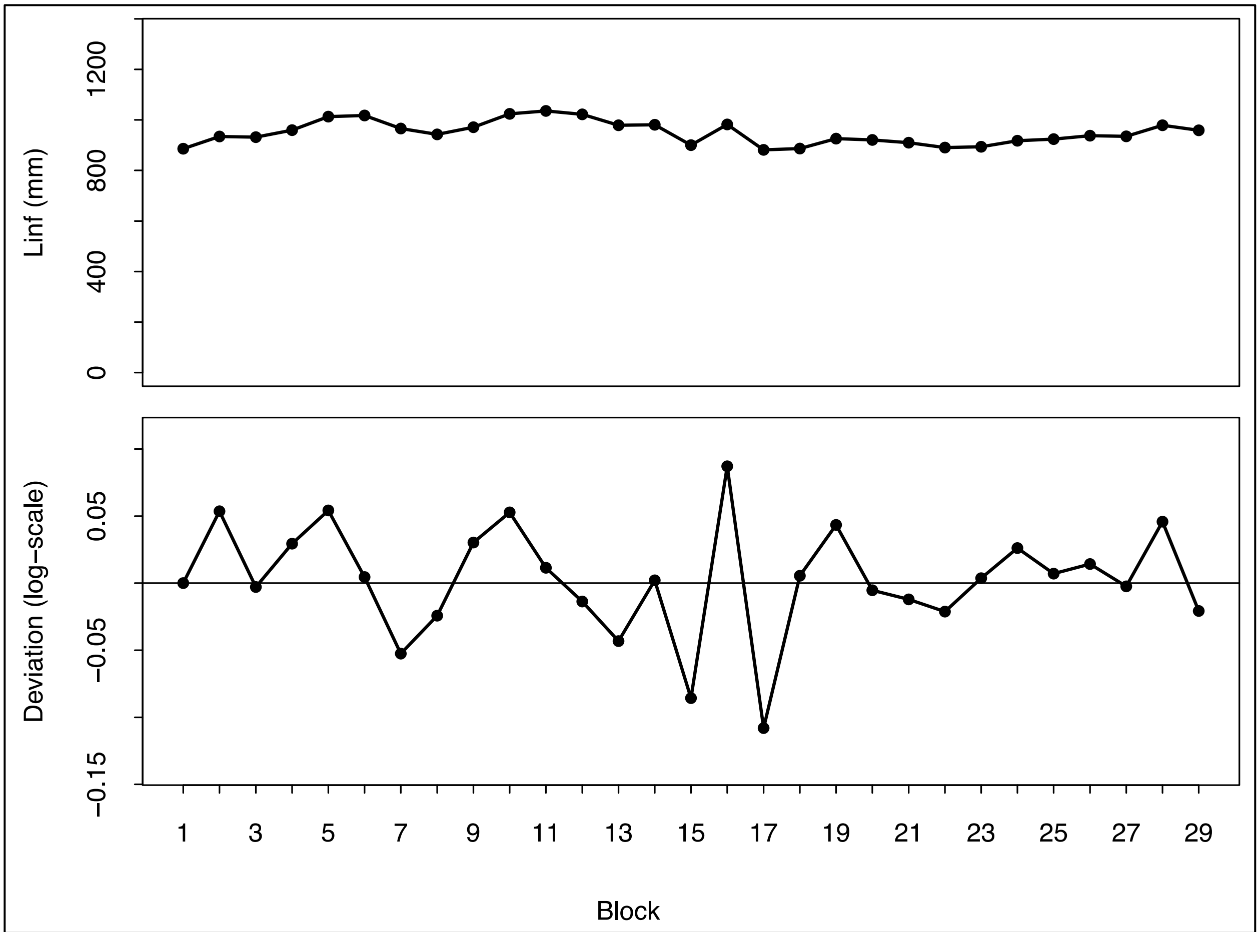

Figure 3.27. Predicted growth parameter L_∞ (mm; top panel) and deviation (log-scale; bottom panel) from the base model of the stock assessment, 1991–2019. Block numbers 1–29 correspond to the year 1991–2019.

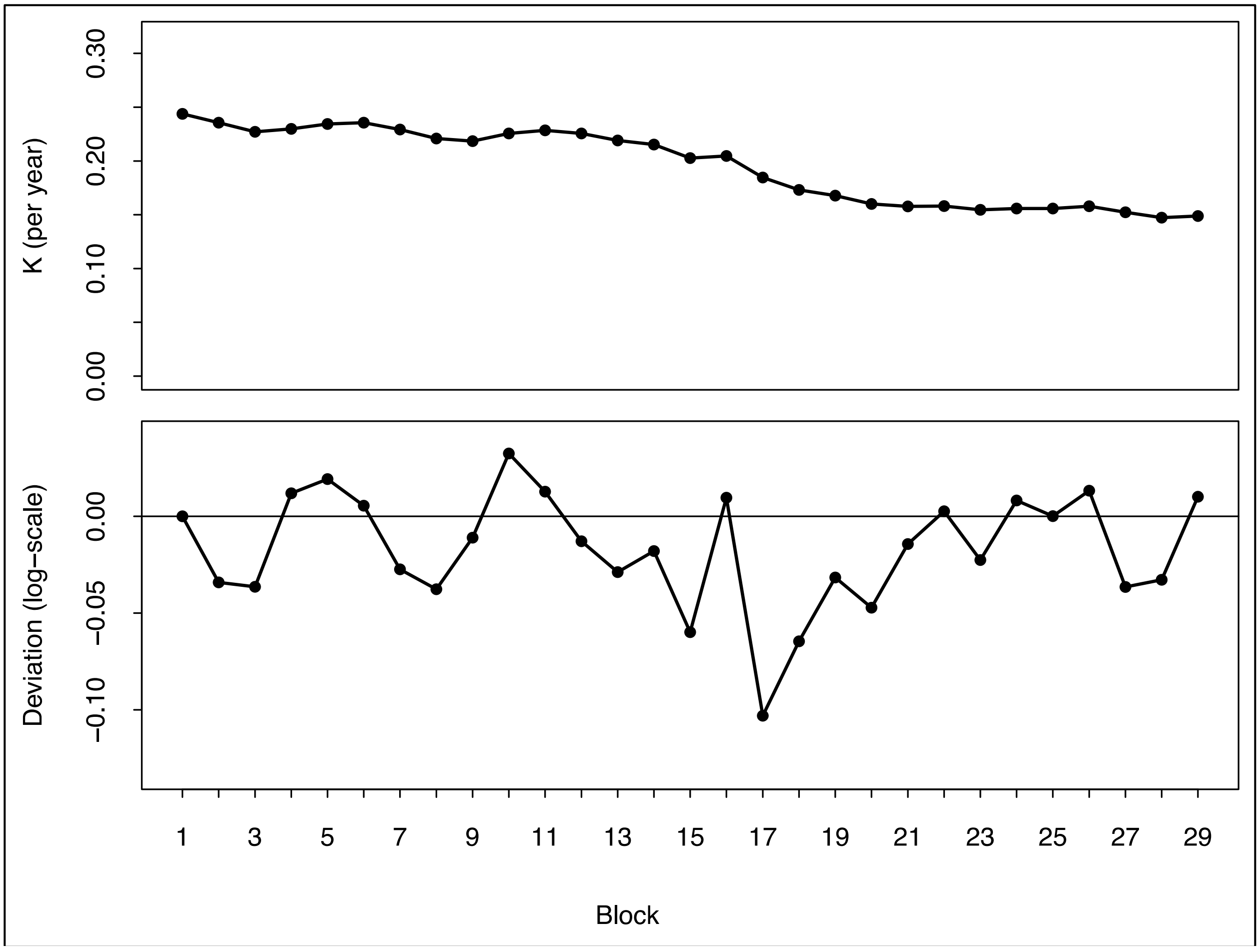

Figure 3.28. Predicted growth parameter K (per year; top panel) and deviation (log-scale; bottom panel) from the base model of the stock assessment, 1991–2019. Block numbers 1–29 correspond to the year 1991–2019.

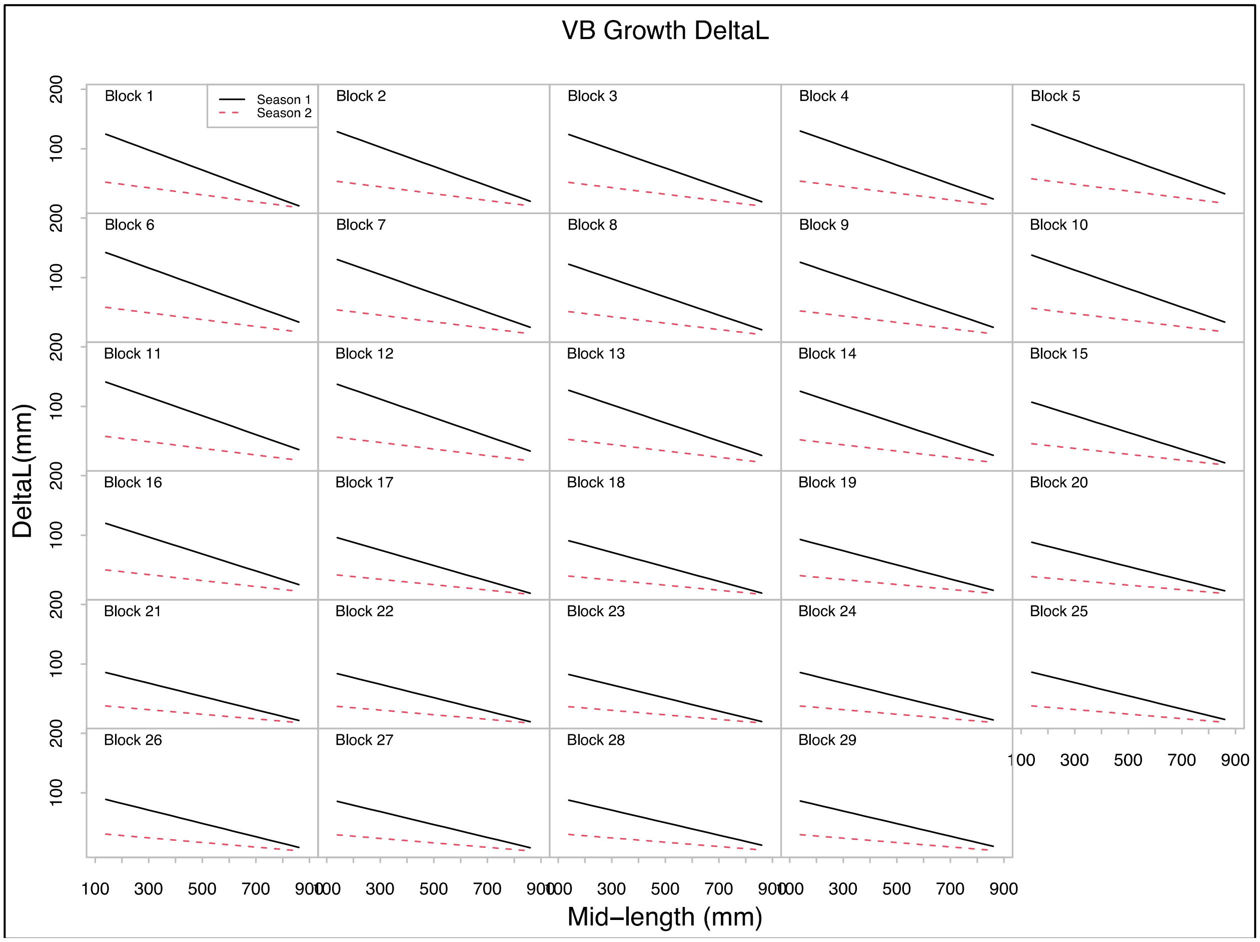

Figure 3.29. Predicted von Bertalanffy growth curve from the base model of the stock assessment, 1991-2019. Season 1—non-winter season, March–November; Season 2—winter season, December–February. Block numbers 1–29 correspond to the year 1991–2019.

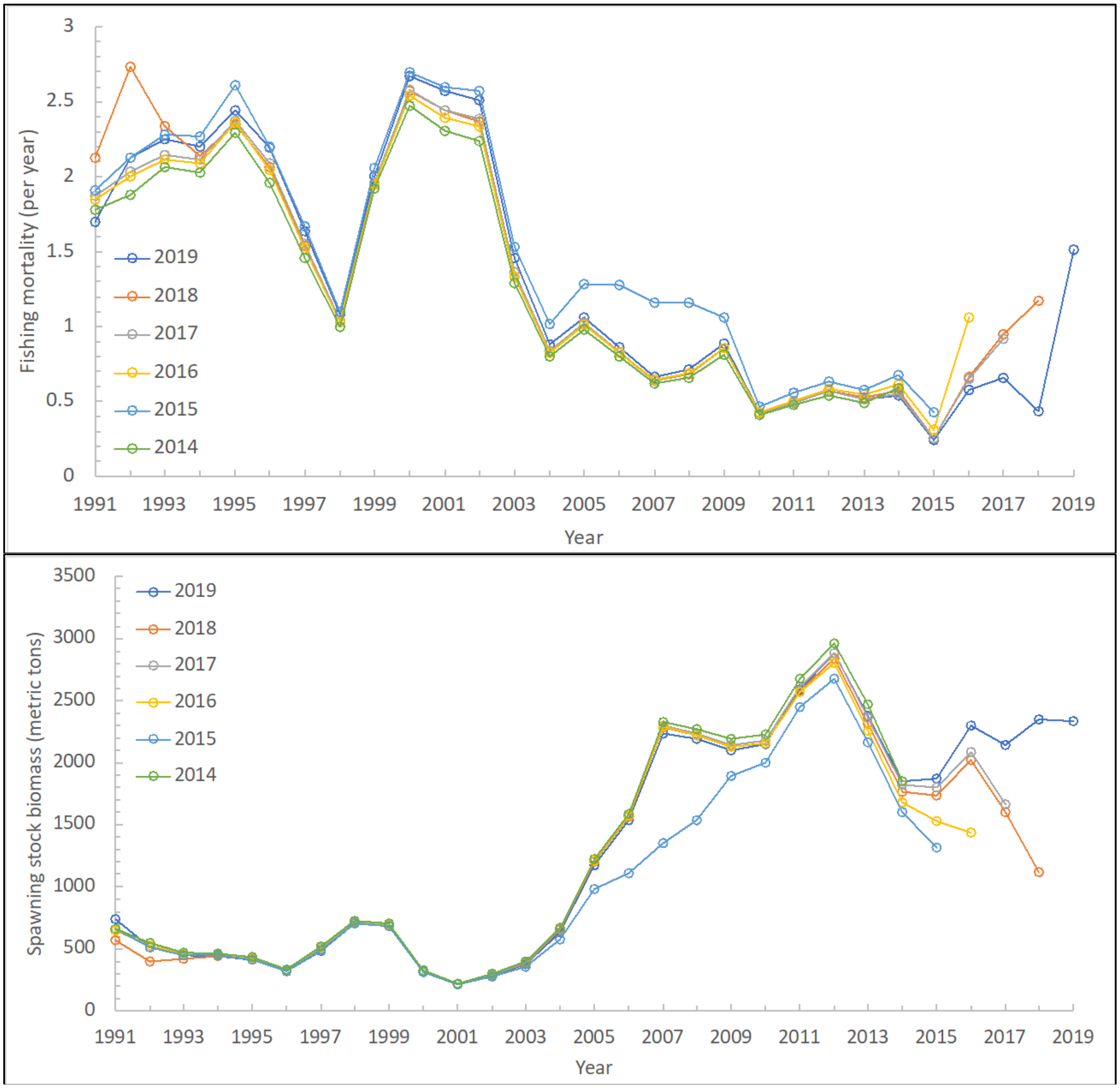

Figure 3.30. Predicted fishing mortality (per year; top panel) and spawning stock biomass (metric tons; bottom panel) from the retrospective analysis in which the model started with the data from 1991 to 2014, and added one additional year of data at a time up to 2019.

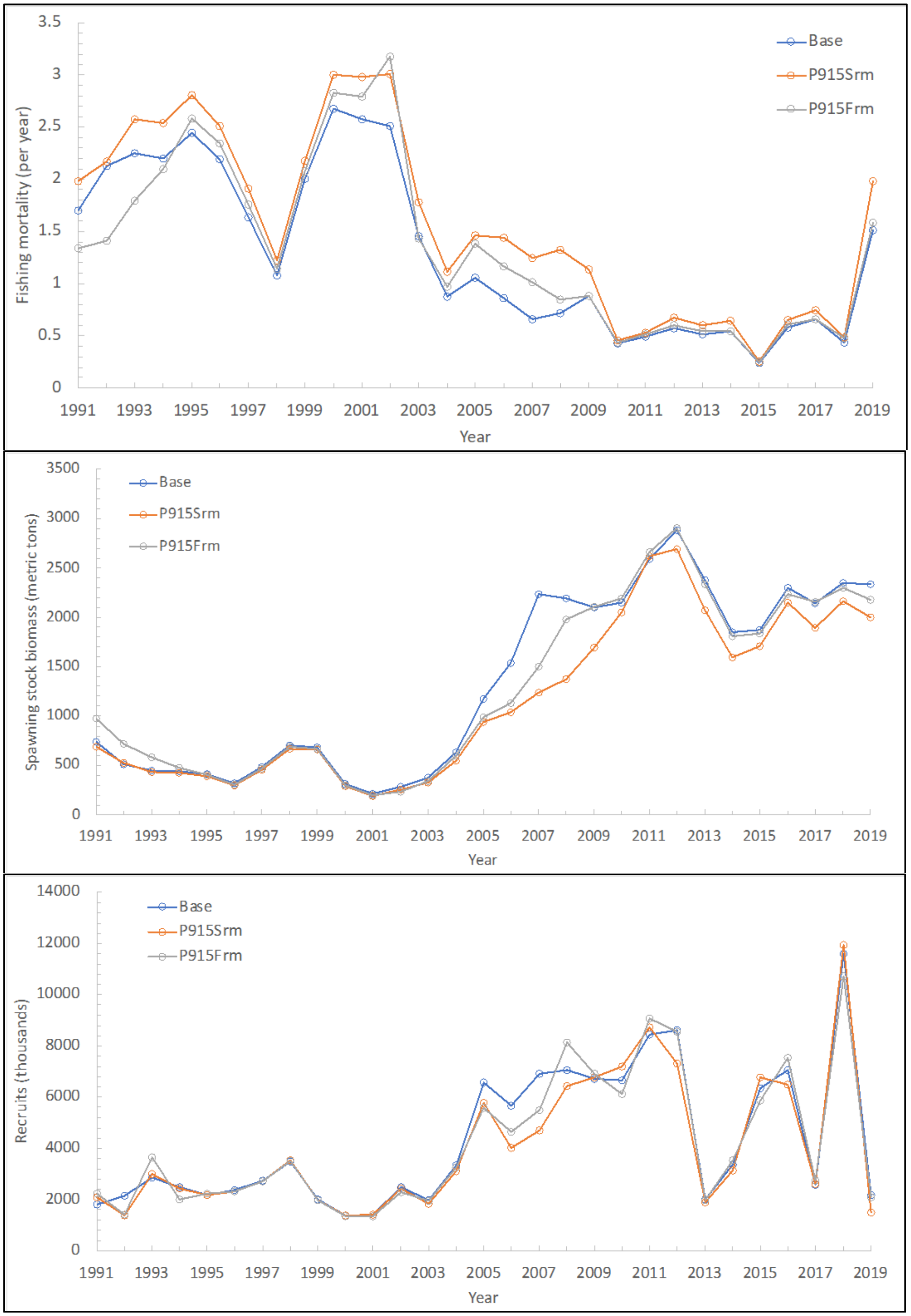

Figure 3.31. Sensitivity of predicted fishing mortality (per year; top panel), spawning stock biomass (metric tons; middle panel) and recruits (thousands of fish; bottom panel) to removal of different fishery-independent survey indices from the base model of the stock assessment, 1991–2019.

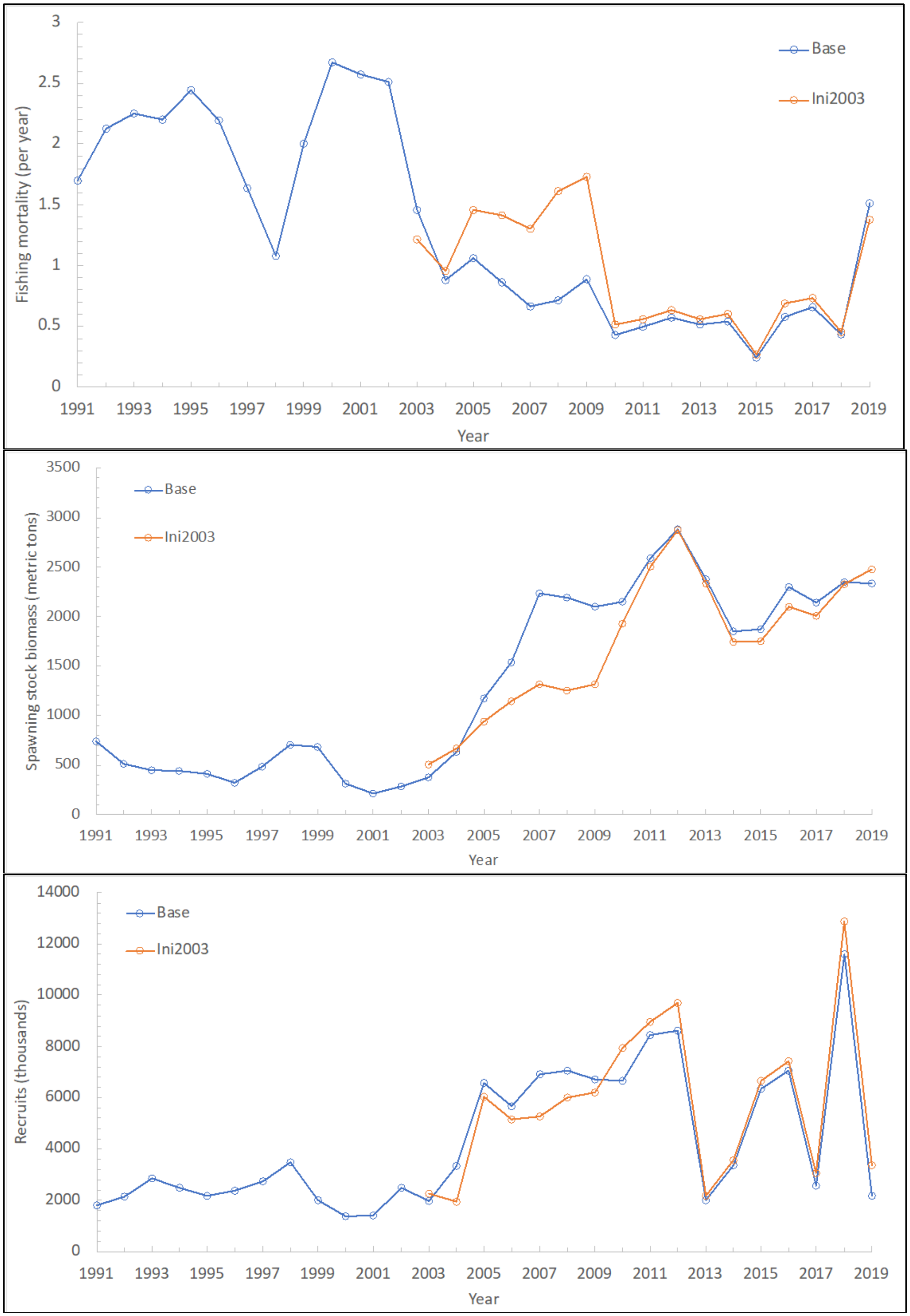

Figure 3.32. Sensitivity of predicted fishing mortality (per year; top panel), spawning stock biomass (metric tons; middle panel) and recruits (thousands of fish; bottom panel) to different initial years.

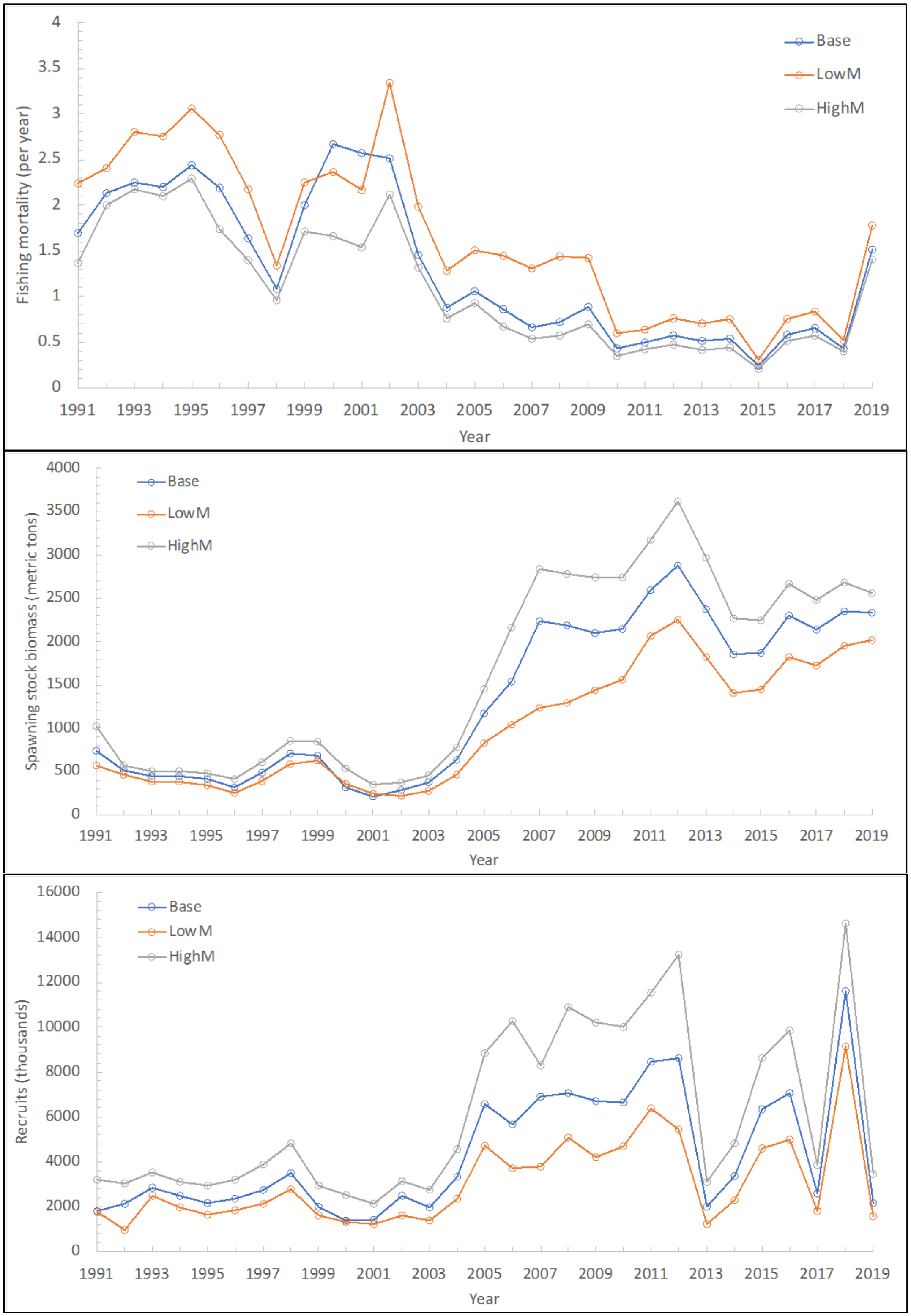

Figure 3.33. Sensitivity of predicted fishing mortality (per year; top panel), spawning stock biomass (metric tons; middle panel) and recruits (thousands of fish; bottom panel) to different annual natural mortality values.

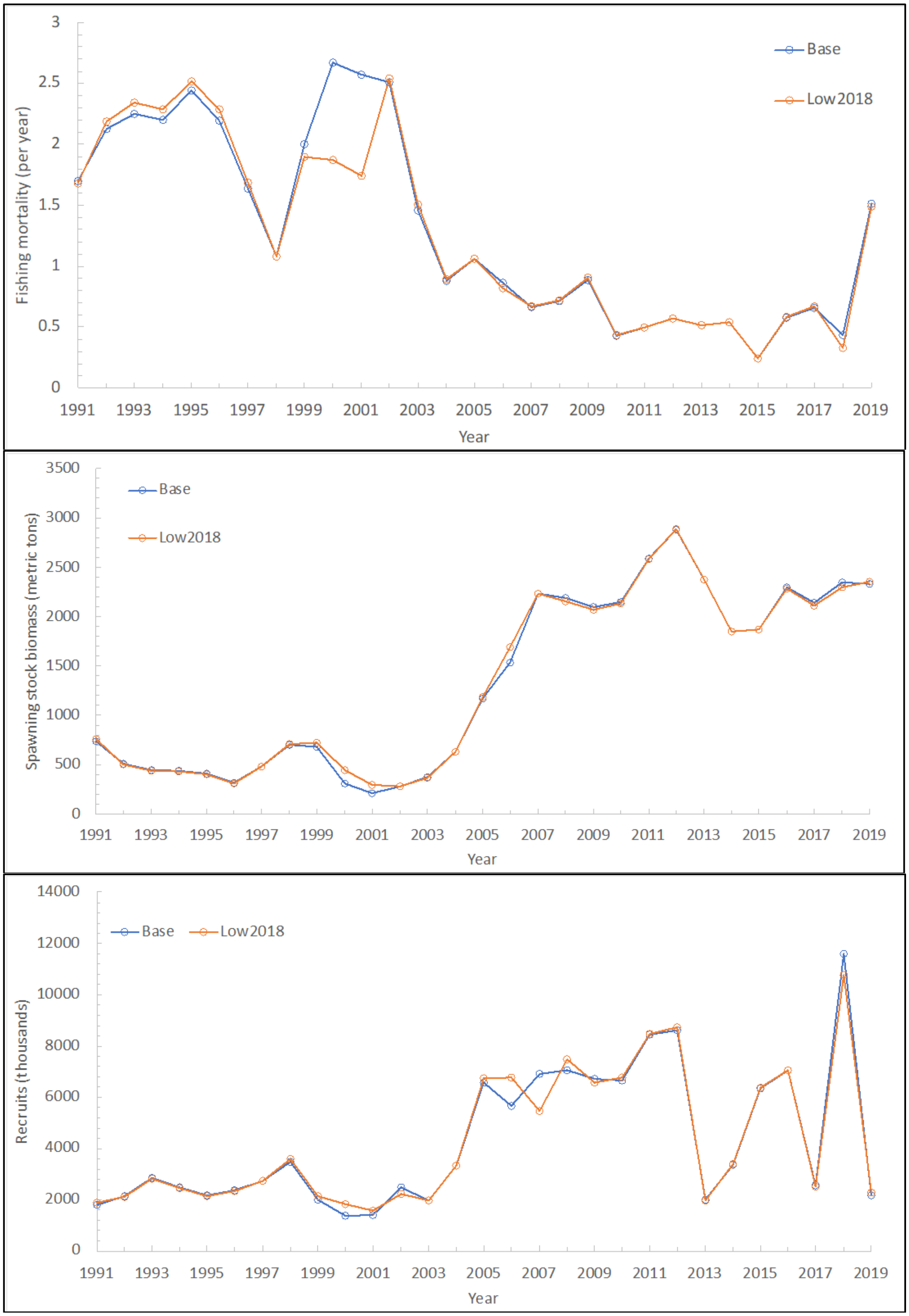

Figure 3.34. Sensitivity of predicted fishing mortality (per year; top panel), spawning stock biomass (metric tons; middle panel) and recruits (thousands of fish; bottom panel) to the 2018 non-winter season recreational discard input.

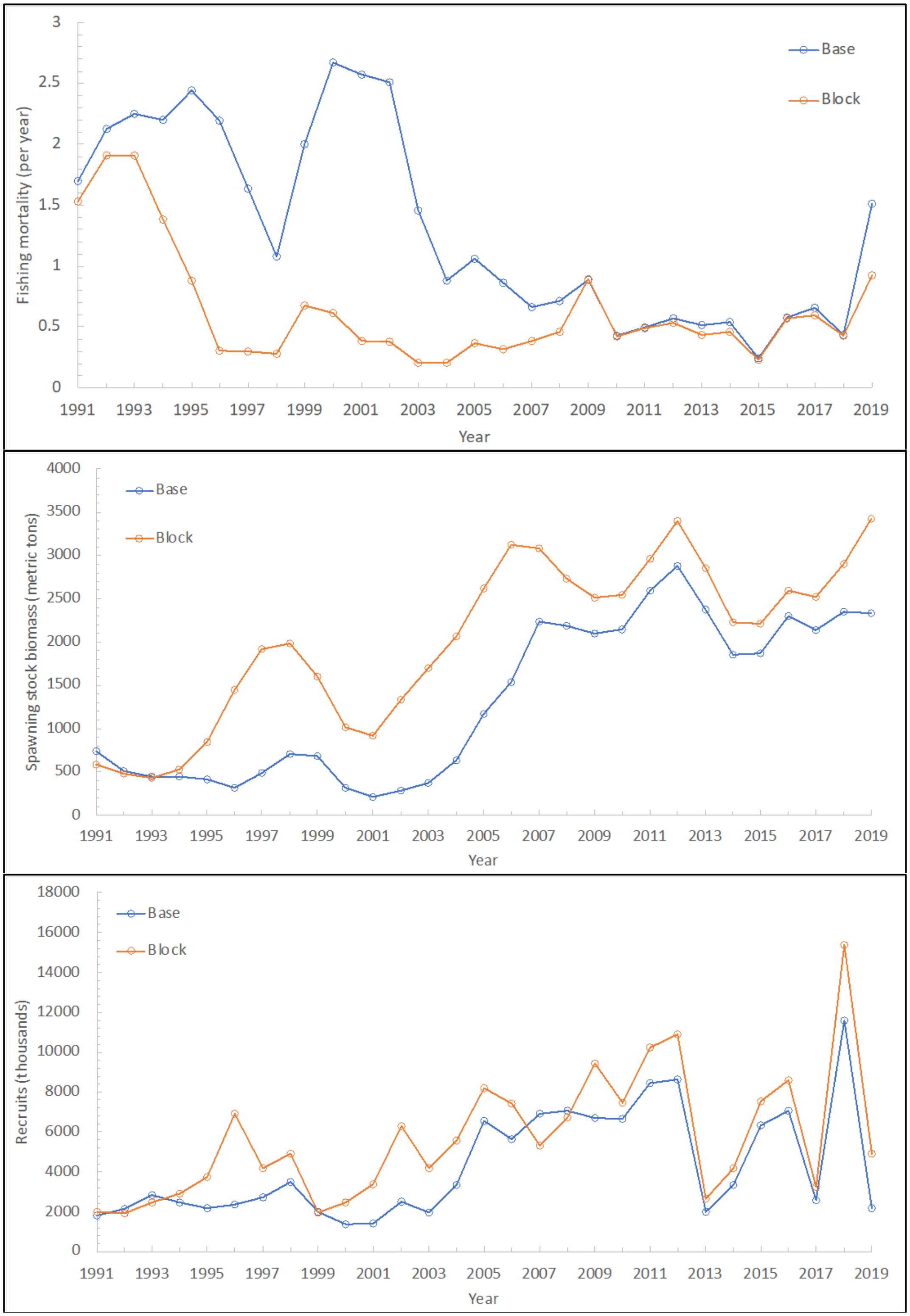

Figure 3.35. Sensitivity of predicted fishing mortality (per year; top panel), spawning stock biomass (metric tons; middle panel) and recruits (thousands of fish; bottom panel) to the assumption on fleet selectivity time block.

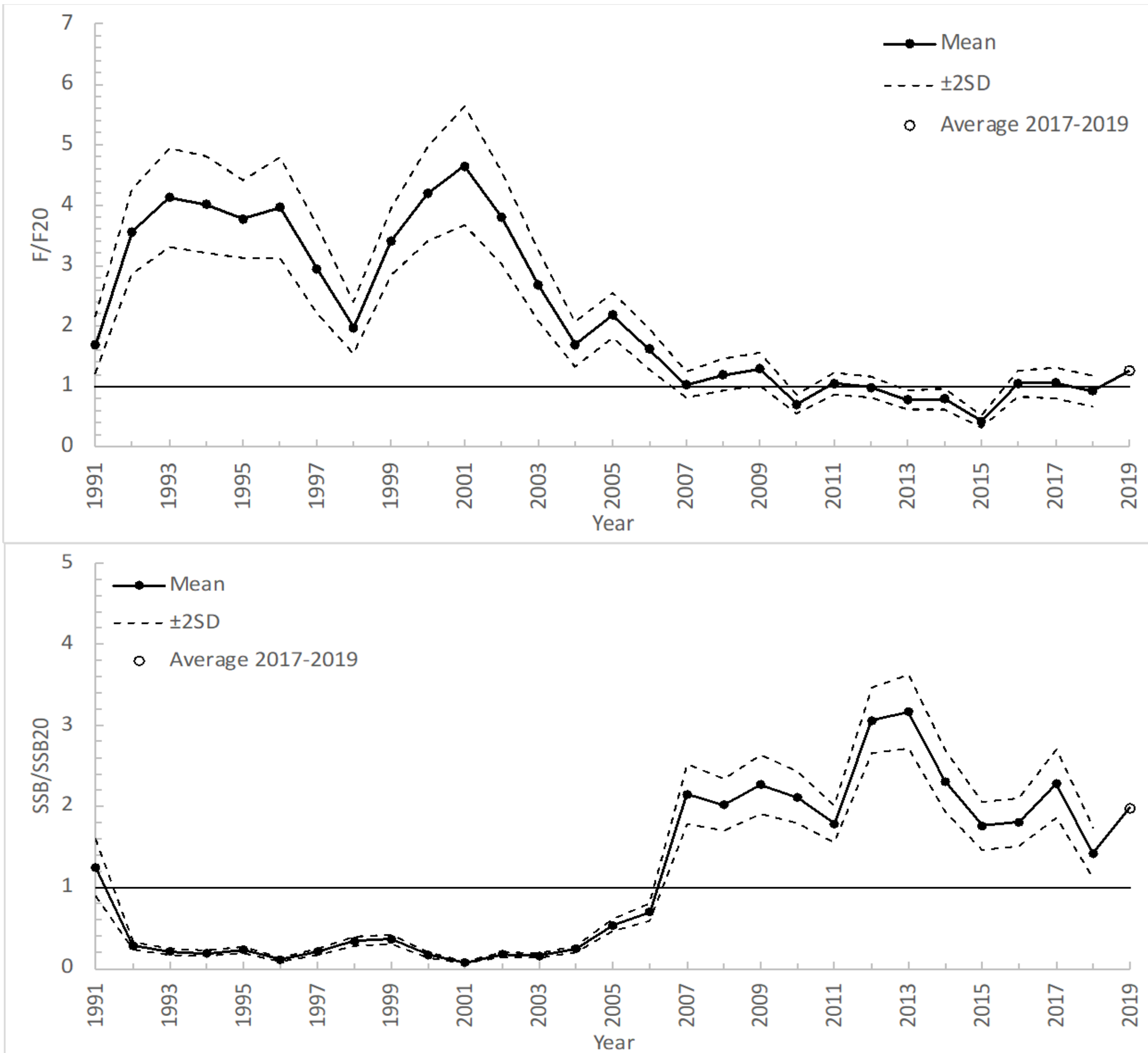

Figure 4.1. Predicted fishing mortality (per year) and spawning stock biomass (metric tons) relative to the fishing mortality threshold (F/F_{20}) and the spawning stock biomass threshold (SSB/SSB_{20}) from the base model of the stock assessment, 1991–2019. The horizontal black line shows a ratio of one. The terminal-year estimate is an average of the most recent three years weighted by the inverse CV values.

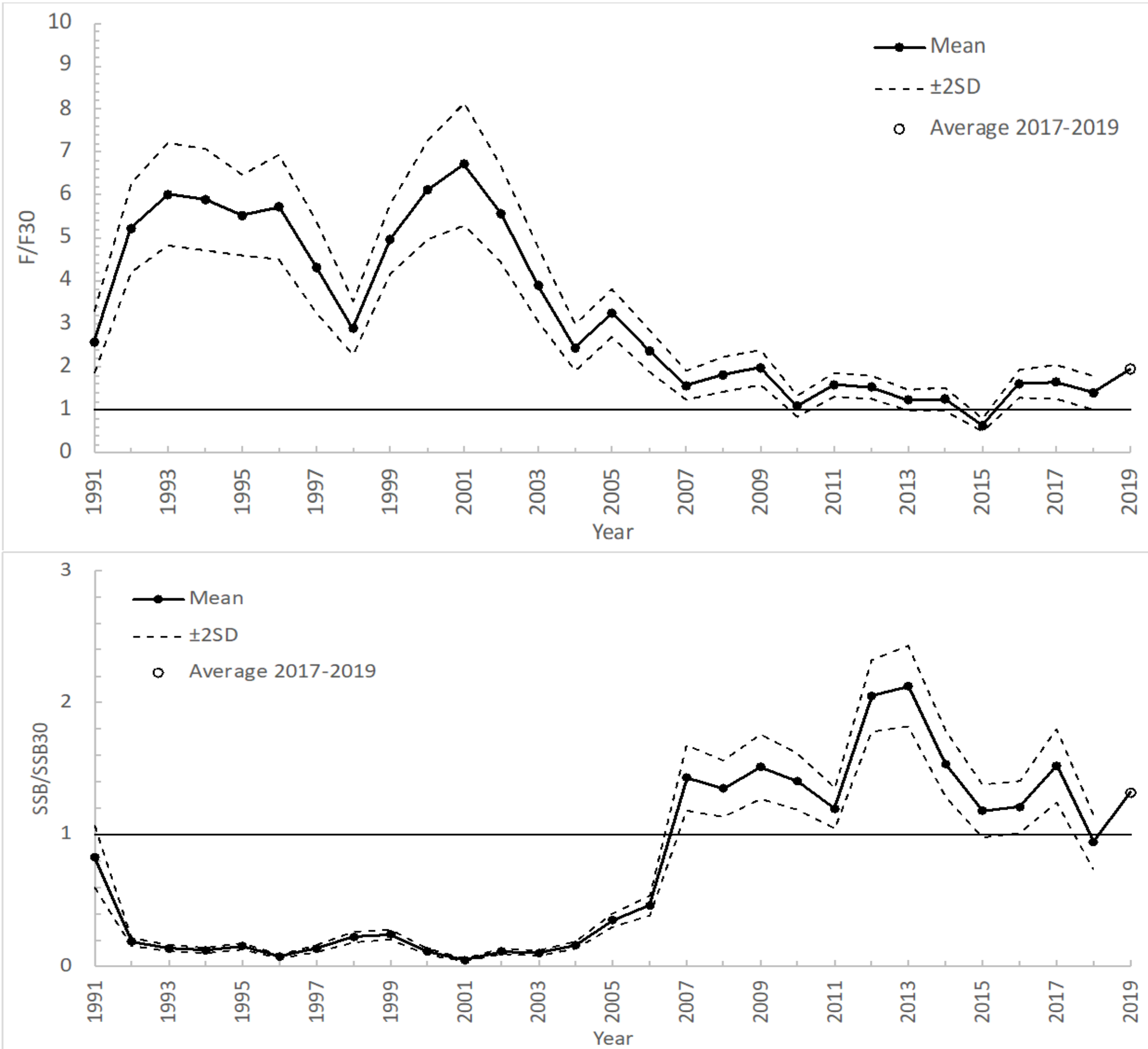

Figure 4.2. Predicted fishing mortality (per year) and spawning stock biomass (metric tons) relative to the fishing mortality target (F/F_{30}) and the spawning stock biomass target (SSB/SSB_{30}) from the base model of the stock assessment, 1991–2019. The horizontal black line shows a ratio of one. The terminal-year estimate is an average of the most recent three years weighted by the inverse CV values.

External Peer Review Report
for the
2022 Stock Assessment
of
Spotted Seatrout in Virginia and North Carolina

External Peer Review Panel

Michael D Murphy(chair) – Retired, Florida Fish and Wildlife Conservation Commission, St. Petersburg, Florida

Joseph E. Hightower -

Emeritus Faculty, NC State University, Raleigh, North Carolina

Mark R. Fisher - Science Director, Texas Parks and Wildlife Department, Rockport, Texas

September 2022

EXECUTIVE SUMMARY

The Spotted Seatrout external Peer Review Panel met in Jacksonville, North Carolina from August 30 - September 1, 2022. Prior to the meeting, the agenda (below) was finalized on July 25, the Stock Assessment Report along with input/output files for the base assessment model were made available (August 1,2), the Terms of Reference for the review were provided to the Panel, and a conference call between the Panelists and the Assessment team was held on August 23. The conference call allowed the Panel to request additional analyses and ask for clarification about data and analyses contained in the Stock Assessment Report. During the meeting North Carolina staff provided presentations on the assessment history, fisheries, and fisheries management during the first day. The spatial and temporal extent of the stock assessment was described. A thorough review of the fishery dependent monitoring for lengths and ages and sex was given as was a presentation of all surveys available for monitoring spotted seatrout. The Panel retired early this day (3:30P) after completion of these presentations and a series of questions and answers. The Panel commends the Assessment team for their concise and comprehensive presentation of the data inputs used in the stock assessment.

On Wednesday the Panel was presented with a thorough description of the assessment model, data inputs and results. The base-run model fit the available data (1991-2019 fisheries landings and length composition, 2003-2019 survey index and length composition) quite well. A strong retrospective pattern was seen in the output suggesting that there could be upward bias in the recent estimates of F and downward bias in the estimated spawning stock biomass. Several alternate data summaries, additional analyses, and model sensitivities were requested and the timely responses greatly facilitated evaluation of the assessment model.

The Panel accepted the base model analyses of spotted seatrout population dynamics as the best scientific information available and suitable for management advice. However, the Panel felt that the terminal-year fishing mortality used in the status determination calculation should be modified to take into consideration the uncertainty inherent in the terminal year estimates. The Panel felt that the Assessment team should utilize an average (e.g., three-year, weighted by inverse of variance) as the best representation of the terminal-year SSB and F estimates.

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1 TERMS OF REFERENCE

The geographic scope of the spotted seatrout considered in the assessment was for fish from all waters of Virginia and North Carolina. Several tag/recapture studies and past genetics analyses indicate little mixing between South and North Carolina but more extensive seasonal movement to and from Virginia. More recent genetic analyses determined that there is a mixing zone between North and South Carolina in the Cape Fear area (O'Donnell *et al.* 2014). Given the infrequent movement of fish between North and South Carolina based on tag recaptures, the relatively small geographic area of mixing, and the relatively low level of spotted seatrout landings made from the mixing zone, the Panel accepted the stock boundaries as defined in the Assessment Report.

1.1 Evaluate the thoroughness of data evaluation and presentation including:

1.1.1 Justification for inclusion or elimination of available data sources

The descriptions of the commercial and recreational fisheries, gears used and seasonality of activity along with fisheries management authority and the history of management actions directed at spotted seatrout in Virginia and North Carolina were adequately described to give context to changes seen in the fisheries over time.

The available recreational and commercial landings and discards data were described, and sources of bias were identified well in the report. The assessment model includes commercial harvest (in number) from VA and NC; commercial discards (relatively minor in magnitude) is only available for NC. Estimates of recreational harvest and discards are available for both Virginia and North Carolina. Recreational discards have increased dramatically in recent years, and estimated dead discards account for a significant fraction of removals. The Panel felt that these data were justified and the best available to account for fishing-induced mortalities. However, the recreational estimates are based on a survey that produces annual error estimates for both seen harvest (Type A) and live releases (Type B2). The Panel accepted the current configuration of the model which utilizes a constant error estimate over time for the recreational fishery harvest and discards but advised more complete use of the survey-estimated errors in the future. The Panel accepted the analyst's estimation schemes used to calculate the commercial live releases and dead discards for the gillnet fishery where direct samples were not available. This fishery is a very small component of the total fishery take.

There are several sampling programs that provide data on the length structure of spotted seatrout seen in the commercial landings and commercial discards. Additionally, the recreational survey (MRIP) provides length composition of landed and kept fish but not of live releases. This was a major data-deficiency for the size-structured assessment model, especially given the increased importance of live-release mortalities to the total fisheries catch in recent years. The Panel accepted the model-based estimation (through a meta-analysis-derived length selectivity function) of this length structure but recommended the future collection of these data through innovative volunteer programs already being initiated by NC staff. Recreational discards size structure and live-release mortality rates were available from proxy observations made from other studies, e.g., tagging. The Panel accepted the current treatment of these data realizing that they need improvement in the future.

The assessment model used spring and fall data from the NCDMF fishery-independent gillnet survey (Program 915, which uses a range of mesh sizes), beginning in 2003. Other surveys, some of which span the entire period of the assessment (1991-2019), either caught few spotted seatrout (NCDMF Program 195, Juvenile red drum survey; NEAMAP, CHESMAP) or catch only age-0 fish below the length range included in the model (NCDMF Program 120). The Panel requested a sensitivity assessment model run that included the Program 120 survey data, but the model was unable to capture the highly variable recruitment dynamics suggested by the trend in spotted seatrout recruit abundance in that survey. More effort should be made to try and incorporate this survey, with the need to possibly increase the amount of variability in recruitment accepted by the model (standard deviation of the recruit deviations).

Fishery-dependent indices were considered but were dropped out of hand over the concerns about the lack of experimental design as used for fishery-independent surveys and the potential for bias from changing catchability over time.

Several life history characteristics were calculated external to the assessment model. A large set (>24,000 fish) of available otolith-based annual age data (raw data) from both fisheries-dependent and fisheries-independent data sources in Virginia and North Carolina were used in an external analysis to provide estimates of von Bertalanffy growth parameters. The Panel judged these data and the analyses as adequate to calculate sex-averaged parameters for asymptotic length (L_∞) and the Brody growth coefficient (K) as needed to estimate the expected mean growth increments for each size class in the initial March-November growth transition matrix.

Available biological data were also used to determine the female size-specific maturity schedule, the maximum age used to estimate a base annual natural mortality rate, and the weight-length relationships. The maturity and weight-length relations were used to calculate the female spawning stock biomass. The Panel questioned the assumed linear relation assumed between the spawning stock biomass and fecundity in this species but accepted it as a measure to be used in the status determination until further information became available from North Carolina. Additionally, the female maturity ogive showed an unusually high level of maturity in one smaller size class that the Panel felt should be checked. The Panel accepted the maturity schedule as estimated.

Habitat and ecological relations were described in a presentation and while pointing out potentials for habitat loss effecting the stock or its dynamics, the only consideration deemed important for inclusion in the assessment model were the changes in natural mortality ascribed to extreme cold events. Many tagging studies were examined to provide information on the variability of natural mortality, often associated with cold kills. This was largely the basis for the decision to use the current size-structure assessment model that can be used to estimate time-varying natural mortality. A base natural mortality was estimated given the observed 9-year maximum age and the cumulative lifetime mortality was distributed across lengths using a weight-based Lorenzen (1996) function. Overall annual estimates of natural mortality (M) were divided into warm (March-November) and cold (December-February) seasons assuming a 1:2 ratio with warm season's M held constant at 0.2. The cold season M was estimated in the model, though constrained through a standard deviation restriction. Assumptions are routinely needed in assessment models to define natural mortality. The Panel accepted the rationale used to define M as used in this assessment model.

1.1.2 Consideration of survey and data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, sample size)

The harvest data are assumed to be precise as reflected by the small CVs (0.05, commercial; 0.10, recreational) used in the model. There is considerable (but unknown) uncertainty in the estimated dead recreational discards, obtained as an assumed constant live-release mortality rate (0.10) multiplied by the reported live discards. Discards were fitted using a higher CV (0.25 for both fisheries) to reflect uncertainties associated with those estimates.

The Multiple Panel Gill Net Survey (Program 915) was the sole source of relative abundance indices. These were split into spring (April-June) and fall (September through November) indices. This survey is spatially extensive (within NC) and covers all months except December-February. The spatial extent increased over time and the stock assessment uses a consistent subset of data from 2003 (Fall index) and 2004 (Spring index). Two weaknesses are that the survey covers only the most recent 17 of the 29 years covered by the assessment (1991-2019) and is not conducted in Virginia. The Panel agreed with the development of the standardized indices from these data. The Panel found that the Gillnet survey was well designed for measuring changes in spotted seatrout abundance although its temporal extent only back to 2003 limited its use in guiding the estimation of relative abundance for the entire time series used in the assessment (1991-2019).

1.1.3 Calculation and standardization of indices and other statistics

Generalized linear models were used to adjust for variables that might affect the indices (e.g., temperature or salinity on sampling dates). Nominal and standardized indices showed similar patterns, perhaps due to the relatively intensive and extensive design of the Program 915 survey. The Panel found these analyses to reflect operating standards currently in use in fisheries analyses.

1.2 Evaluate the adequacy, appropriateness, and application of data used in the assessment.

The complete set of available data needed to run the current assessment model and capture all the estimation variability will never be available. However, the Panel found that the available data and estimates were appropriately used and that any assumptions needed to complete the data needed for this analysis, while probably resulting in an underestimate of the overall uncertainty in its findings on fishing mortality and spawning stock biomass, were appropriate and adequate.

1.3 Evaluate the adequacy, appropriateness, and application of method(s) used to assess the stock.

The analysis was based on a size-structured model (Cao *et al*. 2017), modified to allow for time-varying natural mortality (as has been observed in Spotted Seatrout). The model was fitted using maximum likelihood methods and Automatic Differentiation Model Builder software (ADMB; Fournier *et al.* 2012; http://admb-foundation.org). The original size-structured model is peer-reviewed and supports management of northern shrimps (*Pandalus* spp.). Selectivity was estimated for commercial and recreational harvest but fixed at assumed values for discards. The shape of size selectivity was assumed to be logistic for harvest fleets and dome-shaped (double normal) for discards fleets. Natural mortality and growth are time-varying parameters. This provides flexibility to account for temporal changes including cold-stun mortality events.

Likelihood components (landings, discards, survey indices) were given equal weight (1.0). Model diagnostics used to assess fit included presence of estimated parameters at a bound, jitter analysis, evaluation of fits to commercial landings and survey indices, length composition of fisheries and surveys, and retrospective analysis. There were no obvious issues in fit of the base model, including fit to harvest, survey indices and length composition. The Spring survey was relatively uninformative (flat and variable) but precision was higher and the fit was improved for the Fall index. Jitter analysis provided evidence that a global solution had been obtained, but also suggested substantial uncertainty about the final fishing mortality estimate. Model fit showed a change in stock dynamics around the start of the survey data (e.g., fishing mortality: Assessment Report's Figure 3.21; recruitment: Figure 3.24); however, this was also approximately the start of increased recreational harvest.

Time-varying estimates of natural mortality showed some similarity to the temporal pattern from tag-return models, but tag-return models showed substantially higher estimates.

The model has a very large number of parameters (n=367), including time-varying growth and natural mortality. This provides the model with much flexibility but also the potential for overparameterization. Estimates of growth parameters suggested a relatively stable maximum size (L_∞) but declining growth rate (K). An independent analysis of age and length data suggested that growth was stable over time (no trend in mean length-at-age). The Panel believes that this discrepancy warrants further investigation, to determine whether the time-varying growth model is overparameterized. Initial sensitivity runs using fixed or estimated time-independent growth parameters showed that estimates of F and spawning stock biomass were sensitive to the growth sub model structure. However, management guidance (F>threshold) was the same for the base run (time-varying) and sensitivity runs (Table 1).

Sensitivity runs were conducted by: (1) omitting one of the two surveys; (2) changing the start of the analysis to 2003 (start of survey data); (3) varying the assumed average natural mortality rate; (4) using a lower value for the (extreme) estimated number discarded in the non-winter season in 2018; and (5) using two selectivity eras for the recreational fishery (based on a 2009 change in minimum length). Results for the more recent period (the focus for management) were relatively insensitive to removal of either survey (suggesting a consistent signal for the two surveys) or changing the starting year of the assessment. Fishing mortality was similar but ending spawning stock varied when the assumed average natural mortality rate was varied. Changing the non-winter discards estimate for 2018 had a negligible effect on recent estimates. Using two selectivity periods to account for the regulation change had a negligible effect on fishing mortality but spawning stock was affected. For model changes that affect complexity (number of estimated parameters, e.g., one versus two selectivity eras), it might be possible to assess whether the increase in complexity was warranted by the improved fit.

There is a strong need for a continuity model to help evaluate how the change from age-structured models that were used in the past to the new size-structured framework has changed the findings. Allowing for cold season variability in natural mortality is a step forward in accurately analyzing spotted seatrout population dynamics in Virginia and North Carolina but it is important to identify other potential biases introduced in this model change.

The time block selectivity model appears to make a difference in early F estimates and stock status. The selectivity-blocked trend in total annual F appears to follow the pattern of total kill taken from the stock (Fig. 1) better than F estimates made from the single time block model. Both the base model and the 2-time-period sensitivity models appear to predict the sizes and number of fish landed, discarded dead, or live-release deaths just as well, thus this sensitivity configuration appeared to have support though with a slight increase in the number of parameters compared to the base model. However, a very strong retrospective pattern emerges from the time-blocked selectivity model results possibly indicating a strong misspecification in the model. The Panel felt that further consideration of this model configuration should be made in the future.

1.4 Reference points

1.4.1 Evaluate the adequacy and appropriateness of recommended stock status determination criteria.

The nonstationary use of M complicated reference point estimation. As currently used the threshold and target fishing mortality and spawning stock biomass are all based on the terminal year (2019) population dynamics. With changing M, accurate benchmark calculations cannot be made unless future natural mortality rates are known (Miller and Legault 2017). Calculations of year-specific benchmarks appear to show that the relative variability of natural mortality does not impart a high degree of variability in the threshold or target values of fishing mortality of spawning stock biomass (Fig. 2). The Panel felt a more important consideration for spotted seatrout is the method used to determine the current state of the fishery in terms of F and SSB and recommended a weighting scheme that considered the terminal-year estimates and their precision.

1.4.2 Evaluate the methods used to estimate values for stock status determination criteria.

The methods appear adequate except for the need to include the variability in the terminal-year dynamics in the calculation.

1.4.3 Comment on the appropriateness of comparing terminal year estimates to stock status determination criteria.

The jitter analysis shows high uncertainty in the terminal year F, as does the estimated variance (which underestimates uncertainty because of fixed parameters and assumptions in the model). The retrospective analysis shows a strong pattern of decreasing F as additional years of data are available. The high terminal-year F was due to very high recreational landings for 2019. The Program 915 survey was not conducted in 2020 and Spring of 2021. All these factors lead to uncertainty about recent status, and suggest a more measured approach (e.g., averaging last few years) to calculating status determination.

The Panel felt that the terminal-year F estimate's variability is large and that it should be incorporated into the calculation of the current stock dynamics, e.g., average last three year's estimates using inverse-variance weighted.

1.5 Do the results of the stock assessment provide a valid basis for management for at least the next five years given the available data and current knowledge of the species stock dynamics and fisheries? Please comment on response.

Yes, the Panel felt that the results adequately capture the recent dynamics of the spotted seatrout stock in North Carolina and Virginia. However, prior to about 2007, there is little information (surveys) to constrain the estimates of abundance or mortality. The sensitivity analyses generally pointed to some consistency in the model estimates of fishing mortality during the period of about 2007 through 2019. The earlier period was highly variable through the different sensitivities.

The sensitivity runs show that the thresholds and targets are highly sensitive to the form of the model, but management guidance (overfished/overfishing) is not sensitive (Table 1). There is however a notable sensitivity to the assessment structure (data, software, assumptions, analyst). Status of spotted seatrout has varied markedly from one assessment to the next, and we recommend against attaching too much significance to a single assessment. Gradual stable management (and regulation change) will be more consistent with the gradual pace of understanding stock dynamics.

The estimates of F from 1991 ~2003 are much higher than in the previous assessment. If accurate, then there should be few fish older than age 3 or 4 observed in the population during those years. The Panel recommends using representative age data from this period to calculate mortality rates that can be used to verify this high of an overall mortality rate.

The Panel recommends that the stock's status relative to threshold and target values calculated for fishing mortality and spawning stock abundance not rely only on the terminal year's estimates but use an average of recent estimates. The Panel believes this would be less likely to inflict wide changes in stock status based on poorly estimated terminal year parameters.

1.6 Evaluate appropriateness of research recommendations. Suggest additional recommendations warranted, clearly denoting research and monitoring needs that may appreciably improve the reliability of future assessments.

Given the large programs dedicated to gathering representative age- and sex-specific information from North Carolina's fisheries and surveys each year, the Panel recommends that there be an effort given to developing an age-structured model that can incorporate temporal changes in natural mortality. At the least, a component of the objective function within the current size-structured model should include a fit to age data.

The size structured model's current configuration did not incorporate estimated errors for the recreational landings and live releases. Though these are available, there was a hesitancy to use other than constant CV's for these data because the model was conditioned on catch and less stable when year/season -specific errors were included.

Re-evaluate the female maturity analysis with consideration of the extreme outlier used in the current assessment.

Spotted seatrout have a protracted spawning season, typically from April-October. A June index of juvenile recruitment will miss a large portion of the later spawn and is incomplete. As a research priority, NC should consider implementing a new fishery-independent juvenile survey, perhaps conducted year-round. It would also be useful for other species.

There is a large increase in the number of removals (all fleets combined) beginning in 2005 (Figure 1). This is a pivotal year for the model results, as well. It would be interesting to understand whether these increases were accompanied by an increase in recreational fishing effort in both Virginia and North Carolina. It is recommended that this be investigated as to whether design changes in the MRIP survey could be responsible for this change.

We suggest a lower emphasis on commercial monitoring for this species, because of the relatively minor impact of commercial fishing on the stock. Recreational discards should be the primary focus (and a high, rather than low, priority) because of the trend and magnitude of recreational catch-and-release. The planned expansion of a Citizen Science initiative to include spotted seatrout may be helpful, if biases related to participating angler reporting can be addressed.

We recommend testing and validating the model with known data sets. It has been used for northern shrimps (which lack age data) but not for fish with information about length and age. Testing can determine the extent to which length composition data can extract stock dynamics for longer-lived, multi-aged fish stocks, and can assess the best way to incorporate the available age data (fishery and survey).

Prior to expanding the Program 915 to winter months (that were initially sampled, then dropped for safety reasons), we recommend a detailed analysis of the existing data. This could determine the extent to which late fall and spring data provide insights into overwinter changes. This analysis could also provide insights into the magnitude of cold-stun events, which could explain differences in the effects observed in tagging and telemetry studies versus survey and fishery monitoring.

We recommend additional work to evaluate more fully the utility of the Program 120 survey, which spans the entire period used for the assessment. Including the recruitment index data may require a higher variance to accommodate the large fluctuations observed in the survey. Initial model results from a sensitivity run suggest that the model is sensitive to inclusion of recruitment data, at least for the early years prior to the start of the Program 915 survey.

We recommend that integration of tagging data be given high priority, given the dramatic difference in results regarding survival rate and natural mortality. Tagging provides an independent look at population dynamics and has different assumptions from analyses of harvest and survey data. Tag returns can also be used to investigate growth (growth increments) that could be compared to the size-based model inferences. An advantage of tagging studies is that key aspects can be tested using auxiliary studies (e.g., double tagging to address tag loss). There is a substantial data set of tags released (2008-2019 for NC; 1995-2018 for VA). Additional field or tank studies might be done to explore the possibility of chronic mortality associated with tagging and telemetry.

Age validation was suggested as a low priority. It is always a worthwhile endeavor but might be removed from the list until age data are being used in the assessment.

1.7 If applicable, recommend recruitment and fishing mortality/catch scenario(s) for projections

N/A

1.8 Recommend timing of next stock assessment for the species

We recommend maintaining the current approach of a five-year cycle. This provides enough additional data to warrant an update. There will be an information gap in the next assessment because of the cessation of sampling during the pandemic. A five-year delay will allow for enough new data to make updating worthwhile. Until the next assessment is done, real-time monitoring using the Program 915 survey and MRIP recreational catch-per-angler-hour could provide insights into the stock's status.

2 ADDITIONAL COMMENTS

3 LITERATURE CITED

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Spotted Seatrout Stock Assessment Peer Review Workshop
30 August–1 September 2022
Jacksonville, North Carolina

Final Agenda

DAY 1: TUESDAY, 30 AUGUST 2022, 12:00 pm–5:00 pm

Day 1 Goals**:** Review purpose and expectations of peer review, gain understanding of fisheries and management history, gain understanding of species biology and ecology, and review and evaluate assessment input data

Preliminaries

- Welcome & introductions (*Steve Poland*)
- Purpose of review workshop & expected products (*Mike Murphy*)
- Review agenda & code of conduct (*Mike Murphy*)

Background

- Presentation: Assessment History (*Laura Lee*)
- Presentation: Fisheries & Management History (*David Behringer*)
- Presentation: Stock Structure & Species Life History (*Lucas Pensinger*)
- Review Panel Q & A

Data

- Presentation: Fisheries-Dependent Monitoring (*Alan Bianchi, Drew Cathey, & David Behringer*)
- Presentation: Fisheries-Independent Surveys (*David Behringer*)
- Review Panel Q & A

DAY 2: WEDNESDAY, 31 AUGUST 2022, 9:00 am–5:00 pm

Day 2 Goals**:** Review and evaluate assessment model and results, review and evaluate method for estimating reference point values, review and evaluate current stock status, request additional analyses, and review and comment on research recommendations

Seasonal, Size-Structured Model

- Presentation: Model Data Input (*Yan Li*)
- Presentation: Model Structure & Parameterization (*Yan Li*)
- Presentation: Model Results (*Yan Li*)
- Review Panel Q & A
- Identify additional analytical requests

Status Determination

- Presentation: Reference Points & Stock Status (*Yan Li*)
- Review Panel Q & A

- Identify additional analytical requests

Research Recommendations

- Presentation: Research Recommendations (*Yan Li*)
- Review Panel Q & A

DAY 3: THURSDAY, 1 SEPTEMBER 2022, 9:00 am–1:00 pm

Day 3 Goals**:** Recommend best model configuration for assessing stock, recommend best approach for estimating reference point values, recommend whether results provide a valid basis for management, complete draft version of peer review report, and identify any outstanding tasks

Initial Summary

- Review results of additional analytical requests
- Review Panel deliberations (closed session)
- Review Panel reviews initial conclusions with Working Group (closed session)
- Review Panel begins drafting report (closed session)/Working Group session addressing additional analytical requests

Wrap-Up & Next Steps

- Review results of additional analytical requests
- Review Panel deliberations (closed session)
- Review Panel reviews conclusions with Working Group (closed session)
- Review Panel session drafting report (closed session)
- Identify tasks to be completed & timeline

ADDITIONAL INFORMATION

There will be a one-hour break for lunch on Wednesday. Additional breaks will be given at the discretion of the chair.

The order and timing of agenda items is subject to change.

The goals listed for each day are intended for the peer review panel and chair.

During closed sessions, everyone except the peer review panel and chair will be asked to leave the room unless noted otherwise above.

Only the peer review panel and chair participate in the development of the peer review report. The report will not be available to the NCDMF staff, the public, or others until it is considered complete.

Table 1. Biological Reference Points for various sensitivity runs.

Model	TerminalF	TerminalSSB	Fthresh	SSBthresh	Ftarget	SSBtarget
Base	1.512	2337.974	0.691	832.344	0.437	1251.797
P915Srm	1.980	1997.854	0.671	764.102	0.422	1147.740
P915Frm	1.583	2181.306	0.667	834.094	0.422	1252.305
Ini2003	1.376	2475.647	0.525	2701.429	0.359	4025.220
LowM	1.774	2016.808	0.359	1890.147	0.242	2812.434
HighM	1.404	2560.487	1.208	549.635	0.730	824.951
Low2018	1.486	2356.872	0.676	850.583	0.427	1277.680
Block	0.925	3428.873	0.823	1234.601	0.510	1851.404
P120noLag	1.900	2028.298	0.681	795.909	0.432	1193.179
P1201YrLag	1.145	2814.201	0.676	784.001	0.427	1183.223
constGLinfFix	3.635	1125.937	0.549	2268.698	0.374	3429.834
constGLinfKFix	2.503	1577.664	0.559	1394.682	0.374	2094.259
constGLinfKEst	2.048	1936.712	0.500	1415.319	0.330	2127.802
P120NoMissing	0.726	4076.007	0.642	904.110	0.413	1347.701

Model configuration:
Base: default
P915Srm: omission of Program 915 spring gill-net data
P915Frm: omission of Program 915 fall gill-net data
Ini2003: start analysis in 2003
LowM: Annual average natural mortality set to 0.4, lower than the base model (0.6)
HighM: Annual average natural mortality set to 0.8, higher than the base model (0.6)
Low2018: March-November recreational discards set to the average of the previous five years, lower than the base model (1,863.527 thousands of fish)
Block: Two time blocks for fleet selectivity, 1991–2008 and 2009–2019
P120noLag: Inclusion of Program 120 survey data, with no lag
P1201YrLag: Inclusion of Program 120 survey data, with one-year lag
constGLinfFix: Modified growth sub-model with fixed L_∞
constGLinfKFix: Modified growth sub-model with fixed L_∞ and K
constGLinfKEst: Modified growth sub-model with constant but estimated L_∞ and K
P120NoMissing: Inclusion of Program 120 survey data, with 0.01 added to dates with 0 catch

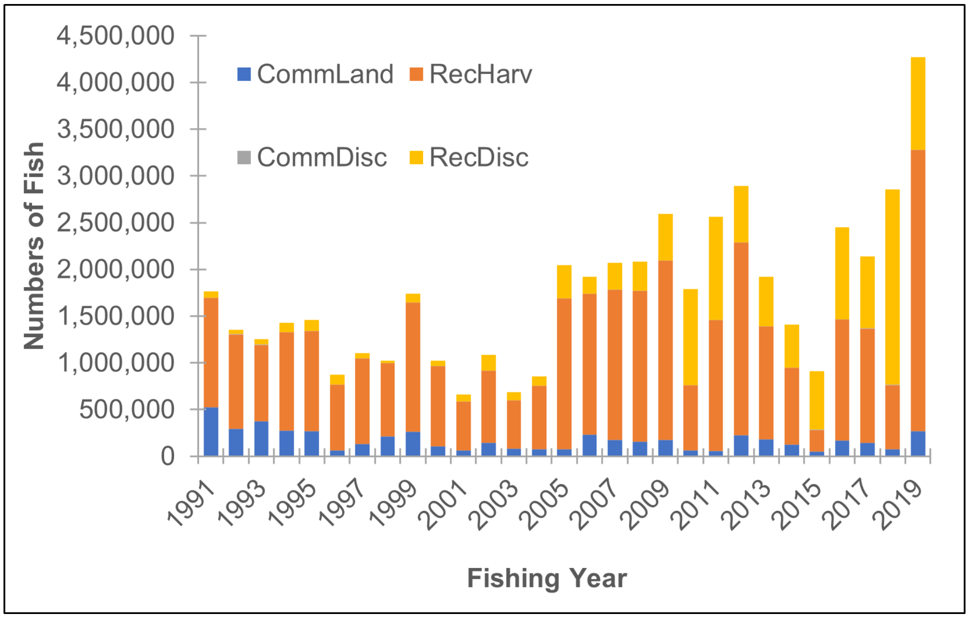


Figure 1. Total kill of spotted seatrout by fishery sector in North Carolina and Virginia during 1991-2019.

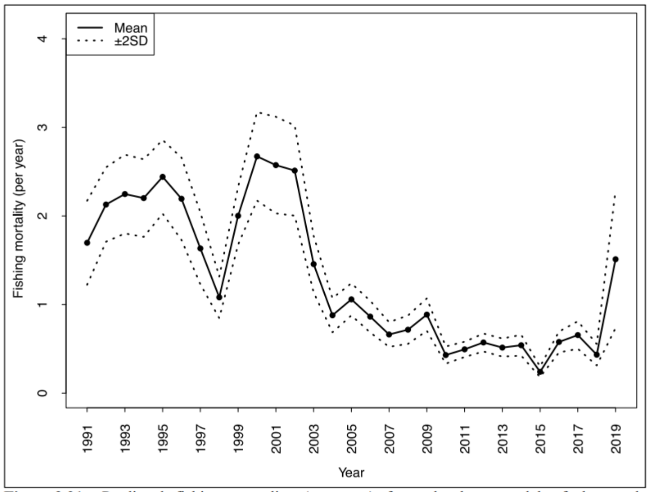


Figure 3.21. Predicted fishing mortality (per year) from the base model of the stock assessment, 1991–2019.

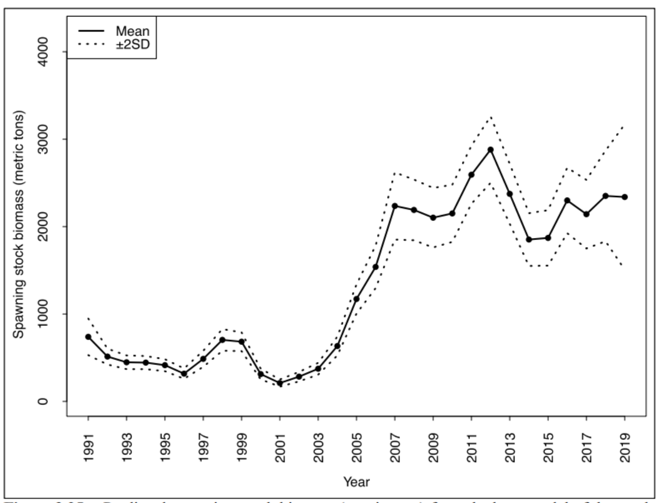


Figure 3.25. Predicted spawning stock biomass (metric tons) from the base model of the stock assessment, 1991–2019.

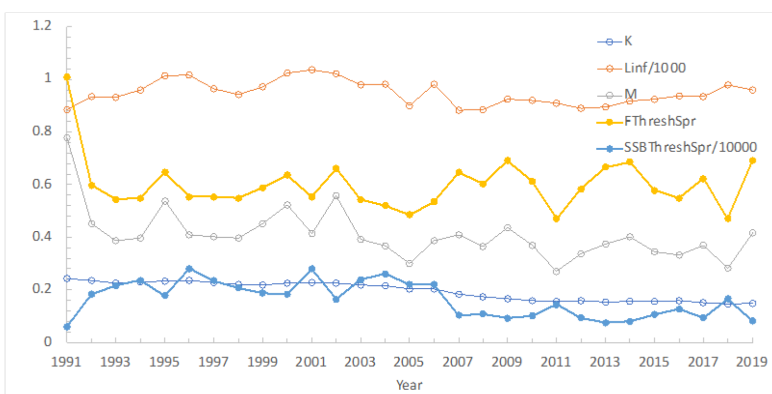


Figure 2. Base model estimates of annual F (Fig. 3.21), spawning stock biomass (Fig. 3.25) and associated estimation error (± 2SD's; dotted lines), and year-specific estimates of F and SSB at the threshold value of 20% spawning potential ratio. Year-to-year changes in thresholds are mostly associated with changes in estimates of annual M.

Estuarine Striped Bass Fishery Management Plan Amendment 2 Decision Document

August 2022

N.C. Division of Marine Fisheries

3441 Arendell Street

Morehead City, North Carolina 28557

This Decision Document is a companion document to Amendment 2 to the Estuarine Striped Bass Fishery Management Plan. It provides a brief overview and context for the issues. The document also provides references to the full Amendment document where more detailed information and exact management option language is located. The Estuarine Striped Bass Fishery Management Plan Amendment 2 document is the plan under consideration and is the focus of all MFC action.

Summary

During the August MFC business meeting the MFC will review departmental comments and vote on final adoption of draft Amendment 2 of the Estuarine Striped Bass Fishery Management Plan (Amendment 2) . If approved, the DMF, Marine Fisheries Commission (MFC) and Wildlife Resource Commission (WRC) will begin implementing the approved management.

The current stock assessment indicates the Albemarle-Roanoke Striped Bass Stock Assessment is overfished and overfishing is occurring. To address overfishing, the DMF implemented adaptive management approved under Amendment 1 of the Estuarine Striped Bass FMP. This significantly reduced the total allowable harvest for all fisheries to end overfishing. The management being considered in Amendment 2 will continue with this reduced total allowable harvest for all fisheries and the rebuilding process.

A stock status determination is not available for the Central Southern Management Area stocks of striped bass, however, based on evaluation of available data sustainable management are presented as part of Amendment 2.

Amendment Timing

November 2020	Division holds public scoping period
February 2021	MFC approves goal and objectives of FMP
October 2020 - September 2021	Division drafts FMP
September - October 2021	Division holds workshops to further develop draft FMP with Plan Advisory Committee
October 2021 - January 2022	Division updates draft plan
February 2022	MFC votes to send draft FMP for public and AC review
March 2022	MFC Advisory Committees meet to review draft FMP and receive public comment
May 2022	MFC selects preferred management options
June - July 2022	DEQ Secretary and Legislative review of draft FMP
August 2022	**MFC votes on final adoption of FMP**
TBD	DMF, WRC and MFC implement management strategies

FMP Goal and Objectives

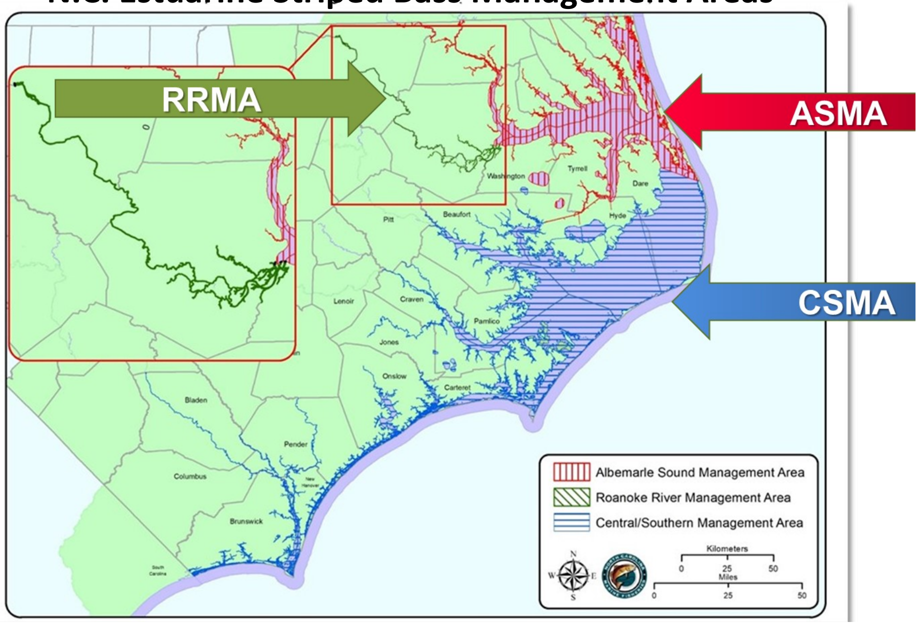
The goal of Amendment 2 is to manage the estuarine striped bass fisheries to achieve self-sustaining populations that provide sustainable harvest based on science-based decision-making processes. If biological and/or environmental factors prevent a self-sustaining population, then alternate management strategies will be implemented that provide protection for and access to the resource. The following objectives will be used to achieve this goal.

- Implement management strategies within North Carolina and encourage interjurisdictional management strategies that maintain and/or restore spawning stock with adequate age structure and abundance to maintain recruitment potential and to prevent overfishing.
- Restore, enhance, and protect critical habitat and environmental quality in a manner consistent with the Coastal Habitat Protection Plan, to maintain or increase growth, survival, and reproduction of the striped bass stocks.
- Use biological, social, economic, fishery, habitat, and environmental data to effectively monitor and manage the fisheries and their ecosystem impacts.
- Promote stewardship of the resource through public outreach and interjurisdictional cooperation regarding the status and management of the North Carolina striped bass stocks, including practices that minimize bycatch and discard mortality.

Background

There are two estuarine striped bass management units and four stocks in North Carolina. The Northern management unit includes the Albemarle Sound Management Area (ASMA) and Roanoke River Management Area (RRMA). The striped bass stock in these two harvest management areas is referred to as the Albemarle– Roanoke (A-R) stock, and its spawning grounds are in the Roanoke River in the vicinity of Weldon, NC. Implementation of recreational and commercial striped bass regulations within the ASMA is the responsibility of the MFC. Within the RRMA, commercial regulations are the responsibility of the MFC while recreational regulations are the responsibility of the WRC. The A-R stock is also included in the management unit of Amendment 7 to the Atlantic States Marine Fisheries Commission (ASMFC) Interstate FMP for Atlantic Striped Bass. The Southern management unit is the Central Southern Management Area (CSMA) and includes the Tar-Pamlico, Neuse, and the Cape Fear rivers stocks.

N.C. Estuarine Striped Bass Management Areas



The most recent A-R striped bass stock assessment was completed and approved for management use in 2020. The assessment indicated the resource is overfished and is experiencing overfishing. The North Carolina Fisheries Re-form Act and Amendment 7 to the ASMFC Interstate FMP for Atlantic Striped Bass require management measures to be implemented to end overfishing in 1-year and end the overfished status in 10-years. Adaptive management described in Amendment 1 was triggered by the assessment and the November 2020 Revision to Amendment 1 to the North Carolina Estuarine Striped Bass FMP reduced the striped bass total allowable landings (TAL) from 275,000 pounds to 51,216 pounds in the ASMA and RRMA. This reduction in TAL is expected to end overfishing in one year. This adaptive management action maintains compliance with Amendment 1 to the North Carolina Estua-rine Striped Bass FMP and ASMFC Addendum IV to Amendment 6 to the Interstate FMP for Atlantic Striped Bass. The new TAL was effective January 1, 2021. The commercial and recreational fisheries are set at a 50/50 allocation. Recreational allocation is split evenly between the ASMA and RRMA.

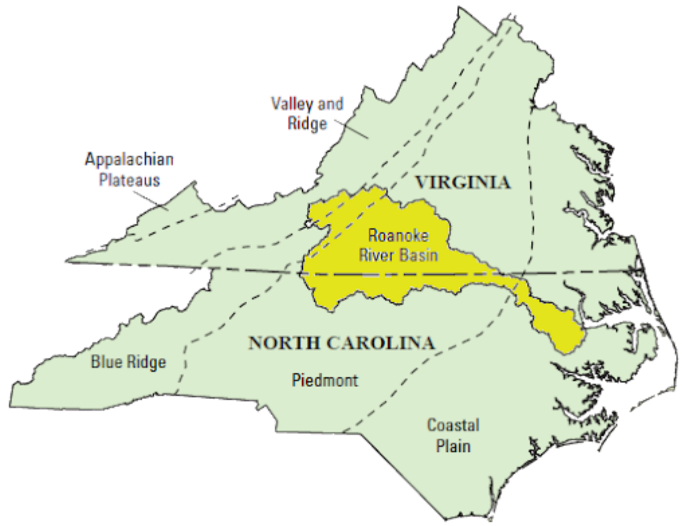
The CSMA Estuarine Striped Bass Stocks report completed in 2020, is a collection of (1) all data that have been collected, (2) all management effort, and (3) all major analyses that have been completed for CSMA stocks to serve as an aid in development of Amendment 2. While this report does not yield a stock status, it does indicate that sustainability of Tar-Pamlico and Neuse rivers stocks is unlikely at any level of fishing mortality. It also indicates that natural recruitment is the primary limiting factor. The report concludes that without stocking, abundance will decline. In the Cape Fear River, abundance declined even with no possession measures in place. No-possession measures were implemented in the Cape Fear River in 2008 and the Tar-Pamlico and Neuse rivers in 2019. The overall goal of the no-possession measures is to increase the age structure and abundance of fish in these systems to move towards sustainable stocks.

River Flow

Striped bass are broadcast spawners, producing eggs that must remain suspended in the water column to develop and hatch. Proper river flow is a critical environmental factor influencing year class strength. In the RRMA, extended periods of high water flow from May to June negatively impact eggs and fry. Recruitment failures since 2001 are thought to be due to spring flooding.

There are three dams on the Roanoke River above Weldon. The Federal Energy Regulatory Commission does limit activities, such as hydropeaking, to limit dam impacts. However, rainfall in the river basin impacts the ability to regulate river flow while limiting flooding. The Roanoke River is impacted by rain north of Winston-Salem, NC and into southern Virginia.

A cooperative agreement with the US Army Corp. of Engineers strives to maintain Roanoke River flow rates within specified ranges to allow for striped bass spawning success. Flow rates that strive to benefit striped bass spawning are negotiated. Spawning success is measured by the annual juvenile abundance index (JAI). In 2005, the flow was ideal for spawning and the JAI was high. In 2013, the flow rate was too high for half of the spawning period. The resulting JAI was low. Poor recruitment is a major factor causing population declines. Inter-agency work continues to address these environmental concerns.



Roanoke River Basin USGS Report 2012-5101

Stocking

In the late 19th century, the Weldon Hatchery began growing striped bass to release into the wild. Since then striped bass have been stocked in the Albemarle Sound, Tar-Pamlico, Neuse, and Cape Fear rivers. An interagency cooperative agreement (See Appendix 1A, p. 51) between the US Fish and Wildlife Service, DMF, and WRC was established in 1986 to oversee the North Carolina Coastal Striped Bass Stocking Program. An annual workplan establishes stocking goals by river system.

Historically, Roanoke River broodstock were used when stocking the rivers of North Carolina. This has resulted in genetically similar fish stocks across the state. Broodstock are now retrieved from the different river systems; however, the fish are genetically from the same stock.

Stocking is necessary to maintain the Tar-Pamlico, Neuse, and Cape Fear stocks. Data collection efforts continue to evaluate if self-sustaining stocks are achievable in these systems. If not, alternative management may be considered, such as hatchery supported fisheries. More on the history of stocking and an assessment of the state stocking program is provided in Appendix 1 of the FMP document (p. 31) . This information informs the three sustainable harvest issue papers.

MFC Preferred Management Measures

In May 2022, the North Carolina MFC reviewed the input from the WRC, MFC Advisory Committees, and the public for draft Amendment 2 and selected its preferred management options listed below. The MFC selected the options recommended by the DMF which are listed below. In addition, the MFC passed a motion continuing the current prohibition of gill nets above the ferry lines in the Tar-Pamlico and Neuse Rivers. The DMF is to study the effects of the gill net closure and reevaluate the decision based on the study outcome during the next full amendment review. Amendment 2 was jointly developed by the Division of Marine Fisheries (DMF) staff and Wildlife Resources Commission (WRC) staff, with recommendations provided by the WRC and DMF.

Measures to Achieve Sustainable Harvest for the Albemarle Sound-Roanoke River Stock *(Appendix 2)*

- Continue to use stock assessments and projections to determine the Total Allowable Landings (TAL) that achieve sustainable harvest
- Continue managing the ASMA commercial fishery as a bycatch fishery
- Modify accountability measures: if landings in any fishery exceeds their allocation, all landings in excess will be deducted from that fisheries TAL the next calendar year or until the overage is paid back
- In the ASMA, implement a harvest slot of a minimum size of 18-inches TL to not greater than 25 inches TL in the commercial and recreational sectors
- In the RRMA, maintain current harvest slot limit of a minimum size of 18-inches TL to not greater than 22-inches TL with no harvest allowed on fish greater than 22 inches.
- Allow commercial harvest of striped bass with gill nets in joint and coastal waters of the ASMA and continue recreational harvest and catch-and-release fishing in the ASMA and RRMA. Implement a requirement to use non-offset barbless circle hooks when fishing with live or natural bait in the inland waters of the Roanoke River upstream of the Hwy 258 bridge from May 1 through June 30. The requirement from April 1 through June 30, only a single barbless hook or lure with single barbless hook (or hook with barb bent down) may be used in the inland waters of the Roanoke River upstream of U.S. Highway 258 Bridge will remain in effect.
- Adopt adaptive management framework that will allow for future adjustments of the TAL based on results of updated stock assessments and provide the Director the flexibility to modify daily possession limits, harvest seasons, and gear requirements to manage harvest to the TAL and reduce discards.

Measures to Achieve Sustainable Harvest for the Tar-Pamlico and Neuse Rivers Stocks *(Appendix 3)*

- Continue the no-possession measure.
- Continue gill net closure above the ferry lines and the 3-foot tie-downs below the ferry lines.
- In 2025, review data through 2024 to determine if populations are self-sustaining and if sustainable harvest can be determined.

Measures to Achieve Sustainable Harvest for the Cape Fear River Stock *(Appendix 4)*

- Continue Cape Fear River harvest moratorium.
- Adaptive management based on young of year surveys and parentage-based tagging analysis to evaluate if the levels of natural reproduction in the system further warrant a harvest moratorium and allow the Director the flexibility to allow harvest after consultation with the Finfish Advisory Committee

Measures for the Use of Hook and Line as a Commercial Gear *(Appendix 5)*

- Continue to manage the use of hook and line gear in the commercial fishery as an adaptive management option across the fishery. Commercial harvest of stiped bass from hook and line gear is not authorized at this time.

DRAFT
North Carolina
Estuarine Striped Bass
Fishery Management Plan
Amendment 2

By

North Carolina Division of Marine Fisheries

and

North Carolina Wildlife Resources Commission

August 2022

North Carolina Department of Environmental Quality
North Carolina Division of Marine Fisheries
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Disclaimer: Data in this Fishery Management Plan may have changed since publication based on updates to source documents.

ACKNOWLEDGEMENTS

Amendment 2 to the North Carolina (NC) Estuarine Striped Bass Fishery Management Plan (FMP) was developed jointly by the NC Department of Environmental Quality (DEQ), NC Division of Marine Fisheries (DMF) and the NC Wildlife Resources Commission (WRC) under the auspices of the NC Marine Fisheries Commission (MFC) with the advice of the Estuarine Striped Bass FMP Advisory Committee (AC). Deserving special recognition are the members of the Estuarine Striped Bass FMP AC and the DMF Plan Development Team who contributed their time and knowledge to this effort.

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The following division staff were also invaluable in assisting with the development of this document: Alan Bianchi, Corrin Flora, Tina Moore, Steve Poland, Dan Zapf and the many reviewers of the multiple drafts of this plan. Also grateful for the administrative support from Jesse Bissette, Dana Gillikin, Jennifer Lewis, Deborah Manley, and Patricia Smith.

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EXECUTIVE SUMMARY

The North Carolina (NC) Estuarine Striped Bass Fishery Management Plan (FMP) is jointly developed by the NC Division of Marine Fisheries (DMF) and NC Wildlife Resources Commission (WRC). Striped bass fisheries that occur in the sounds and coastal rivers of NC are managed under this FMP, while striped bass fisheries that occur in the Atlantic Ocean are managed through the Atlantic States Marine Fisheries Commission (ASMFC) Interstate FMP for Atlantic Striped Bass. There are four estuarine striped bass stocks managed under two management units in NC. The northern management unit includes the Albemarle Sound (ASMA) and Roanoke River Management Areas (RRMA) while the remainder of the states estuarine waters comprise the CentralSouthern Management Area (CSMA).

The 2020 stock assessment of the Albemarle Sound-Roanoke River striped bass indicated the stock is overfished and undergoing overfishing. The ASMFC requires an end to overfishing within one year, which was addressed through the November 2020 Revision to Amendment 1. This meets the NC standard requiring management action end overfishing in two years. NC law also requires management action to recover from the overfished status within 10 years. Stock status is not available for the other NC stocks due to continuous stocking efforts. However, modeling indicates that these stocks are depressed to an extent sustainability is unlikely under any fishing mortality.

The goal of Amendment 2 is to manage the estuarine striped bass fisheries to achieve self-sustaining populations that provide sustainable harvest based on science-based decision-making processes. If biological and/or environmental factors prevent a self-sustaining population, then alternate management strategies will be implemented that provide protection for and access to the resource. The objectives to achieve this goal include: implement management strategies within NC and encourage interjurisdictional management strategies that maintain and/or restore spawning stock with adequate age structure and abundance to maintain recruitment potential and to prevent overfishing; restore, enhance, and protect critical habitat and environmental quality in a manner consistent with the Coastal Habitat Protection Plan (CHPP), to maintain or increase growth, survival, and reproduction of the striped bass stocks; use biological, social, economic, fishery, habitat, and environmental data to effectively monitor and manage the fisheries and their ecosystem impacts; promote stewardship of the resource through public outreach and interjurisdictional cooperation regarding the status and management of the NC striped bass stocks, including practices that minimize bycatch and discard mortality.

To meet statutory requirements to achieve self-sustaining striped bass stocks, sustainable harvest is addressed in the FMP. An additional issue addresses the use of hook and line as a commercial gear. Specific recommendations for each issue are as follows:

Sustainable harvest: Albemarle Sound-Roanoke River Stock *(Appendix 2)*:

- Use stock assessments and projections to determine the Total Allowable Landings (TAL) that achieve sustainable harvest.
- If fishing mortality (*F*) exceeds the F_{Target}, reduce the TAL to achieve the F_{Target} in one year through a Revision.
- Continue managing the ASMA commercial fishery as a bycatch fishery.

- Accountability measures to address total allowable landing (TAL) overages: if landings in any fishery exceeds their TAL, all landings in excess will be deducted from that fisheries TAL the next calendar year or until the overage is paid back.
- In the ASMA, implement a harvest slot of a minimum size of 18-inches TL to not greater than 25-inches TL in the commercial and recreational sectors.
- In the RRMA, maintain current harvest slot limit of a minimum size of 18-inches TL to not greater than 22-inches TL with no harvest allowed on fish greater than 22-inches.
- Allow commercial harvest of striped bass with gill nets in joint and coastal waters of the ASMA and continue recreational harvest and catch-and-release fishing in the ASMA and RRMA. Implement a requirement to use non-offset barbless circle hooks when fishing with live or natural bait in the inland waters of the Roanoke River upstream of the Hwy 258 bridge from May 1 through June 30.
- Adopt adaptive management framework that will allow for future adjustments of the TAL based on results of updated stock assessments and provide the Director the flexibility to modify daily possession limits, harvest seasons, and gear requirements to manage harvest to the TAL and reduce striped bass discards.

Sustainable harvest: Tar-Pamlico, and Neuse rivers stocks *(Appendix 3):*

- Continue the no-possession measure in Supplement A to Amendment 1.
- Maintain gill net closure above the ferry lines and maintain the 3-foot tie-downs below the ferry lines.
- In 2025, review data through 2024 to determine if populations are self-sustaining and if sustainable harvest can be determined.

Sustainable harvest: Cape Fear River stock *(Appendix 4):*

- Maintain Cape Fear River harvest moratorium.
- Adaptive management based on young-of-year surveys and parentage-based tagging analysis to evaluate if the levels of natural reproduction in the system further warrant a harvest moratorium and provide the Director the flexibility to allow harvest after consultation with the Finfish Advisory Committee.

Hook and line as a commercial gear *(Appendix 5):*

- Continue to manage the use of hook and line gear in the commercial fishery as an adaptive management option across the fishery. Commercial harvest of stiped bass from hook and line gear is not authorized at this time.

INTRODUCTION

This is Amendment 2 to the NC Estuarine Striped Bass FMP. By law, each FMP must be reviewed at least once every five years in accordance with N.C.G.S. section 113-182.1. The NC DMF reviews each FMP annually and a comprehensive review is undertaken about every five years. The last comprehensive review of the plan (Amendment 1) was approved by the NC Marine Fisheries Commission (MFC) in 2013. FMPs are the ultimate product that brings all information and management considerations into one document. The DMF prepares FMPs for adoption by the MFC for all commercially and recreationally significant species or fisheries that comprise state marine or estuarine resources. The goal of these plans is to ensure long-term viability of these fisheries.

In NC striped bass (*Morone saxatilis*) stocks are managed among four areas: (1) Albemarle Sound Management Area (ASMA), (2) Roanoke River Management Area (RRMA), (3) Central/Southern Management Area (CSMA), and (4) Atlantic Ocean. The MFC adopts rules and policies and with DMF implements management measures for the estuarine striped bass fishery in Coastal Fishing Waters in accordance with N.C.G.S. section 113-182.1. The Estuarine Striped Bass FMP is jointly developed with the NC WRC. The migratory Atlantic Ocean stock is managed by the ASMFC. The ASMA and RRMA are also subject to compliance requirements of the ASMFC Interstate FMP for Atlantic Striped Bass.

FISHERY MANAGEMENT PLAN HISTORY

Original FMP Adoption:	November 1993
	May 2004
Amendments:	Amendment 1 – May 2013
Revisions:	November 2014 Revision to Amendment 1
	November 2020 Revision to Amendment 1
Supplements:	Supplement A – February 2019
Information Updates:	None
Schedule Changes:	August 2016
Comprehensive Review:	At least five years after Amendment 2 adoption

Past versions of the Estuarine Striped Bass FMP, Revisions, Amendment, and Supplement (NCDMF 2004, 2013, 2014, 2019, and 2020) are available on the DMF website.

MANAGEMENT UNIT

There are two geographic striped bass management units in NC (Figure 1). The northern management unit is comprised of two harvest management areas: the RRMA and the ASMA. These two management areas form the geographical area of the Albemarle-Roanoke (A-R) stock of striped bass. Commercial regulations in the RRMA are the responsibility of the MFC, while recreational regulations are the responsibility of the WRC. Recreational and commercial striped bass regulations within the ASMA are the responsibility of the MFC. The RRMA and ASMA are also subject to the ASMFC Interstate FMP for Atlantic Striped Bass. To ensure compliance with the ASMFC Interstate FMP, the A-R stock is additionally managed under the NC FMP for Interjurisdictional Fisheries.

The southern geographic management unit is the CSMA that is comprised of the Tar-Pamlico, Neuse, and Cape Fear rivers and the Pamlico Sound. Management of striped bass within the CSMA is the sole responsibility of NC through the MFC and the WRC.

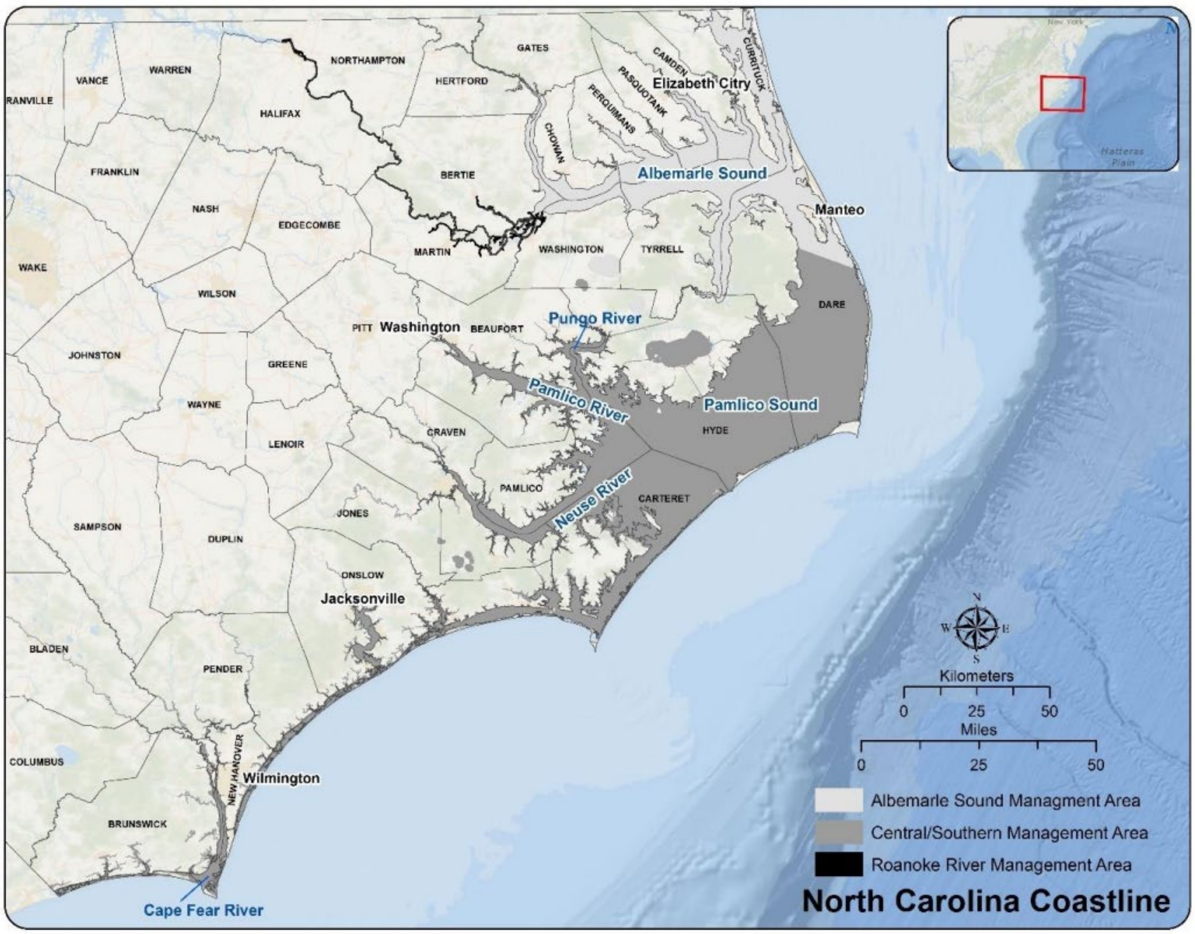


Figure 1. Boundary lines defining the Albemarle Sound Management Area, Central/Southern Management Area, and the Roanoke River Management Area.

GOAL AND OBJECTIVES

The goal of Amendment 2 is to manage the estuarine striped bass fisheries to achieve self-sustaining populations that provide sustainable harvest based on science-based decision-making processes. If biological and/or environmental factors prevent a self-sustaining population, then alternate management strategies will be implemented that provide protection for and access to the resource. The following objectives will be used to achieve this goal.

- Implement management strategies within North Carolina and encourage interjurisdictional management strategies that maintain and/or restore spawning stock with adequate age structure and abundance to maintain recruitment potential and to prevent overfishing.
- Restore, enhance, and protect critical habitat and environmental quality in a manner consistent with the Coastal Habitat Protection Plan, to maintain or increase growth, survival, and reproduction of the striped bass stocks.
- Use biological, social, economic, fishery, habitat, and environmental data to effectively monitor and manage the fisheries and their ecosystem impacts.
- Promote stewardship of the resource through public outreach and interjurisdictional cooperation regarding the status and management of the North Carolina striped bass stocks, including practices that minimize bycatch and discard mortality.

DESCRIPTION OF THE STOCK

BIOLOGICAL PROFILE

Striped bass is an estuarine dependent species found from the lower St. Lawrence River in Canada to the west coast of Florida, through the northern Gulf of Mexico to Texas. In NC, the species is also known as striper, rockfish, or rock. Stocks from Maine to the A-R in NC are migratory, spending most of their adult life in the estuaries and ocean before moving into fresh water to spawn in the spring. The large, A-R stock striped bass leave the Roanoke River system after spawning and migrate north, to ocean waters from New Jersey to Massachusetts. In the fall, these fish migrate south to ocean waters off Virginia and NC, before entering the Albemarle Sound and Roanoke River again in the spring (Callihan et al. 2015). Southern stocks, including the stocks of the CSMA, are riverine, spending their entire life in the estuary and river systems (Setzler et al. 1980; Rulifson et al. 1982; Callihan 2012).

Striped bass migrate far distances to spawning grounds located in freshwater portions of coastal rivers. Spawning grounds for the A-R stock are concentrated at the fall line, where the coastal plain meets the piedmont, 137 miles up the Roanoke River near Weldon, NC. Spawning grounds in the CSMA rivers are not as clearly defined. On the Tar-Pamlico River, striped bass spawning is suspected to occur from the Rocky Mount Mills Dam,125 miles upstream of Washington, NC, to Tarboro, NC (Smith and Rulifson 2015). Neuse River spawning grounds are centered between Smithfield and Clayton, NC, but range from Kinston river mile (rm) 130 to Raleigh (rm 236). On the Cape Fear River, historic striped bass spawning grounds are located at the fall line near Smiley's Falls (rm 165) in Lillington, NC, but access to this spawning habitat is restricted by a series of three lock and dam systems. In the Northeast Cape Fear River, adult striped bass have been captured and acoustically tagged during the spawning season between White Stocking, NC (rm 73) and Chinquapin, NC (rm 104), with potential spawning occurring as far upstream as Hallsville, NC (rm 114; Rock et al. 2018).

Striped bass are relatively long-lived and can reach 50–60 pounds. Females grow larger than males, with a reported maximum total length of 60 inches. The oldest observed striped bass in the A-R stock was 31 years old, while within the CSMA the maximum age was 17 years. The largest recorded striped bass, which weighed 125 pounds, was caught in the early 1900s in the Albemarle Sound. Females in the A-R stock are 97% mature at age-4 (Boyd 2011), while females in the Tar-Pamlico and Neuse rivers are 98% mature by age-3 (Knight 2015). In the Tar-Pamlico and Neuse rivers, fecundity (number of eggs a female produces) ranges from 223,110 eggs for an age-3 female to 3,273,206 eggs for an age-10 female (Knight 2015).

Streamflow and water temperature are important environmental conditions that influence the success of annual striped bass reproduction and recruitment (number of juveniles produced). Striped bass require flowing, freshwater that allows eggs to remain suspended until they hatch and fry to be transported to nursery areas. Female striped bass produce large quantities of eggs that are broadcast into riverine spawning areas and fertilized by mature males. Fertilized eggs drift with downstream currents and hatch in 1.5–3 days depending on water temperature (Mansueti 1958). Spawning in NC can occur from late March until early June. Peak spawning activity for the A-R stock occurs when water temperature reaches 62–67 degrees Fahrenheit on the spawning grounds.

Striped bass form large schools, feeding on available fishes and invertebrates. Oily fish such as Atlantic menhaden (*Brevoortia tyrannus*), herrings (*Clupea* spp.), and shads (*Alosa* spp.) are common prey, but spot (*Leiostomus xanthurus*), mullet (*Mugil* spp.), Atlantic croaker (*Micropogonias undulatus*), American eel (*Anguilla rostrata*), and blue crabs (*Callinectes sapidus*) are also consumed.

STOCK UNIT

There are four striped bass stocks in NC: Albemarle-Roanoke (A-R), Tar-Pamlico, Neuse, and Cape Fear stocks.

ASSESSMENT METHODOLOGY

The A-R stock was assessed using Stock Synthesis through a forward-projecting statistical catch-at-age model which was applied to data characterizing landings/harvest, discards, fishery-independent indices, and biological data collected during 1991–2017 (Lee et. al 2020).

Traditional stock assessment techniques could not be applied to CSMA stocks because of high hatchery contribution and lack of natural recruitment in these systems. A demographic matrix model was developed to evaluate stocking and management measures for striped bass in all three CSMA river systems. In addition, a tagging model was developed to estimate striped bass abundance in the Cape Fear River.

STOCK STATUS

A-R Stock

The 2020 A-R striped bass stock assessment indicates the stock is overfished and overfishing is occurring (Lee et. al 2020). The estimate of fishing mortality (F) in the terminal year of the assessment (2017) was 0.27, greater than the $F_{35\%\text{SPR Threshold}}$ of 0.18 (Figure 2). The estimate of spawning stock biomass (SSB) was 78,576 pounds, less than the $SSB_{35\%SPR\ Threshold}$ of 267,390 pounds (Figure 3). The stock had a period of strong recruitment from 1993 to 2000, then a period of low recruitment from 2001 to 2017. The complete stock assessment can be reviewed on the division Fishery Management Plans website.

The 2020 stock assessment is used to establish sustainable harvest in the A-R stock fisheries. This is done by calculating the Total Allowable Landings (TAL) that can be removed annually from the stock. The TAL is currently allocated with a 50/50 split to the recreational and commercial fisheries. The ASMA commercial fishery receives 50% of the TAL with the RRMA recreational and the ASMA recreational fisheries each receiving a 25% allocation of the TAL.

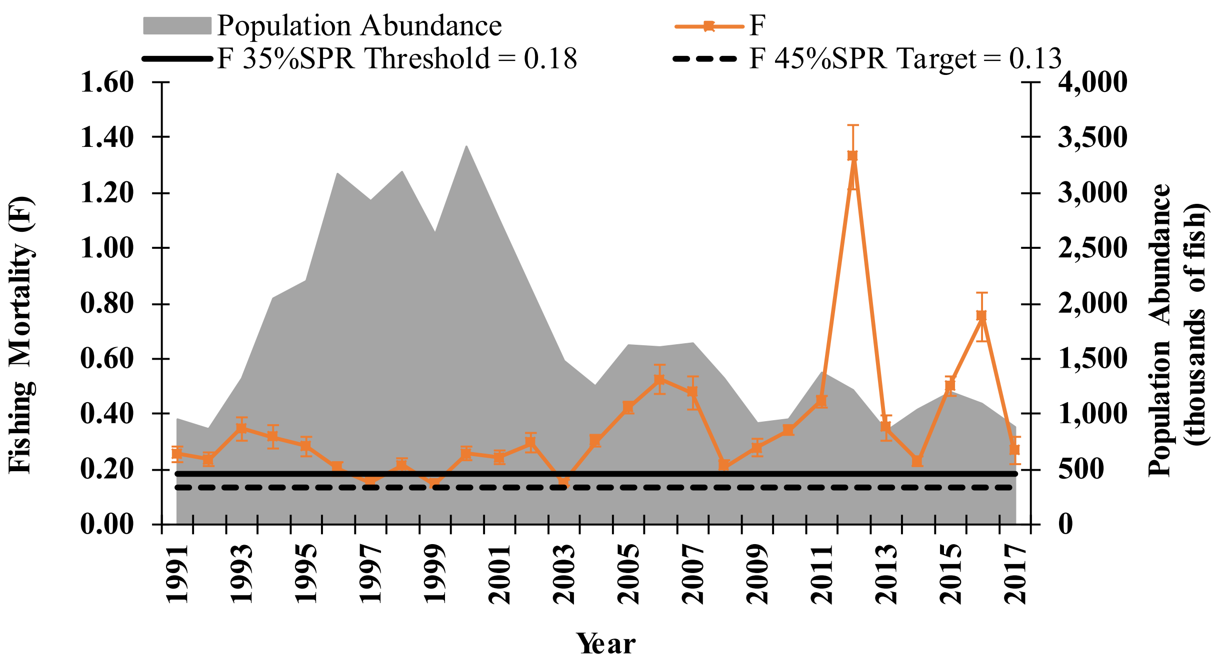


Figure 2. Estimates of fishing mortality (F) and population abundance for the Albemarle-Roanoke striped bass stock, 1991–2017. Error bars represent ± two standard errors. Source: Lee et al. 2020.

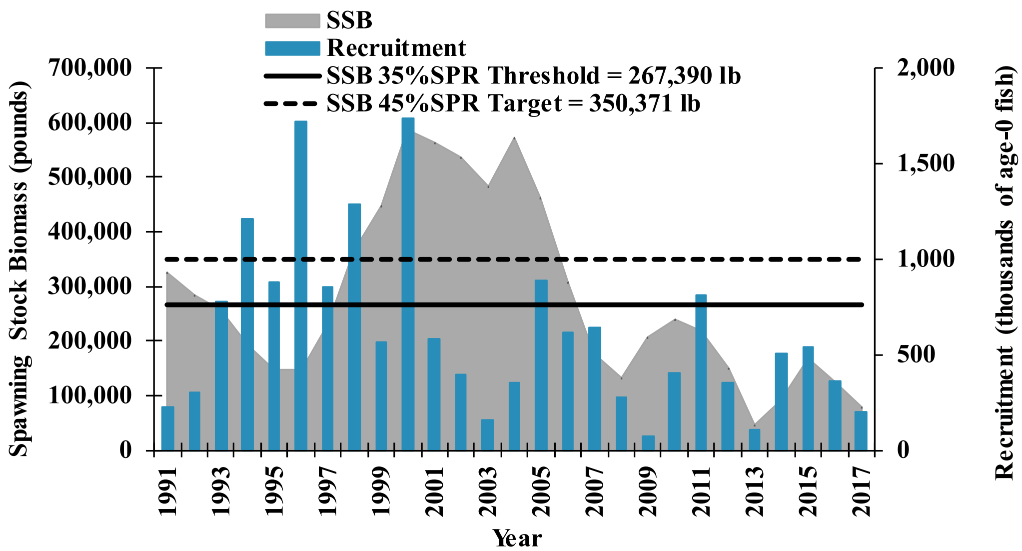


Figure 3. Estimates of spawning stock biomass (SSB) and recruitment of age-0 fish coming into the population each year for the Albemarle-Roanoke striped bass stock, 1991–2017. Source: Lee et al. 2020

CSMA Stocks

The demographic matrix model indicates the striped bass populations in the CSMA are depressed to an extent that sustainability is unlikely at any level of fishing mortality. The model suggests insufficient natural recruitment is the primary factor limiting population abundance of Tar-Pamlico and Neuse stocks and suggests the populations would decline without stocking (Mathes et al. 2020). Tagging model results indicate a consistent decline in abundance estimates for striped bass in the Cape Fear River (2012–2018). Even with a no-possession provision for the Cape Fear River since 2008, 2018 abundance was less than 20% of the 2012 abundance. The CSMA stocks are supported by continuous stocking efforts as evidenced by stocked fish comprising nearly 100% of the striped bass on the spawning grounds (O'Donnell and Farrae 2017). For more information on stocking see Appendix 1: Striped Bass Stocking in Coastal North Carolina. The complete stock assessment report can be reviewed on the division Fishery Management Plans website.

DESCRIPTION OF THE FISHERIES

Additional in-depth analyses and discussion of NC's commercial and recreational striped bass fisheries can be found in earlier versions of the Estuarine Striped Bass FMP, Revisions, Amendment 1, and Supplement A (NCDMF 2004, 2013, 2014, 2019, and 2020); all FMP documents are available on the DMF Fishery Management Plans website and commercial and recreational landings can be found in the License and Statistics Annual Report (NCDMF 2020) produced by the DMF which can be found on the DMF Fisheries Statistics page, including a report entitled North Carolina Striped Bass (*Morone saxatilis*) Commercial Fishery (Gambill and Bianchi 2019).

COMMERCIAL FISHERIES

ASMA

Under Amendment 1, the ASMA commercial striped bass fishery is a bycatch fishery, striped bass harvest occurs while targeting other finfish species. Striped bass cannot be greater than 50% by weight of all other finfish species landed per trip. Daily landing limits of 5–25 striped bass further deter fishers from targeting striped bass and aim to ensure striped bass quota is available when multispecies gill net fisheries are operating. Most striped bass harvest occurs with the American shad (*Alosa sapidissima*) anchored gill net fishery in the spring, followed by the southern flounder (*Paralichthys lethostigma*) anchored gill net fishery in the fall. Since 2015, as a commercial fishery for invasive blue catfish (*Ictalurus furcatus*) has developed, more striped bass landings have occurred in this strike net fishery. Strike nets are fished by locating a school of fish, encircling the school with a gill net, then immediately retrieving the net. Harvest from pound nets is the second leading harvest gear with an average of 20% of the total harvest since 2010.

Commercial landings in the ASMA have been limited by an annual TAL since 1991. Due to gill net mesh size regulations and minimum striped bass size limits since 1993, most harvest consists of fish 4–6 years of age. During 1990–1997 the commercial TAL was set at 98,000 pounds because the A-R stock was at historically low levels of abundance and required rebuilding. The stock was declared recovered in 1997 and the commercial TAL was gradually increased as stock abundance increased. The TAL reached its maximum level of 275,000 pounds in 2003 as the stock reached record levels of abundance.

Beginning in 2004, commercial landings no longer reached the annual TAL, even with increases in the number of harvest days and daily possession limits. From 2005 to 2009, landings steadily declined averaging 150,000 pounds annually (Figure 4).

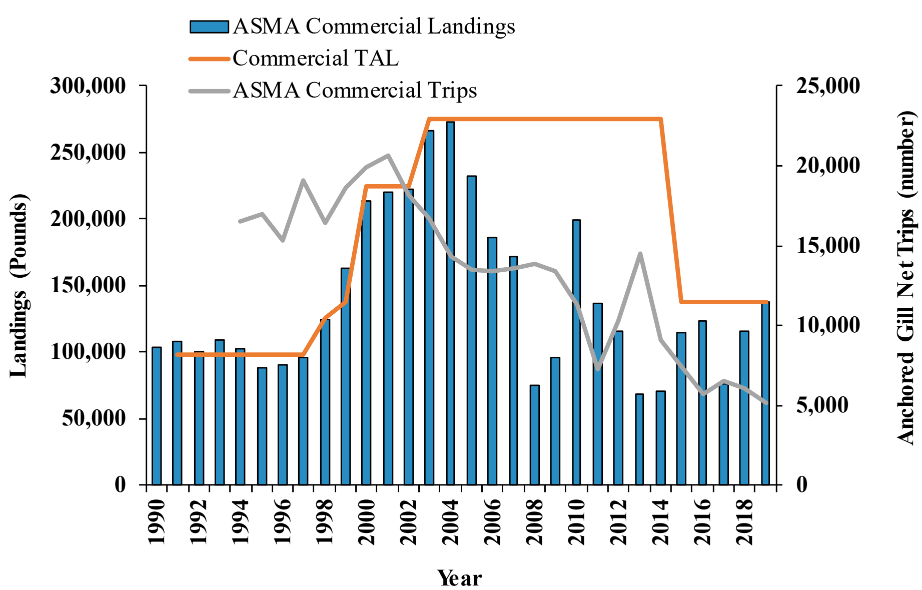


Figure 4. Commercial striped bass landings and the number of all anchored gill net trips in the Albemarle Sound Management Area (ASMA), 1991–2019.

The decline in landings in years 2005–2009 was due to poor year classes produced during 2001–2004. An increase in landings in 2010 was due to the strong 2005-year class. Since 2013, landings have declined in part because of a shortened American shad season. In 2021, the commercial TAL was reduced to 25,608 pounds to meet requirements of adaptive management measures in Amendment 1 to the Striped Bass FMP to end overfishing in one year of stock assessment results indicated the stock was undergoing overfishing (NCDMF 2020).

CSMA

Supplement A (NCDMF 2019) closed the CSMA commercial striped bass fishery to protect important year classes of striped bass. From 1994 to 2018 commercial landings in the CSMA were limited by a 25,000 lb annual TAL. From 1994 to 2018 striped bass commercial landings in the CSMA averaged 26,132 lb (Figure 5). Most commercial landings are from the Tar-Pamlico, Pungo, Neuse, and Bay rivers (Figure 6). From 2004 to 2018, there was only a spring harvest season, opening March 1 and closing when the annual TAL was reached.

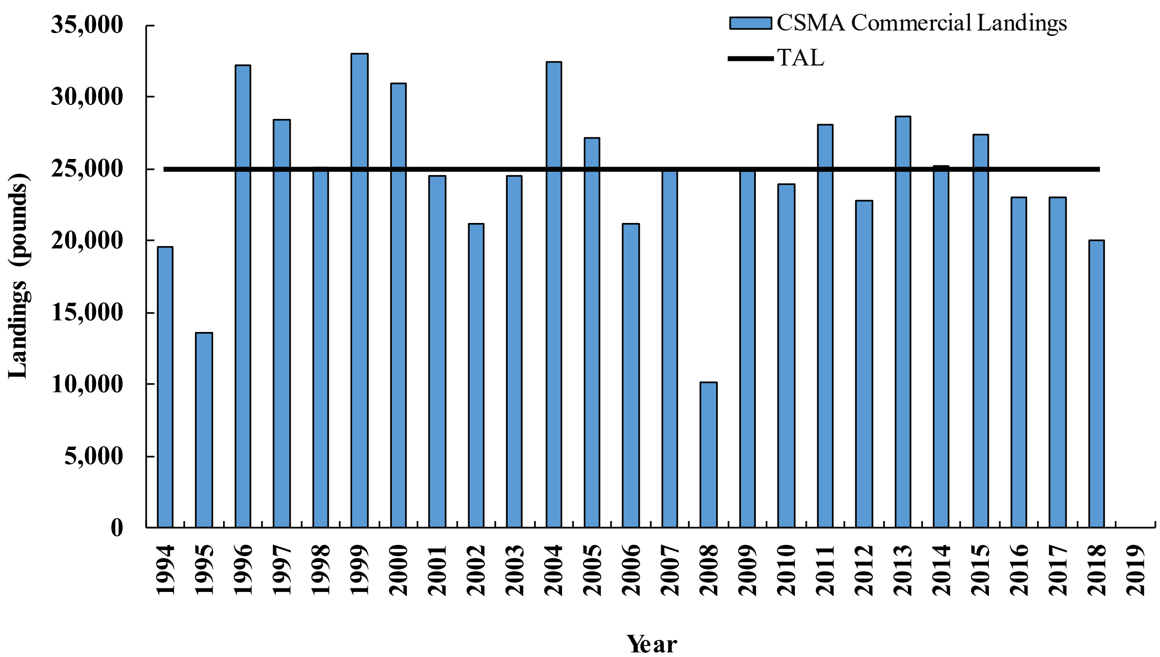


Figure 5. Annual commercial CSMA striped bass harvest and TAL in pounds, 1994–2019. Since 2019 the commercial season has been closed.

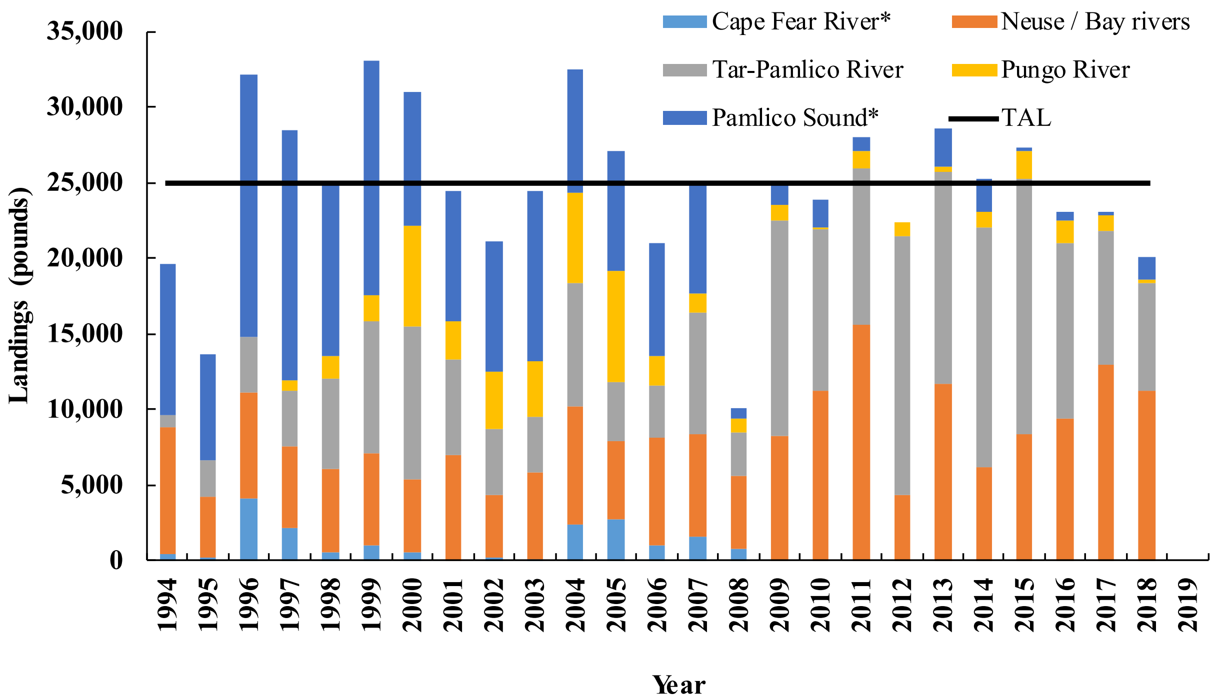


Figure 6. Commercial striped bass harvest by system, and the TAL in the CSMA, 2004–2019. There has been a harvest moratorium in the Cape Fear River since 2008, and a closed season in the CSMA since 2019. *Landings data for the Cape Fear River in 2001 and the Pamlico Sound in 2012 are confidential.

RECREATIONAL FISHERIES

ASMA

In the initial 1993 FMP, effective January 1, 1994, the MFC and WRC approved management to split the TAL evenly between the commercial and recreational sectors when the stock recovered (NCDMF 1993). In 1997 the stock was declared recovered and in 1998 the MFC allocated the TAL 50/50 between the commercial and recreational sectors through incremental steps. The ASMA receives 25% of the recreational allocation. The ASMA recreational TAL increased from 29,400 pounds in 1997 to 137,500 pounds in 2003. Adaptive management to address the overfished status in 2021 reduced the ASMA recreational TAL to 12,804 pounds (NCDMF 2020). Recreational landings peaked in 2001 at 118,506 pounds (Figure 7). Recreational landings in the ASMA primarily consist of fish age 3–5.

Beginning in fall 2005, harvest was allowed seven days a week in the ASMA. Additionally, in fall 2006 possession limits were increased from two to three fish. Despite the increases in bag limits and days recreational fishery was open, harvest continued to decline. Several poor year classes produced since 2001 may have contributed to the decline in stock abundance and recreational harvest since 2006. The recreational limit was decreased to two fish per person per day in January 2016. Recreational harvest from 1991 to 2019 averaged 42,466 pounds in the ASMA. Releases are usually greater than harvest and are dominated by fish less than the 18-inch minimum length limit. Undersized releases during the last 10 years have averaged 24,051 fish (Table 1).

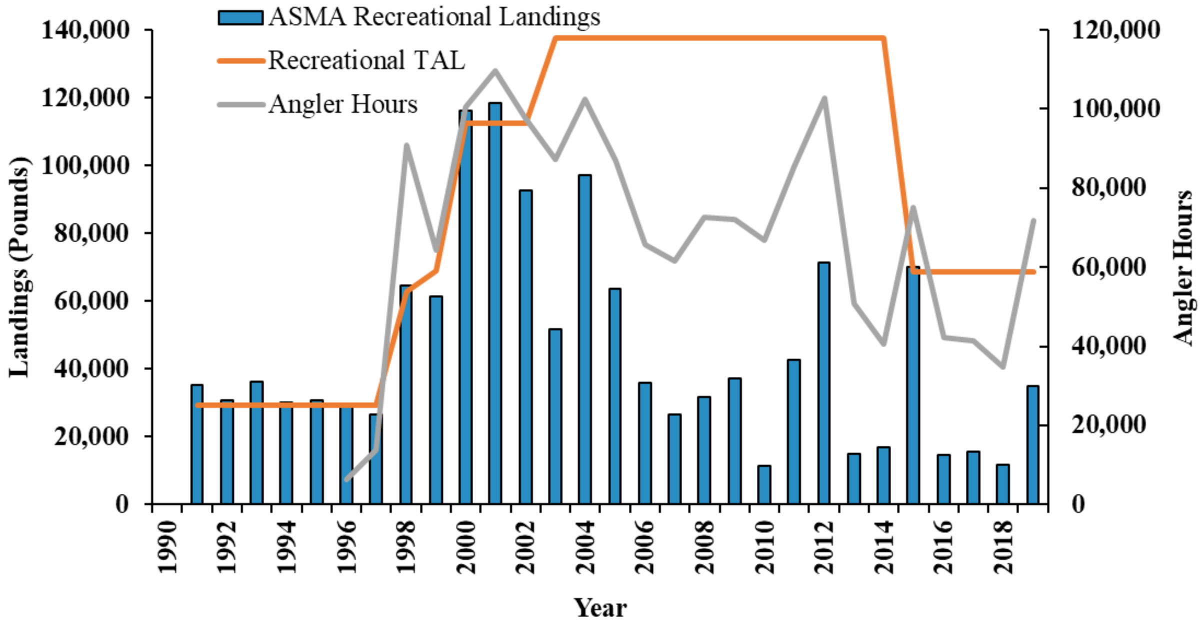


Figure 7. Recreational striped bass landings and the hours of striped bass fishing effort in the Albemarle Sound Management Area (ASMA) 1991–2019.

RRMA

Harvest from 1982 through 2019 averaged 54,103 pounds in the RRMA (Table 2; Figure 8). Discards outnumber landings annually, especially in the RRMA where concentrations of fish on the spawning grounds can be dense. Annual releases from 2005 through 2019 in the RRMA averaged 80,821 fish.

From 2003 to 2016, landings averaged 64,389 pounds, with a few noticeably low years (Figure 8). Adaptive management measures implemented in 2021 reduced the RRMA recreational TAL to 12,804 pounds (NCDMF 2020). Recreational landings in the RRMA are dominated by age-3 to age-5 fish, primarily due to a no possession rule of fish between 22 and 27-inches total length (TL) and general angling techniques. Few fish over age 9 are observed in the creel survey because most anglers do not use the large artificial lures or natural bait needed to effectively target striped bass over 28-inches TL.

Table 1. Estimates of striped bass angling effort, harvest, and numbers caught and released from the Albemarle Sound Management Area, 1991–2019. Cells with a dash indicate estimates were not generated in that year. Estimates of discards are not available for the post-harvest period.

Year	Striped Bass Trips	Angler Hours	Number of fish harvested	Total pounds harvested	Striped Bass Discard (#over-creel)	Striped Bass Discard (#under-sized)	Striped Bass Discard (#legal-sized)	Total number of fish released
1991			14,395	35,344				23,540
1992			10,542	30,758				19,981
1993			11,404	36,049				13,241
1994			8,591	30,217				
1995			7,343	30,564				
1996		6,349	7,433	29,186				
1997		13,656	6,901	26,724				30,771
1998		90,820	19,566	64,761				91,888
1999		64,442	16,967	61,447				40,321
2000		100,425	38,085	116,414				78,941
2001		109,687	40,127	118,645				61,418
2002		97,480	27,896	92,649				51,555
2003		87,292	15,124	51,794				25,281
2004		102,505	28,004	97,097	9,877	28,859	2,305	41,041
2005	13,735	86,943	17,954	63,477	11,333	7,032	2,855	21,220
2006	10,707	65,757	10,711	35,985	2,490	6,339	626	9,455
2007	9,629	61,679	7,143	26,633	1,148	12,259	192	13,599
2008	11,793	72,673	10,048	31,628	391	36,324	260	36,975
2009	11,326	72,021	12,069	37,313	20	38,683	1,860	40,563
2010	9,660	66,893	3,504	11,470	569	15,398	233	16,200
2011	13,114	85,325	13,341	42,536	317	20,114	1,141	21,572
2012	14,490	102,787	22,345	71,456	1,024	19,977	3,970	24,971
2013	7,053	50,643	4,299	14,897	31	16,034	316	16,381
2014	7,264	40,478	5,529	16,867	18	22,558	510	23,086
2015	11,132	75,009	23,240	70,008	1,573	45,559	2,402	49,534
2016	7,023	42,276	4,794	14,486	252	8,822	1,278	10,352
2017	7,658	41,371	4,215	15,480	56	24,004	600	24,660
2018	9,057	34,764	3,465	11,762	281	21,337	3,970	25,588
2019	19,864	61,645	8,502	34,968	2,301	34,452	1,625	38,378

DRAFT – SUBJECT TO CHANGE

Table 2. Estimates of striped bass angling effort, harvest, and numbers caught and released from the Roanoke River Management Area, 1988–2019. Blank cells indicate data was not collected in that year. **For 1989–2009 number of trips was calculated by dividing the angler hours by 4.75 (assumes each trip was 4.75 hours long). Since 2010, number of trips were estimated based on creel survey data sampling probabilities.

	Open Season (Harvest estimates)					Post-Harvest Period (Catch and Release Only)		
Year	Number Harvested	Weight (lb)	Effort (angler-hours)	Trips**	Number released	Number released	Effort (angler-hours)	Trips**
1988		74,639						
1989	8,753	32,107	46,566	9,803				
1990	15,694	42,204	56,169	11,825				
1991	26,934	72,529	74,596	15,704				
1992	13,372	36,016	49,277	10,374				
1993	14,325	45,145	52,932	11,144				
1994	8,284	28,089	44,693	9,409				
1995	7,471	28,883	56,456	11,885		52,698	20,639	4,345
1996	8,367	28,178	46,164	9,719		148,222	32,743	6,893
1997	9,364	29,997	23,139	4,871		271,328	47,001	9,895
1998	23,109	73,541	72,410	15,244		102,299	26,367	5,551
1999	22,479	72,967	72,717	15,309		113,394	30,633	6,449
2000	38,206	120,091	95,622	20,131				
2001	35,231	112,805	100,119	21,078				
2002	36,422	112,698	122,584	25,807				
2003	11,157	39,170	77,863	16,392				
2004	26,506	90,191	145,782	30,691				
2005	34,122	107,530	130,755	27,527		68,147	24,146	5,083
2006	25,355	84,521	120,621	25,394		24,719	15,235	3,207
2007	19,305	62,492	141,874	29,868		11,622	9,254	1,948
2008	10,541	32,725	110,608	23,286		47,992	17,764	3,740
2009	23,248	69,581	120,675	25,405				
2010	22,445	72,037	125,495	24,347	77,882	46,028	31,281	5,111
2011	22,102	71,561	122,876	27,311	80,828	26,865	15,110	2,707
2012	28,847	88,539	110,982	27,151	40,772	22,246	8,935	1,881
2013	7,718	25,197	100,391	19,539	49,148	25,074	12,423	2,246
2014	11,058	33,717	80,256	15,960	93,471	72,068	17,542	2,972
2015	20,031	58,962	111,419	22,827	78,401	29,839	12,229	2,207
2016	21,260	65,218	129,132	25,036	34,753	17,891	11,291	2,087
2017	9,899	32,569	101,565	19,688	68,693	9,754	7,446	1,317
2018	8,741	26,797	95,447	18,280	121,969	65,245	14,499	2,462
2019	16,582	53,379	99,259	20,633	117,550	69,642	26,867	5,283

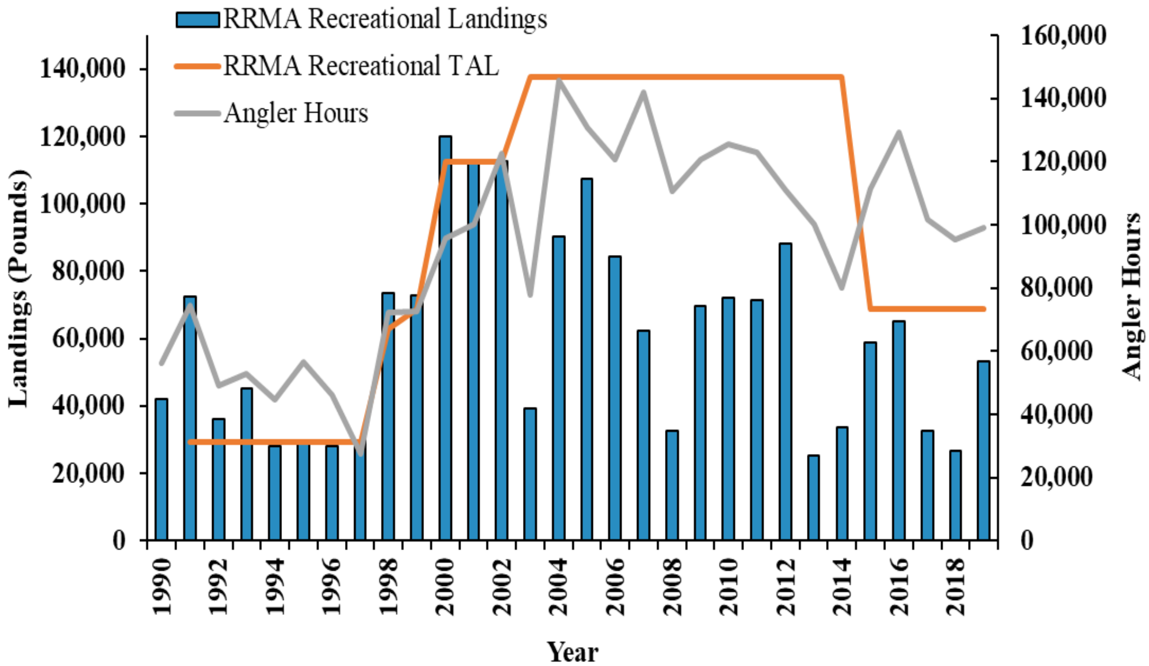


Figure 8. Recreational striped bass landings and the hours of striped bass fishing effort in the Roanoke River Management Area (RRMA) 1991–2019.

CSMA

The DMF began collecting recreational striped bass data in the major rivers of the CSMA in 2004. In 2013, due to low recreational striped bass catch in the Cape Fear River, creel survey methodology was adjusted to target American and hickory shad (*Alosa mediocris)* effort. The Supplement A recreational no possession measure approved in February 2019 limited recreational harvest in 2019. Recreational landings fluctuated between 2004 and 2019 (Table 3; Figure 9).

From 2004 to 2007 most recreational harvest occurred in the Neuse River, but since 2008 harvest has generally been split between the Tar-Pamlico and Neuse rivers (Figure 10). In 2016 and 2017, the number of trips and hours spent targeting striped bass in the CSMA increased substantially compared to other years (Table 3). Within the CSMA there is a significant catch-and-release fishery, averaging 47,309 releases from 2010 to 2019 (Table 3). Undersized discards peaked in 2017 but declined through 2019.

Table 3. Recreational striped bass effort, harvest and discards from the CSMA, 2004–2019. The 2019 season was January 1–March 19, 2019.

Year	Fishing Trips	Effort Hours	Number Harvested	Pounds Harvested	Total Discards
2004	12,782	63,791	6,141	22,958	13,557
2005	16,414	69,370	3,832	14,965	16,854
2006	10,611	42,066	2,481	7,352	14,895
2007	10,971	46,655	3,597	10,794	23,527
2008	6,621	28,413	843	2,990	17,966
2009	5,642	26,611	895	3,061	6,965
2010	6,559	25,354	1,757	5,537	7,990
2011	12,606	51,540	2,728	9,474	24,188
2012	18,338	71,964	3,922	15,240	43,313
2013	20,394	86,918	5,467	19,537	32,816
2014	15,682	70,316	3,301	13,368	30,209
2015	18,159	79,398	3,934	14,269	31,353
2016	23,675	110,453	6,697	25,260	75,461
2017	26,125	119,680	7,334	26,973	131,129
2018	16,393	69,917	3371	10,884	49,122
2019	8,820	40,580	959	3,562	37,039
Average	14,362	62,689	3,579	12,889	34,774

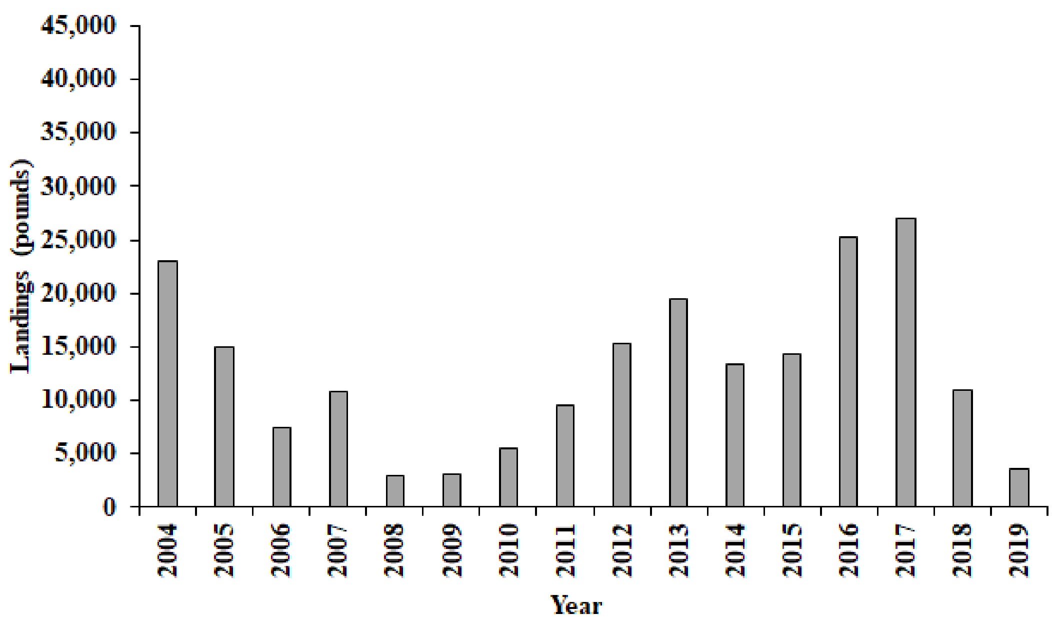


Figure 9. Annual recreational CSMA striped bass landings in pounds, 2004–2019. The 2019 season was January 1–March 19, 2019.

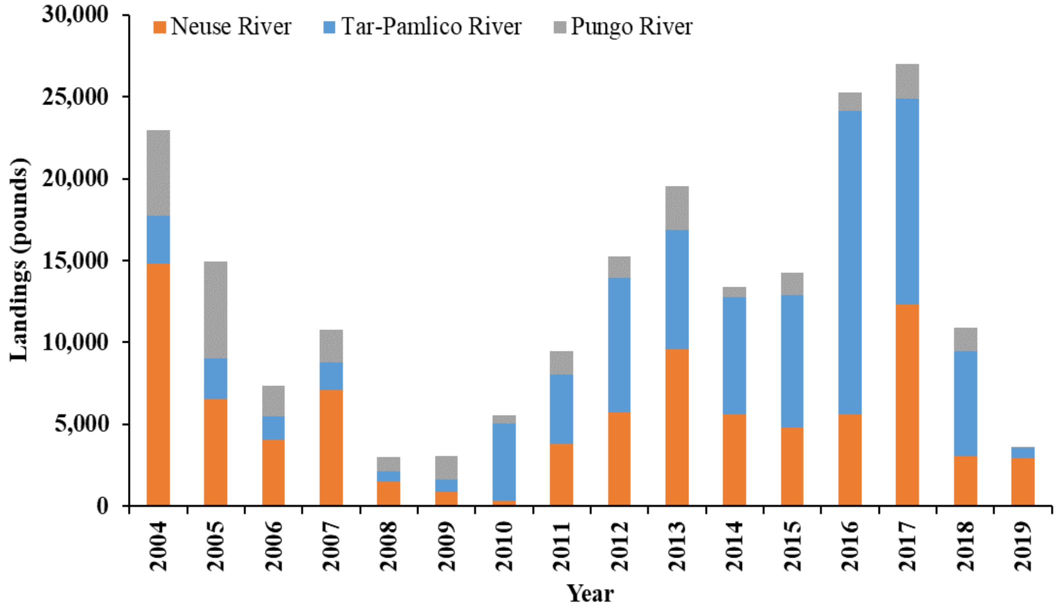


Figure 10. Recreational striped bass harvest in the Tar-Pamlico, Pungo, and Neuse rivers, 2004–2019. The 2019 season was January 1–March 19, 2019.

SUMMARY OF ECONOMIC IMPACTS OF STRIPED BASS FISHING

Modeling software, IMPLAN, is used to estimate the economic impacts of an industry to the state at-large, accounting for revenues and participation. For a detailed explanation of the methodology used to estimate the economic impacts please refer to DMF's License and Statistics Section Annual Report on the Fisheries Statistics page. For further information on overall trends, economics, and characteristics of the commercial fishery see the report entitled North Carolina Striped Bass (*Morone saxatilis*) Commercial Fishery (Gambill and Bianchi 2019).

Commercial

Commercial landings and effort data collected through the DMF trip ticket program are used to estimate the economic impact of the commercial fishing industry. For commercial fishing output, total impacts are derived by incorporating modifiers from NOAA's Fisheries Economics of the United States report (National Marine Fisheries Service 2018), which account for proportional expenditures and spillover impacts from related industries. By assuming striped bass fisheries contribute to the expenditure categories at a proportion equal to their contribution to total commercial ex-vessel values, we can generate an estimate of the total economic impact of striped bass harvest in the CSMA and ASMA. This same indirect impact methodology is applied to the aggregate landings of other species harvested during a striped bass trip. Economic impacts of the striped bass fishery and alternative species cannot be combined. As these landings occurred during the same trips with the same participants, much of the economic impact of striped bass harvest is also reflected in the economic impact of harvest of other species. These two impact categories have been separated to demonstrate how commercial striped bass fishing in the CSMA and ASMA impacts the state economy outside of direct landings, and how that effect could change if commercial striped bass effort were eliminated or reduced.

ASMA

Commercial effort and output in the ASMA are greater than in the CSMA. The number of striped bass commercial fishery participants in the ASMA is roughly two to three times higher than in the CSMA. More effort, and historically higher TAL in the ASMA compared to the CSMA leads to increased harvest of striped bass. Average annual landings of striped bass are roughly 100,000 pounds in the ASMA, with average ex-vessel values of $300,000 (Figure 11). Both values are approximately five times greater than annual values in the CSMA.

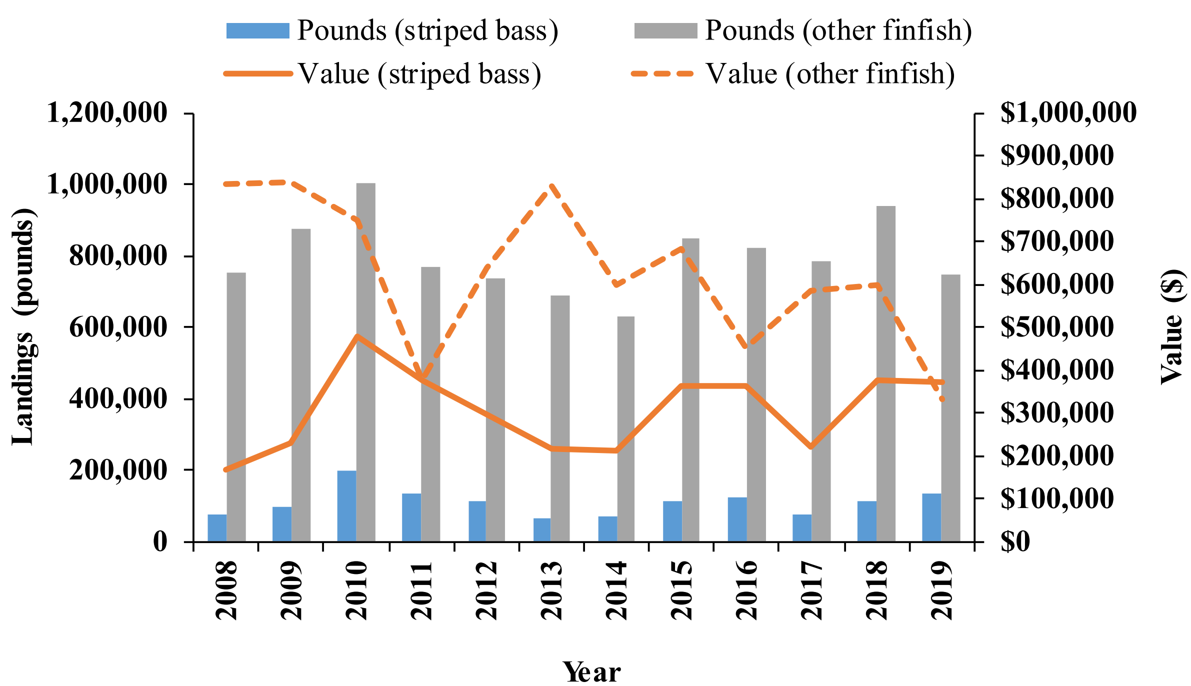


Figure 11. Annual commercial striped bass effort and ex-vessel value data for the ASMA, 2008–2019.

From 2008 to 2019 striped bass landings in the ASMA averaged 110,691 pounds (Table 4). During the same period harvest of all other species during trips which had striped bass as bycatch in the ASMA averaged 799,570 pounds (Table 5). Dockside value of other species landed in nets that also caught striped bass varies annually although the highest value species are often a mixture of catfishes, American shad, white perch (*M. Americana*), striped mullet (*M. cephalus*), spotted seatrout (*Cynoscion nebulosus*), and southern flounder.

As the total value of striped bass and other products harvested annually in the ASMA is significantly greater, so are the economic impacts to the state (Tables 4 and 5). Annual sales impacts of striped bass harvest average over $1 million annually, with the impacts from the harvest of other species valued between $1 million and nearly $4 million. In general, these estimates demonstrate that the ASMA striped bass commercial fishery produces a greater overall economic impact to the state than in the CSMA.

Table 4. Annual commercial striped bass effort data and estimates of annual economic impact to the state of North Carolina from striped bass harvest for the ASMA, 2008–2019.

Year	Pounds Landed	Ex-Vessel Value	Total Participants	Total Trips	Job Impacts	Income Impacts	Value-added Impacts	Sales Impacts
2008	74,921	$167,750	278	2,857	287	$311,255	$583,523	$756,264
2009	95,794	$231,914	279	3,495	291	$430,176	$813,040	$1,033,704
2010	199,829	$479,648	327	6,116	353	$847,691	$1,586,334	$2,043,151
2011	136,266	$378,577	276	4,212	296	$671,721	$1,256,856	$1,618,695
2012	115,605	$298,162	264	3,612	280	$524,276	$978,808	$1,258,901
2013	68,338	$218,662	268	2,864	280	$372,105	$692,894	$893,139
2014	70,989	$214,143	236	2,834	248	$359,952	$668,554	$864,931
2015	114,488	$365,505	237	4,043	257	$633,013	$1,183,400	$1,515,359
2016	123,111	$362,759	197	4,245	215	$633,119	$1,177,209	$1,477,691
2017	75,991	$222,854	178	2,717	189	$374,107	$696,497	$887,232
2018	116,144	$377,668	193	3,621	215	$683,207	$1,239,287	$1,614,420
2019	136,820	$370,278	192	3,309	212	$636,930	$1,167,901	$1,507,707
Average	110,691	$307,327	244	3,660	260	$539,796	$1,003,692	$1,289,266

Table 5. Annual effort data and estimates of annual economic impact to the state of North Carolina from harvest of all other species caught during trips when striped bass landings occurred in the ASMA, 2008–2019.

Year	Pounds Landed	Ex-Vessel Value	Total Participants	Total Trips	Job Impacts	Income Impacts	Value-added Impacts	Sales Impacts
2008	752,788	$833,879	271	2,826	317	$1,547,237	$2,900,673	$3,759,363
2009	875,110	$838,842	276	3,423	321	$1,555,961	$2,940,795	$3,738,946
2010	1,004,196	$751,024	314	5,896	354	$1,327,298	$2,483,852	$3,199,126
2011	769,786	$376,144	262	4,012	282	$667,404	$1,248,778	$1,608,292
2012	734,894	$639,535	260	3,536	294	$1,124,534	$2,099,472	$2,700,252
2013	690,471	$828,539	265	2,840	310	$1,409,953	$2,625,466	$3,384,216
2014	628,430	$598,214	236	2,818	268	$1,005,535	$1,867,623	$2,416,208
2015	847,805	$682,205	236	3,958	273	$1,181,502	$2,208,785	$2,828,378
2016	823,328	$453,967	194	4,217	217	$792,302	$1,473,192	$1,849,224
2017	784,689	$587,458	177	2,712	207	$986,166	$1,836,006	$2,338,796
2018	937,616	$599,714	193	3,590	228	$1,084,890	$1,967,910	$2,563,599
2019	745,726	$333,321	192	3,295	210	$573,358	$1,051,334	$1,357,223
Average	799,570	$626,904	240	3,594	273	$1,104,678	$2,058,657	$2,645,302

Beyond the high-level relationship between commercial striped bass effort and statewide economic impacts, there is also a range of smaller-scale factors in this fishery that could affect its overall contribution to the state economy. A notable example is the difference in management between the CSMA and ASMA. Historically, the CSMA was allocated a smaller striped bass TAL and operated over a shorter season than the ASMA. Additionally, The ASMA striped bass fishery is regulated under a bycatch requirement, in which striped bass cannot be harvested unless it is with other finfish species.

While the exact economic costs and benefits of these differences in regulations cannot be quantified, it is likely the overall economic impact differs greatly between management areas.

CSMA

Prior to the 2019 closure, striped bass commercial effort in the CSMA was low. Roughly 100 participants engaged in less than 1,000 striped bass trips annually (Table 6), with the total harvest never exceeding 30,000 pounds or $85,000 (Table 6; Figure 12). Because of the TAL, striped bass harvest was consistent year-over-year except for 2008, which produced notably low striped bass landings. Landings of other species from the striped bass fishery are more variable than striped bass landings. Although landings of other species from striped bass trips generally produced a larger total amount of product, these species generally sold for lower overall prices. As a result, despite higher landings, annual ex-vessel values of other species are comparable to striped bass.

Table 6. Annual commercial striped bass effort data and estimates of annual economic impact to the state of North Carolina from striped bass harvest for the CSMA, 2008–2019. Commercial and recreational harvest of striped bass was closed in the CSMA in March of 2019, with no observed effort for all of 2019.

Year	Pounds Landed	Ex-Vessel Value	Total Participants	Total Trips	Job Impacts	Income Impacts	Value-added Impacts	Sales Impacts
2008	10,115	$20,906	110	706	111	$38,790	$72,722	$94,249
2009	24,847	$56,616	103	915	106	$105,016	$198,482	$252,352
2010	23,888	$55,678	103	680	106	$98,401	$184,143	$237,170
2011	28,054	$72,452	80	661	84	$128,553	$240,536	$309,785
2012	22,725	$51,958	69	571	72	$91,360	$170,567	$219,376
2013	28,597	$84,824	97	784	102	$144,348	$268,790	$346,469
2014	25,245	$69,098	125	826	129	$116,147	$215,725	$279,091
2015	27,336	$84,703	104	809	109	$146,697	$274,246	$351,175
2016	23,041	$69,271	94	685	98	$120,898	$224,795	$201,506
2017	23,018	$66,033	100	808	103	$110,850	$206,376	$237,914
2018	19,903	$61,477	90	776	94	$111,213	$201,732	$233,959
2019								
Average	23,343	$63,001	98	747	101	$110,207	$205,283	$251,186

When effort data are extended to generate state-wide economic impacts, the same patterns hold. The striped bass fishery produces roughly a quarter of one million dollars in sales impacts annually (Table 6). As the annual ex-vessel values and number of participants are comparable with other species harvested during striped bass trips, the economic impact of striped bass and other species is similar, but the economic impact of alternative species varies more year to year (Table 7).

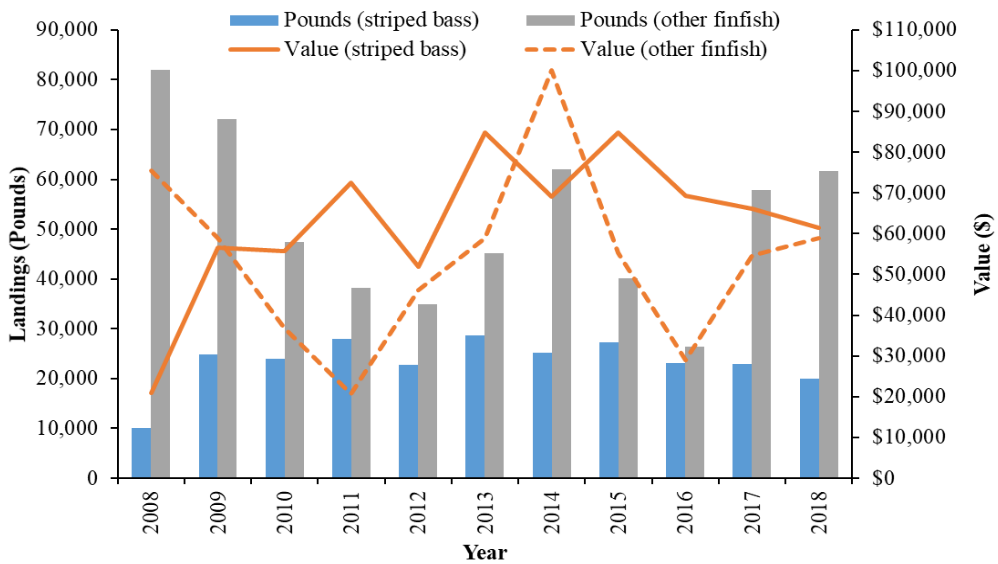


Figure 12. Annual Striped Bass effort and ex-vessel value data for the CSMA, 2008–2019.

Table 7. Annual effort data and estimates of annual economic impact to the state of North Carolina from harvest of all other species caught during trips when striped bass landings occurred in the CSMA, 2008–2019. Commercial and recreational harvest of striped bass was closed in the CSMA in March of 2019, with no observed effort for all of 2019.

Year	Pounds Landed	Ex- Vessel Value	Total Participants	Total Trips	Job Impacts	Income Impacts	Value-added Impacts	Sales Impacts
2008	81,922	$75,381	109	664	113	$139,867	$262,214	$339,839
2009	72,125	$58,882	90	824	93	$109,221	$206,429	$262,455
2010	47,382	$36,904	97	521	99	$65,220	$122,051	$157,198
2011	38,189	$20,637	71	472	72	$36,617	$68,514	$88,239
2012	34,855	$46,172	60	429	62	$81,186	$151,573	$194,947
2013	45,107	$58,914	91	668	94	$100,255	$186,685	$240,637
2014	62,013	$100,115	114	504	119	$168,283	$312,559	$404,368
2015	40,056	$55,244	89	574	92	$95,677	$178,866	$229,039
2016	26,374	$28,877	85	548	86	$50,398	$93,710	$117,629
2017	57,812	$54,695	105	712	108	$91,817	$170,941	$197,062
2018	61,723	$58,959	97	688	100	$106,658	$193,469	$224,373
2019								
Average	51,596	$54,071	92	600	94	$95,018	$177,001	$223,253

Recreational

Creel surveys provide data on recreational angler effort and expenditures to measure state-wide economic impacts of the fishery. The creel surveys collect information on target species, angler hours, and expenditures across six categories: lodging, food, ice, bait and tackle, vehicle fuel, and boat fuel. Combined, these data allow for an assessment of direct trip expenditures, as well as spillover impacts using IMPLAN statistical software.

ASMA

Annual ASMA effort estimates are combined with per-trip expenditure estimates from the CSMA creel survey, as these values are not tracked in the ASMA. Trip expenditure estimates are only provided using DMF survey data, combined with ASMA effort data. The ASMA maintains the same definition of a striped bass trip as the CSMA, in which striped bass is the angler's primary target, secondary target, or was caught.

In terms of trips and angling hours, the ASMA has the lowest striped bass angling effort among the three management areas (Table 8). Generally, the ASMA produces the lowest overall economic impact to the state of these management areas. As with the RRMA, this analysis extrapolates impact values from CSMA expenditure estimates and does not present impact estimates that are fully reflective of the ASMA system.

Table 8. Annual recreational striped bass effort estimates and state-level economic impacts of recreational striped bass angling in the Albemarle Sound Management Area. For this analysis, a striped bass trip is as a primary or secondary directed trip for striped bass, or a trip where striped bass was caught.

Year	Estimated Total ASMA Striped Bass Trips	Estimated Total ASMA Striped Bass Angling Hours	Estimated Sales Impacts	Estimated Income Impacts	Estimated Value-Added Impacts	Estimated Job Impacts	Total Expenditures Using DMF Inshore Vessel Trip Costs
2008	11,793	72,673	$378,011	$135,019	$204,838	3.44	$1,834,428
2009	11,326	72,021	$421,153	$152,375	$299,096	3.91	$1,755,517
2010	9,660	66,893	$1,466,355	$551,802	$802,439	11.82	$1,521,849
2011	13,114	85,325	$1,067,875	$377,870	$601,856	9.15	$2,131,210
2012	14,490	102,787	$836,596	$291,843	$477,153	6.99	$2,403,561
2013	7,053	50,643	$494,936	$172,553	$283,706	4.1	$1,187,069
2014	7,264	40,478	$830,858	$288,344	$476,395	6.81	$1,242,414
2015	11,132	75,009	$937,967	$326,264	$535,776	7.72	$1,906,246
2016	7,023	42,276	$312,791	$109,274	$176,394	2.63	$1,217,791
2017	7,658	41,371	$1,098,641	$382,203	$632,422	9	$1,356,190
2018	9,057	34,764	$510,289	$177,879	$289,450	4.22	$1,643,121
2019	19,864	61,645	$1,528,169	$532,055	$873,914	12.63	$3,475,633
Average	10,786	62,157	$823,637	$291,457	$471,120	6.87	$1,806,252

While angler effort, participation, and overall expenditures drive the economic impact of recreational estuarine striped bass angling in the state, the valuation can also be affected by smaller-scale factors specific to the fishery. Several social, regulatory, or environmental factors could affect the total economic impact of any fishery, though these are often difficult to quantify due to lack of data and clear causality. A notable component that may impact expenditures, and therefore economic impacts to the state, across management areas is variability in slot limits.

Each management area operates under different recreational harvest limits, including season length and size restrictions. For example, the ASMA is open for harvest from October to April with an 18-inch minimum TL size limit and the RRMA allows harvest from March to April and includes an 18-inch minimum TL size limit and a 22–27-inch TL no harvest protective slot. Varying restrictions could affect angler expenditures and total economic impact across management areas. Longer harvest seasons with less restrictive size limits could increase angler effort and expenditures in the ASMA compared to the RRMA, and likely lead to greater economic impacts to the recreational fishing industry.

RRMA

The RRMA creel survey does not collect reliable angler expenditure data annually, although Dockendorf et al. 2015 does provide an estimate of angler expenditures for the 2015 fishing year. Therefore, this analysis incorporates CSMA angler expenditure data instead, using the assumption that angler expenditures would be comparable across water bodies annually. Given that on-site expenditure values are not available, the only annual total expenditure estimates are those using RRMA effort data and DMF recreational angler expenditure survey data. In addition, the RRMA creel survey does not specifically include secondary targeting as part of its directed trip definition, but all striped bass trips, whether anglers target striped bass by itself or in combination with other species, are included in the estimates.

The state-wide economic impacts of the RRMA recreational fishery are higher than the ASMA and the CSMA because of higher overall effort and less year-to-year variability (Table 9). However, while it is assumed that CSMA expenditure values are a valid proxy for the RRMA, annual variability of the CSMA values impact the RRMA estimates. Therefore, while these are valid estimates of overall impact, they may not be perfectly reflective as they rely on indirect expenditure data.

CSMA

Recreational striped bass effort in the CSMA has generally increased over time, with corresponding increases in state-wide economic impacts. However, striped bass effort in 2019 dropped to its lowest levels in 10 years, with corresponding decreases in economic impact to the state (Table 10). The large increase in value of the fishery in 2017 is most directly attributed to higher lodging estimates from that year's creel survey, which can significantly impact model outputs.

Table 9. Annual recreational striped bass effort estimates and state-level economic impacts of recreational striped bass angling in the Roanoke River Management Area. For this analysis, a striped bass trip is as a directed trip for striped bass or a trip where striped bass was caught.

Year	Estimated Total RRMA Striped Bass Trips	Estimated Total RRMA Striped Bass Angling Hours	Estimated Sales Impacts	Estimated Income Impacts	Estimated Value-Added Impacts	Estimated Job Impacts	Total Expenditures Using DMF Inshore Vessel Trip Costs
2008	23,286	110,608	$746,409	$266,604	$404,467	6.79	$3,622,190
2009	25,405	120,675	$944,680	$341,790	$513,880	8.77	$3,937,746
2010	24,347	125,495	$3,695,792	$1,390,759	$2,022,463	29.79	$3,835,657
2011	27,311	122,876	$2,223,940	$786,945	$1,253,414	19.16	$4,438,423
2012	27,151	119,917	$1,567,592	$546,849	$894,076	13.1	$4,503,733
2013	19,539	112,814	$1,371,146	$478,033	$785,967	11.35	$3,288,550
2014	18,932	97,798	$2,165,449	$751,506	$1,241,620	17.74	$3,238,077
2015	25,034	123,648	$2,109,331	$733,712	$1,204,871	17.36	$4,286,828
2016	27,123	140,423	$1,208,006	$422,018	$681,239	10.14	$4,703,140
2017	21,004	109,011	$3,013,303	$1,048,289	$1,740,066	24.67	$3,719,693
2018	20,742	109,947	$1,168,648	$407,372	$662,889	9.67	$3,763,013
2019	20,633	99,259	$1,674,227	$582,907	$957,440	13.84	$3,811,110
Average	23,376	116,039	$1,824,044	$646,399	$1,030,199	15.20	$3,929,013

Table 10. Annual recreational striped bass effort estimates and state-level economic impacts of recreational striped bass angling in the Central-Southern Management Area. For this analysis, a striped bass trip is defined as any trip in which striped bass was an angler's primary target species, secondary target, or was caught.

Year	Estimated Total CSMA Striped Bass Trips	Estimated Total CMSA Striped Bass Angling Hours	Estimated Sales Impacts	Estimated Income Impacts	Estimated Value-Added Impacts	Estimated Job Impacts
2008	6,620	28,415	$212,196	$75,793	$114,986	1.93
2009	5,640	26,607	$209,725	$75,879	$114,085	1.95
2010	6,889	25,355	$995,635	$374,666	$544,846	8.03
2011	12,608	51,540	$1,026,671	$363,289	$578,633	8.8
2012	18,338	71,964	$1,058,786	$369,354	$603,879	8.85
2013	20,394	86,918	$1,431,103	$498,937	$820,335	11.85
2014	15,682	70,316	$1,793,659	$622,479	$1,028,444	14.69
2015	18,159	79,398	$1,530,041	$532,211	$873,974	12.59
2016	23,675	110,453	$1,054,420	$368,363	$594,627	8.85
2017	26,125	119,680	$3,748,044	$1,303,895	$2,164,350	30.69
2018	16,394	69,917	$923,651	$321,970	$523,920	7.64
2019	8,820	40,580	$715,654	$249,466	$409,261	5.92
Average	14,945	65,095	$1,224,965	$429,692	$697,612	10.15

ECOSYSTEM PROTECTION AND IMPACTS

As an anadromous species, one that migrates from the ocean or estuary upriver to spawn, habitat requirements for striped bass are specific to life stage. Striped bass are commonly found in habitats identified by the NC Coastal Habitat Protection Plan (CHPP) as priority habitats. These include the water column, wetlands, submerged aquatic vegetation (SAV), soft bottom, hard bottom, and shell bottom (NCDEQ 2016). These habitats provide appropriate conditions necessary for different life stages of striped bass.

COASTAL HABITAT PROTECTION PLAN

The Fisheries Reform Act statutes require that a CHPP be drafted by the DEQ and reviewed every five years (G.S. 143B 279.8). The CHPP is intended as a resource and guide compiled by DEQ staff to assist the department, MFC, NC Environmental Management Commission (EMC), and NC Coastal Resources Commission (CRC) for the protection and enhancement of fishery habitats of NC. The CHPP ensures consistent actions between commissions as well as their supporting DEQ divisions. The three commissions adopt rules to implement the CHPP in accordance with Chapter 150B of the General Statutes. Habitat recommendations related to fishery management can be addressed directly by the MFC. Habitat recommendations not under MFC authority (e.g., water quality management, shoreline development) can be addressed by the EMC and the CRC through the CHPP process.

The CHPP Source Document summarizes the economic and ecological value of coastal habitats to NC, their status, and the potential threats to their sustainability (NCDEQ 2016). The Coastal Habitat Protection Plans and Source Document can be viewed and downloaded from: http://portal.ncdenr.org/web/mf/habitat/chpp/07-2020-chpp.

The CHPP completed the five-year review, producing the 2021 Amendment. The Amendment includes two priority issues, "Submerged Aquatic Vegetation (SAV) Protection and Restoration, with Focus on Water Quality Improvements" and "Wetland Protection and Restoration with a Focus on Nature-based Methods", which may have implications for striped bass in NC. The presence of SAV is often used as a bio-indicator of water quality, as it is sensitive to specific conditions. One goal addressed in the CHPP is to modify water quality criteria to improve light penetration to the seafloor, one of the most important factors affecting SAV growth. Water quality improvements that benefit SAV will also benefit the species that use SAV habitat, like striped bass. As noted below, wetlands provide striped bass with a variety of habitat functions. The wetlands issue paper provides significant justification regarding nature-based methods of restoration and shoreline protection. Therefore, improvements to wetlands through the recommendations of the wetlands paper can have direct benefits to striped bass by increasing available habitat that can be used by striped bass.

THREATS AND ALTERATIONS

Striped bass use nearly all the environmentally and economically valuable habitat types that are listed in the 2016 CHPP during one or more life stages. Each habitat type provides environmental conditions critical to the enhancement and sustainability of striped bass populations in NC. Water quality impacts the habitats required by striped bass at various life stages (i.e., wetlands, submerged aquatic vegetation, shell bottom, and soft bottom). The primary human threats to these habitats include coastal development, industrial/wastewater discharges, and runoff. These threats often alter water chemistry, causing shifts in salinity, temperature, dissolved oxygen (DO), suspended solids, nutrients, pH, velocity, depth, flow, and clarity.

Wetlands, submerged aquatic vegetation, shell bottom, and soft bottom are of particular importance for striped bass as they function as nursery habitat, refuge, foraging grounds, and movement corridors. As anadromous fish, striped bass migrate from one system to another. Therefore, barriers to migration have the potential to significantly affect striped bass populations. Dams across rivers can cause segmentation in waterways and prevent striped bass from accessing historical spawning grounds. Additionally, coastal development that alters or removes migration corridors can further restrict the quantity and quality of habitat. The placement of large structures, such as breakwaters, groins, and jetties, can cause alterations in water flow patterns. For larval striped bass, this can result in altered migration patterns and force larval fish into areas where they are susceptible to predation.

Potential environmental influences on the striped bass stock include both dissolved oxygen and blue-green algae blooms. Hurricanes, increases in rainwater runoff, and blue-green algae blooms can lead to decreases in DO that can increase stress on fish and lead to fish kills (fish kills can be reported to the hotline at 1-800-858-0368 or online). For additional information on blue-green algae please see: the DEQ Algal Blooms Page, Albemarle-Pamlico National Estuarine Partnership Blue-green Algae Fact Sheet, and the North Carolina CHPP.

Another area of potential influence on the striped bass stock is the prevalence of the non-native blue catfish and flathead catfish (*Pylodictis olivaris*). Both species have been present in the Tar-Pamlico, Neuse, and Cape Fear river basins for decades, and while flathead catfish are not currently found in the Albemarle Sound basin, the population of blue catfish in the Roanoke River and Albemarle Sound and tributaries has increased dramatically in recent years (Darsee et al. 2019; NCDMF 2019). Striped bass made up only a small fraction of the overall diet of blue catfish in the James River of Chesapeake Bay (Schmitt et al. 2016), but non-native catfishes including flathead catfish and blue catfish were suggested to play a large role in structuring native fish communities and to delay recovery of anadromous fish populations in the Cape Fear River (Belkoski et al. 2021). Predation by non-native catfishes could potentially impact recruitment of striped bass directly or could influence food resources for striped bass through competition (e.g., Pine et al. 2005). The WRC published the 2019 Catfish Management Plan which details goals, strategies, and recommendations for developing and implementing management strategies for invasive catfish. Additional information about blue catfish in NC can be found in the APNEP Aquatic Nuisance Species Management Plan.

Manmade barriers also act as impediments to spawning for striped bass stocks in NC. On the Roanoke River spawning migrations have been impeded since the construction of the initial dam at Roanoke Rapids around 1900 (NMFS and USFWS 2016). In the CSMA, dams on the Tar-Pamlico, Neuse, and Cape Fear rivers obstruct migration and alter the flow regime. The Cape Fear River may provide the best opportunity for remediation of migration impediments. The U.S. Army Corps of Engineers (USACE) owns three locks and dams on the Cape Fear River that are currently not operational. These locks and dams have severely reduced access to historic spawning areas near the fall line. Various unsuccessful forms of passage have been attempted to restore spawning stocks, but recent alterations to fish passage may allow higher passage efficiency over the first lock and dam. Further details regarding fish passage on the Cape Fear River can be found in the Cape Fear River Sustainable Harvest Issue Paper Appendix 4.

FLOW

Striped bass are broadcast spawners, producing eggs that must remain in the water column to develop and hatch (Bain and Bain 1982). Appropriate river flow is critical before and after the spawning period (Hassler et al. 1981) and is the most important factor influencing year class strength. Striped bass require relatively high streamflow to encourage upstream migration prior to the peak of spawning, whereas low to moderate flows are necessary for spawning success and downstream transport of early life stages. Extremely low flows will result in eggs settling on the river bottom where they can be covered in sediment and die (Albrecht 1964), and extended periods of high water from May to June negatively impact reproduction by stranding eggs and larvae in the floodplain where dissolved oxygen is low. Recruitment failures in the ASMA since 2001 are thought to be due to extended spring flooding events.

ASMA/RRMA

Streamflow in the lower Roanoke River is regulated by John H. Kerr Dam, which is operated by the USACE for flood control, hydropower, and recreational uses. Two additional hydropower dams owned and operated by Dominion Energy, Gaston Dam and Roanoke Rapids Dam, are located downstream of Kerr Dam and further regulate streamflow in the Roanoke River. Operation of Kerr Dam is guided by a Water Control Plan (USACE 2016), which is the result of years of environmental studies and collaboration with numerous resource agencies and stakeholders. Gaston and Roanoke Rapids dams are operated by Dominion under conditions of a license received from the Federal Energy Regulatory Commission in 2005 (FERC 2005). Both the USACE Water Control Plan and Dominion's FERC license stipulate flow regimes and restrictions intended to facilitate successful striped bass spawning in the Roanoke River. Staff from the WRC and DMF as well as other resource agencies including DEQ and U.S. Fish and Wildlife Service (USFWS) advise the USACE and Dominion Energy on a weekly basis during the striped bass spawning season to inform streamflow decisions within the constraints of the Water Control Plan and FERC license.

Appropriate flow regimes for successful striped bass reproduction in the Roanoke River have been a concern since Kerr Dam was constructed in 1953. Adequate minimum flows were first addressed in 1957 when the USACE agreed to a 2-feet increase in the guide curve to provide sufficient flows during the striped bass spawning season. The increased storage and changes to the guide curve during the spring spawning season are maintained in the current version of the Water Control Plan. The USACE along with federal and state resource agencies developed and tested a recommended flow regime during the striped bass spawning season beginning in 1989 to identify beneficial flows for successful reproduction. After testing the flow regime for four years, the USACE implemented the negotiated flow regime (Table 11), which specifies high flows in April and low to moderate flows in May and June, on a permanent basis in 1995, and they incorporated the same spawning flow targets in the 2016 revision of their Water Control Plan. Additionally, Dominion is prohibited from conducting hydropeaking operations (large daily variations in streamflow) during the striped bass spawning in April through June 15. This FERC license requirement dictates that Dominion consistently adheres to the USACE weekly flow declaration from Kerr Reservoir. Prior to each spawning season, USACE, WRC, and USFWS staff discuss an overall plan of operation based on Water Management forecasts of available storage and inflows during the upcoming spawning season, and the USACE attempts to meet the weekly target flow regime depending on water availability or the need for flood control.

Table 11. U.S. Army Corps of Engineers guidelines for providing Roanoke River striped bass spawning flows from John H. Kerr Dam.

Dates	Lower Target Flow (cfs)	Median Target Flow (cfs)	Upper Target Flow (cfs)
April 1–15	6,600	8,500	13,700
April 16–30	5,800	7,800	11,000
May 1–15	4,700	6,500	9,500
May 16–31	4,400	5,900	9,500
June 1–15	4,000	5,300	9,500

The negotiated spawning flow regime strives to maintain Roanoke River flow rates within the range of 6,000–8,000 ft^3/s, which was identified as optimum levels for striped bass spawning by Hassler (1981) and Rulifson and Manooch (1990). However, recent analysis indicates that streamflow conditions within the optimum ranges did not always produce strong year classes; rather, the analysis of year-class strength and flows since 1955 showed that poor year classes were produced when flows were above 20,000 ft^3/s during May but did not find a relationship between target-level streamflow and successful recruitment (NCDMF 2021). Flood control is the primary objective of John H. Kerr Dam (USACE 2016), and the reservoir is designed to temporarily store flood waters until they can be released later at the maximum rate possible without causing significant damaging flows downstream. When heavy rainfall causes high inflows into the reservoir, the USACE enters into flood control operations and flows will typically exceed the negotiated flow regime. The Water Control Plan allows for flood releases up to 35,000 ft^3/s when lake levels are between 300 and 320 ft (NGVD29), but flows are generally based on weekly average inflows into the reservoir. At higher lake elevations, flood releases can exceed 35,000 ft^3/s to prevent damage to the dam itself, but, to date, flows from Kerr Dam have never exceeded 35,000 ft^3/s. Between 2016 and 2020, monthly reservoir inflows during the spawning timeframe were above average and some months recorded some of the highest inflows on record (Figure 13). These high-inflow years caused the need for high streamflow and flood control operations during the striped bass spawning season (Tony Young, USACE, personal communication), which has, in turn, resulted in reduced recruitment for the Albemarle-Roanoke striped bass stock.

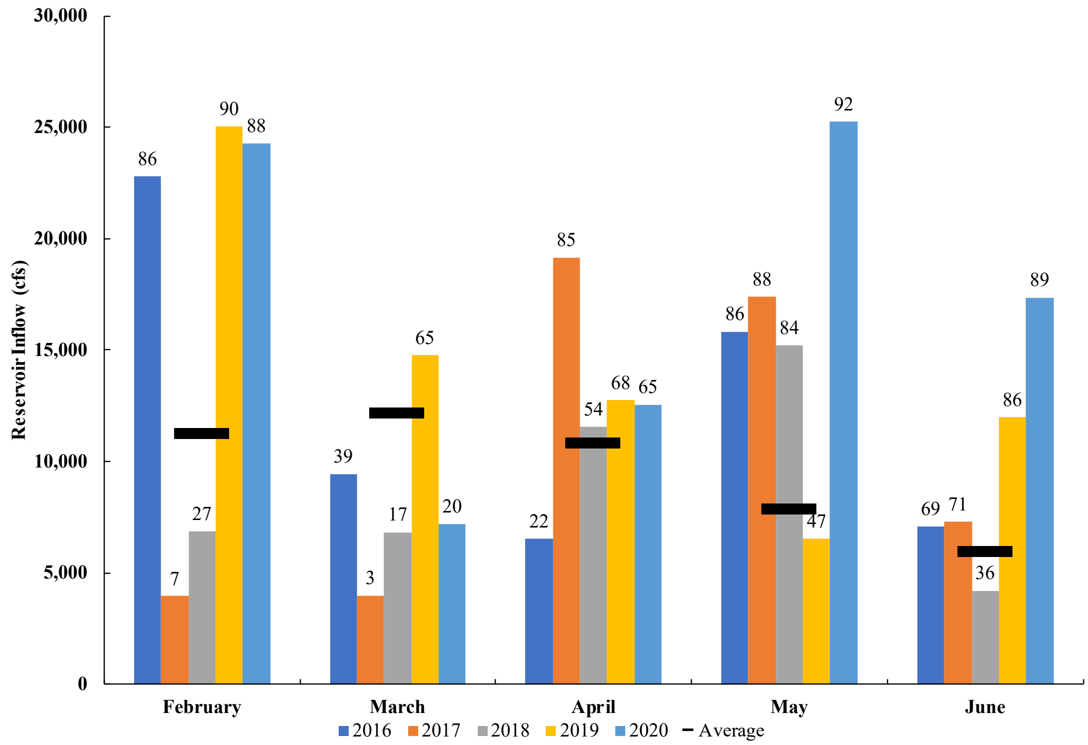


Figure 13. Monthly inflow data for John H. Kerr Reservoir on the Roanoke River during February–June of 2016–2020. Data were provided by USACE staff. Numbers of the columns provide the rank for 92 years of data. A rank of 1 is driest and rank of 92 is wettest.

CSMA

The rivers in the CSMA are less regulated than the Roanoke River, and specific, optimal flow requirements are unknown. The Tar-Pamlico River is impounded by Rocky Mount Mills Dam (rm 124) and Tar River Reservoir Dam (rm 130). Rocky Mount Mills Dam is a small, historic hydropower facility that is not currently regulated by FERC, and Tar River Reservoir is a drinking water reservoir. Both dams are run-of-river operations, and neither has enough storage capacity to provide beneficial spawning flows for striped bass. Rocky Mount Mills Dam is an impediment to anadromous fish migrations, but it is unlikely that striped bass would benefit from passage beyond the dam as the typical spawning habitat is downstream. However, regulated flows, such as hydropeaking, could reduce striped bass spawning success. Because the mill dam lacks FERC oversite, continued communication between resource agencies and the dam operators is critical to maintain striped bass spawning habitat on the upper Tar-Pamlico River. The Neuse River has benefitted from several dam removals over the last few decades, including Quaker Neck Dam (rm 140) in 1998 and Milburnie Dam (rm 218) in 2017. Falls of the Neuse Dam at rm 236 is now the first impediment to striped bass migration. Falls Dam is operated by the USACE for flood control and drinking water supply. There are no formal spawning flow agreements for Falls Dam, but the USACE consults with resource agency staff weekly regarding water releases on the Neuse River and tries to provide increased streamflow when water is available. The Cape Fear River is heavily impacted by three USACE locks and dams at rm 60, 93, and 116. Additionally, Buckhorn Dam is a run-of-river low-head dam at rm 196, and B. Everett Jordan Dam, operated by USACE, is operated for flood control and a drinking water reservoir located on the Haw River upstream of the beginning of the Cape Fear River. There are no formal striped bass spawning streamflow agreements for B. Everett Jordan Dam; however, beginning in 2020, the USACE modified reservoir release patterns into the Cape Fear River during the peak migratory season in an attempt to submerge all three locks and dams and enhance upstream passage of striped bass and other anadromous fishes to historic spawning grounds.

Egg densities and buoyancy in different systems have been shown to be suited for the predominant flow rate of that river (Bergey et al. 2003). Chesapeake Bay striped bass eggs are lighter and maintain their position in the water column of calm waters, whereas Roanoke River striped bass eggs are heavier and maintain their water column position in a high energy system (Bergey et al. 2003). A recent study indicated that, egg size and buoyancy from the Tar-Pamlico and Neuse rivers appear to be adapted to their specific river systems based on salinity alone (Kowalchyk 2020; Reading et al. 2020). Striped bass from the Tar-Pamlico and Neuse rivers have smaller and heavier eggs compared to other rivers in NC and may require higher flow rates to remain suspended in the water column (Kowalchyk 2020, Reading et al. 2020). Because low streamflow and shallow water may lead to eggs contacting the bottom (Bain and Bain 1982), striped bass spawning success in CSMA rivers may be limited to years when rainfall produces enough streamflow to keep eggs suspended, provided spawning stock biomass is adequate.

RESEARCH NEEDS

The research recommendations listed below are offered by the division to improve future management strategies of the estuarine striped bass fishery. They are considered high priority as they will help to better understand the stiped bass fishery and meet the goal and objectives of the FMP. A comprehensive list of research recommendations is provided in the annual FMP Review and Research Priorities documents available on the Fishery Management Plans website.

- Identify environmental factors (e.g., flow, salinity, predation, dissolved oxygen, algal blooms) affecting survival of striped bass eggs, larvae, and juveniles and investigate methods for incorporating environmental variables into stock assessment models.
- Refine discard mortality estimates for recreational and commercial fisheries by conducting delayed mortality studies to estimate discard losses for recreational and commercial gear during all seasons factoring in relationships between salinity, dissolved oxygen, and water temperature.
- Determine mixing rates between A-R and CSMA striped bass stocks to better inform stock assessments and management.
- Expand, modify, or develop fishery independent sampling programs to fully encompass all striped bass life stages (egg, larval, juvenile, and adult).
- Enhance recreational and commercial data collection to better characterize the magnitude and demographics (e.g., length, weight, age) of discards

STRIPED BASS AMENDMENT 2 MANAGEMENT STRATEGY

<u>The NCMFC selected management options:</u>

APPENDIX 2: ACHIEVING SUSTAINABLE HARVEST FOR THE ALBEMARLE SOUND-ROANOKE RIVER STRIPED BASS STOCK

1. Manage for Sustainable Harvest through harvest restrictions
   A. Continue to use stock assessments and stock assessment projections to determine the TAL that achieves a sustainable harvest for the A-R stock
2. Management of striped bass harvest in the commercial fishery as a bycatch fishery
   A. Status quo: continue managing the ASMA striped bass fishery as a bycatch fishery
3. Accountability Measures to address TAL overages
   D. If the landings in any one of the management areas' three fisheries (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds their allocated TAL in a calendar year, any landings in excess of their allocated TAL will be deducted from that fisheries' allocated TAL the next calendar year.
4. Size limits to expand the age structure of the stock
   C. In the ASMA, implement a harvest slot of a minimum size of 18-inches TL to not greater than 25 inches TL in the commercial and recreational sectors
   E. In the RRMA, maintain current harvest slot limit of a minimum size of 18-inches TL to not greater than 22-inches TL with no harvest allowed on fish greater than 22 inches.
5. Gear modifications and area closures to reduce striped bass discard mortality
   A. Status quo-continue to allow commercial harvest of striped bass with gill nets in joint and coastal waters of the ASMA and continue recreational harvest and catch-and-release fishing in the ASMA and RRMA, including striped bass spawning grounds in the Roanoke River. The requirement that from April 1 through June 30, only a single barbless hook or lure with single barbless hook (or hook with barb bent down) may be used in the inland waters of the Roanoke River upstream of U.S. Highway 258 Bridge will remain in effect.
   E. Implement a requirement to use non-offset barbless circle hooks when fishing with live or natural bait in the inland waters of the Roanoke River (upstream of Hwy 258 bridge) from May 1 through June 30
6. Adaptive Management
   Adaptive management for the A-R stock and fisheries in the ASMA and RRMA encompasses the following measures:

   - Use peer reviewed stock assessments and updates to recalculate the BRPs and/or TAL. Stock assessments will be updated at least once between benchmarks. Increases or decreases in the TAL will be implemented through a Revision to the Amendment. A harvest moratorium could be necessary if stock assessment results calculate a TAL that is too low to effectively manage, and/or the stock continues to experience spawning failures.
   - Use estimates of F from stock assessments to compare to the F BRP and if F exceeds the F_{Target} reduce the TAL to achieve the F_{Target} in one year through a Revision to the Amendment.

- Ability to change daily possession limits in the commercial and recreational fisheries to keep landings below the TAL.
- Ability to open and close recreational harvest seasons and commercial harvest seasons and areas to keep landings below the TAL and reduce interactions with endangered species.
- Ability to require commercial and recreational gear modifications including, but not limited to, the use of barbless or circle hooks, area closures, yardage limits, gill net mesh size restrictions and setting requirements to reduce striped bass discards.

APPENDIX 3: ACHIEVING SUSTAINABLE HARVEST FOR THE TAR-PAMLICO AND NEUSE RIVERS STRIPED BASS STOCKS

1. Striped Bass Harvest
   A. Continue the no-possession measure in Supplement A to Amendment 1
2. Gear Restrictions/Limits
   A. Maintain gill net closure above the ferry lines and maintain the 3-foot tie-downs below the ferry lines
3. Adaptive Management

   - In 2025, review data through 2024 to determine if populations are self-sustaining and if sustainable harvest can be determined

In addition, the MFC included in its motion "*that the DMF study the effects of the gill net closure and reevaluate it at the next full amendment review. This research will be conducted, preferably within two years, and this closure be addressed based on that study*".

APPENDIX 4: ACHIEVING SUSTAINABLE HARVEST FOR THE CAPE FEAR RIVER STRIPED BASS STOCK

1. Striped Bass Harvest
   A. Status Quo: maintain Cape Fear River harvest moratorium
2. Adaptive Management

   - Continue YOY surveys and PBT analysis after the adoption of the FMP
   - If YOY surveys and/or PBT analysis suggest levels of natural reproduction have increased or decreased compared to what was observed up to the time of FMP adoption, then management measures may be re-evaluated using this new information and adjusted by proclamation using the authority granted to DMF and WRC directors. Rule changes or suspensions would be required to allow harvest.
   - Management measures which may be adjusted include means and methods, harvest area, as well as season, size and creel limit (as allowed for in rule).
   - Use of the DMF director's proclamation authority for adaptive management is contingent on evaluation of adaptive management measures by the Striped Bass Plan Development Team and consultation with the Finfish Advisory Committee.

APPENDIX 5: THE USE OF HOOK AND LINE AS A COMMERCIAL GEAR IN THE ESTUARINE STRIPED BASS FISHERY

1. Hook and Line as a Commercial Gear

   A. Do not allow hook and line as a commercial gear in the estuarine striped bass fishery at this time.

2. Adaptive Management

- If hook and line is allowed for the commercial harvest of striped bass and NC TTP and Quota Monitoring data indicate the TAL will either be quickly exceeded or unable to be met during the potential striped bass season, then management measures may be re-evaluated and adjusted by the proclamation authority granted to the Fisheries Director (as is currently occurring under the existing management strategy).
- If hook and line is allowed for the commercial harvest of striped bass and Marine Patrol enforcement activity or License and Statistics data suggest significant amounts of unreported commercial striped bass catch is occurring, then additional tagging or reporting requirements may be developed and implemented.
- Management measures that may be adjusted include means and methods, harvest area, as well as season, size and limit.
- Implementation of adaptive management measures to enact additional increased tagging or reporting requirements is contingent on evaluation of these measures by the Striped Bass Plan Development Team and consultation with the Marine Fisheries Commission.

APPENDICES

APPENDIX 1: STRIPED BASS STOCKING IN COASTAL NORTH CAROLINA

STOCKING HISTORY

Striped Bass culture originated in North Carolina in the late 19th century with the establishment of the Weldon Hatchery adjacent to the spawning grounds of the Roanoke River (Baird 1880; Worth 1884). The Weldon Hatchery was operated from 1884–1991 by federal and state fisheries agencies, including the North Carolina Wildlife Resources Commission (WRC; Harrell et al. 1990). The Edenton National Fish Hatchery (ENFH), operated by the USFWS, was also heavily involved in striped bass production, and operated the Weldon Hatchery as a sub-station before it was transferred to WRC. Striped Bass eggs and fry (larvae) produced at the Weldon Hatchery from Roanoke River broodfish were widely distributed throughout the U.S. Although annual egg and fry production totals from the early years of the Weldon Hatchery are available for most years (1906–1947; Woodroffe 2011), little is known about fry stocking numbers and locations until WRC records began in 1943. Since that time, over 96 million fry have been released in North Carolina coastal systems (Table 1.1). A detailed overview of historical striped bass stocking in North Carolina and the southeastern U.S. can be found in Woodroffe (2011).

By the 1970s collapse of the Atlantic striped bass stock, hatchery techniques had been refined to achieve grow-out to phase-I (25–50 mm; 1–2 in) and phase-II (125–200 mm; 5–8 in) sizes, providing additional opportunities for stocking. The North Carolina Division of Marine Fisheries (NCDMF) and the USFWS began a pilot project in 1979 to evaluate the restoration potential of stocking phase-II fish. In 1986, the two agencies, along with the WRC, developed a cooperative program to restore self-sustaining stocks of anadromous fishes in coastal North Carolina waters through a combination of fishery management techniques including stocking, regulations, and assessment (Appendix 1.A). The cooperative agreement included plans for USFWS production of Phase-I and Phase-II fish. All sizes of striped bass (fry; phase-I; phase-II; sub-adults; adult broodfish) have been stocked into North Carolina coastal river systems since the agreement. The three agencies produce an annual workplan that details stocking strategies of multiple species including striped bass.

Albemarle Sound

The earliest record of stocking phase-II fish in the Albemarle Sound area occurred in 1978; however, the DMF tagging program and cooperative stockings began in January 1981 (Table 1.2). From 1981–1996, over 700,000 phase-II fish were stocked in the Albemarle Sound system with nearly 54,000 fish tagged. All phase-II fish stocked in Albemarle Sound from 1991–1996 were tagged to avoid natural stock confusion. In addition, over 800,000 phase-I fish were stocked in the Albemarle Sound system from 1979–1981 and 1985. An additional 160,410 phase-I fish were stocked in the Roanoke River from 1976–1979, and 106,392 phase-I fish were stocked in 1992. Stocking in the Albemarle Sound system was discontinued in 1996 due to recovery of the stock. Poor recruitment and the overfished status of the Albemarle-Roanoke stock, however, led the WRC and DMF to develop a stocking contingency plan for the Albemarle Sound in 2021. The contingency plan outlines the decision-making process for stocking surplus phase-I fish from

Roanoke River broodstock if high flow conditions are expected to limit natural recruitment. The Albemarle-Roanoke striped bass contingency plan will be part of the annual cooperative workplan agreement, and its use will be determined each year by agreement of the agencies.

Tar-Pamlico River

Phase-II stocking began in the Tar-Pamlico River in 1977 when 4,380 fish were stocked. Phase-II fish were periodically stocked from 1982–2005, and annual stockings of phase-II fish occurred from 2007–2020 (Table 1.2). The change to annual stocking of phase-II fish was a recommendation in the NC Estuarine Striped Bass FMP (NCDMF 2004). Nearly 2.4 million phase-II fish have been stocked in the Tar-Pamlico River basin since 1977, and more than 2.8 million phase-I fish since 1979. Phase-I fish stocked in 1979 and 1983 were likely surplus, but in 1994 the WRC and ENFH began stocking phase-I fish in the Tar-Pamlico River basin with an annual stocking goal of 100,000 phase-I fish. Annual stocking of phase-I fish was discontinued in 2009 by recommendation in Amendment 1 of the NC Estuarine Striped Bass FMP (NCDMF and NCWRC 2013). Surplus phase-I fish, however, were stocked in 2013, 2014, and 2016. A portion of all phase-II fish were tagged yearly to determine migration and contribution of stocked fish to recreational and commercial fisheries. From 1998–2011, all stocked fish were marked with oxytetracycline (OTC), which leaves a chemical mark on fish otoliths (ear bone) that can be seen under fluorescent light. Parentage-based tagging (PBT) analysis using microsatellite markers was used for genetically identifying fish stocked from 2010–2020.

Neuse River

Recent stocking history of striped bass in the Neuse River basin is similar to the Tar-Pamlico River basin. A small number of phase-II fish were stocked in the Neuse River in 1975. Phase-II fish were periodically stocked from 1981–2007, and annual stockings occurred from 2009–2020 (Table 1.2). More than 2.1 million phase-II fish have been stocked in the Neuse River basin. Additionally, more than 2.4 million phase-I fish have been stocked in the Neuse River basin, with an annual goal of 100,000 fish from 1993–2009. Stocking requests for phase-I fish ended with Amendment 1, but surplus fish were stocked in the Neuse River in several years following 2009. A portion of all phase-II fish were tagged each year to determine migration patterns and contribution of stocked fish to recreational and commercial fisheries. All stocked fish were marked with OTC from 1998–2011, and all striped bass stocked since 2010 are genetically traceable with PBT analysis.

Cape Fear River

The Cape Fear River was first stocked with 4,000 phase-II fish in 1968, and periodic stockings of phase-I and phase-II fish occurred from 1979–2000 (Table 1.2). Infrequent stockings in the Cape Fear River were due to low numbers of tag returns and complications posed by the presence of hybrid striped bass from Jordan Reservoir. Hybrid striped bass stocking was discontinued in Jordan Reservoir in 2002 in favor of striped bass (Table 1.3). Phase-II fish stocking was reinitiated in the Cape Fear River, with stocking in 2004, 2006, and annually since 2008. Phase-I fish were stocked annually from 2001–2009, and surplus phase-I fish were also stocked in 2012 and 2014. A portion of the phase-II fish were tagged. All stocked fish were marked with OTC between 1998–2011, and all striped bass stocked since 2010 are genetically traceable with PBT analysis.

Northeast Cape Fear River

The WRC stocked approximately 26,000 phase-II fish in the Northeast Cape Fear River in 1999 and 2000 (Table 1.2). The WRC also stocked phase-I fish annually during 2001–2009. A final stocking of phase-I fish in the Northeast Cape Fear River occurred in 2012. Approximately 818,000 phase-I fish were stocked in the Northeast Cape Fear River (Table 1.2). All stocked fish, except for those stocked in 2012, were marked with OTC, and the 2012 year-class is genetically traceable with PBT analysis.

Broodstock source

Striped bass originating from the Roanoke River have provided most fish used for stocking in North Carolina waters, but many broodstock sources have been used throughout the state. Early fry stockings from the Weldon Hatchery were entirely from Roanoke River broodfish. Phase-II fish stocked in the Albemarle Sound region were supplied by the ENFH and the USFWS McKinney Lake National Fish Hatchery in NC, with supplemental fish produced in South Carolina, Georgia, Alabama, and Texas, all of which used various broodstock sources. During most years, phase-I fish stocked by WRC originated from Roanoke River broodstock. Broodstock from Roanoke River; Monks Corner, SC; and Weldon/Monks Corner crosses were artificially spawned at the hatcheries to provide fish for grow-out to phase-II. When WSFH began striped bass production in 1994, nearly all striped bass broodstock used for all coastal river stockings were collected from the Roanoke River and Dan River (Roanoke River basin) each year (Jeff Evans, WRC hatchery manager, personal communication). In 2010, however, local broodstock were used for producing phase-II fish for stocking in the Cape Fear River, and local broodstock have been used for stocking the Tar-Pamlico and Neuse rivers since 2012.

Broodstock collection

Striped bass broodstock are collected during annual electrofishing surveys conducted by WRC on the spawning grounds of the Roanoke, Tar-Pamlico, Neuse, and Cape Fear rivers. WRC biologists coordinate broodstock collections with hatcheries staff. Gravid (egg laden) females and three to four males per female are collected and transported to hatcheries. The number of females collected annually varies based on stocking goals and hatchery needs. Broodstock for Tar-Pamlico and Neuse rivers phase-II production are typically delivered to ENFH, whereas broodstock for phase-I production for the Cape Fear and the Roanoke rivers and inland reservoirs are delivered to WSFH. Prior to 2014, WSFH transferred fry to ENFH for grow-out to phase-II.

Table 1.1. Striped bass fry stocked into coastal systems of North Carolina, 1943–2019. Data are from WRC hatchery cards (1943–1971), ENFH records (1982–1990), and the WRC warmwater stocking database, which includes ENFH records (1994–2019).

Roanoke River		Chowan River		Albemarle Sound		Tar-Pamlico River		Neuse River		White Oak River		Northeast Cape Fear River		Cape Fear River	
Year	**Fry Stocked**	**Year**	**Fry Stocked**	**Year**	**Fry Stocked**	**Year**	**Fry Stocked**	**Year**	**Fry Stocked**	**Year**	**Fry Stocked**	**Year**	**Fry Stocked**	**Year**	**Fry Stocked**
1944	3,938,000	1949	171,500	1951	474,200	1943	493,000	1949	100,000	1955	330,000	1965	150,000	1968	1,830,000
1949	1,000,000	1951	359,500	1952	1,025,000	1947	250,000	1951	139,000	1957	270,000	1966	200,000	1982	399,928
1950	1,500,000	1952	750,000	1953	800,000	1948	266,000	1952	175,000	1960	33,000	1967	300,000	2002	900,000
1958	400,000	1953	400,000	1954	1,000,000	1949	475,000	1953	397,000	1964	80,000	1968	425,000	2004	900,000
1959	862,000	1954	2,030,000	1955	820,000	1950	160,000	1954	1,045,000	1983	61,772	1969	320,000		
1960	4,964,000	1955	860,000	1956	150,000	1954	690,000	1955	330,000	1984	45,000	1970	187,000		
1962	1,335,000	1956	300,000	1957	820,000	1955	1,126,000	1956	305,000			1971	100,000		
1963	3,811,000	1959	105,000	1959	200,000	1956	200,000	1957	550,000			2000	999,999		
1964	1,536,000	1961	175,000	1961	525,000	1957	420,000	1959	185,000			2002	500,000		
1965	1,052,000^{+}	1962	225,000	1962	677,000	1959	260,000	1960	25,000			2003	115,000		
1966	1,005,000^{+}	1964	69,000	1964	274,000	1961	460,000	1961	260,000						
1967	1,567,500	1965	219,000	1965	375,000	1962	3,250,000	1962	360,000						
1968	6,334,000	1966	350,000^{+}	1966	925,000	1964	393,000	1964	90,000						
1969*	2,718,000^{+}	1967	297,000	1967	592,000	1965	150,000	1965	150,000						
1970	1,375,000	1968	985,100	1968	2,063,250	1966	200,000^{+}	1966	200,000						
1971	175,000	1969	309,800	1969	619,650	1967	510,000	1967	400,000						
1990	240,000	1970	63,000	1970	156,000	1968	975,000	1968	766,000						
		1971	250,000	1971	150,000	1969	1,943,000	1969	2,049,200						
						1970	6,528,000	1970	66,600						
						1971	1,164,000	1971	66,666						
						1994	1,500,000	1983	176,547						
						2018	608,384	1984	182,000						
						2019	813,000	2015	799,700						
								2016	1,173,000						
								2018	670,464						
								2019	1,755,000						
Totals	33,812,500		7,918,900		11,646,100		22,834,384		12,416,177		819,772		3,296,999		4,029,928

*55 million eggs were also released; $^{+}$includes records with unknown size and date of release that are assumed to be fry based on year of release and data source.

Table 1.2. Stocking records of phase-I and phase-II fish released in coastal systems of North Carolina, 1967–2020. Note, some phase-II fish were stocked in January of the calendar year following the production year-class causing some discrepancies with tables in previous fishery management plans.

	Albemarle Sound		**Roanoke River**		**Tar-Pamlico River**		**Neuse River**		**Northeast Cape Fear River**		**Cape Fear River**	
Year-Class	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**
1967												4,000
1974					*Unknown							
1975								2,124				
1976			18,074									
1977			25,000			4,380						
1978		2,358	30,336									
1979	100,013	-	87,000		104,000		93,480				3,000	14,874
1980	441,689	87,181									12,410	
1981	215,706	-						47,648				
1982		106,675				76,674						
1983		67,433			28,000	-						13,401
1984		236,242				26,000						56,437
1985	45,011	45,200						39,769				
1986		118,345										
1987		15,435				17,993						
1988		5,000										
1989		3,289										77,242
1990		9,466				1,195		61,877			169,792	
1991		2,994				30,801						
1992		2,465	106,392			-						
1993		2,180				118,600	48,000					
1994		2,481			127,635	183,254	103,057	79,933			100,733	
1995		2,498			100,000	140,972	99,176				100,000	
1996		2,490			39,450		100,000	100,760				
1997					28,022	24,031						
1998					230,786		107,730	83,195				30,479
1999					100,000	17,954	100,000			10,327		
2000					188,839		121,993	108,000		15,635		8,915

Table 1.2 (continued).

	Albemarle Sound		Roanoke River		Tar-Pamlico River		Neuse River		Northeast Cape Fear River		Cape Fear River	
Year-Class	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**	**Phase-I**	**Phase-II**
2001					171,000	37,000	103,000		94,083		90,149	
2002					39,110			147,654	50,000		50,000	
2003					100,000	159,996	100,000		151,873		104,775	
2004					100,000		100,000	168,011	50,000		50,000	172,055
2005					114,000	267,376	114,000		54,500		54,500	
2006					134,100		146,340	99,595	84,125		80,450	102,283
2007					160,995	69,871	172,882	69,953	79,690		80,376	
2008					331,202	91,962	314,298		190,460		395,226	92,580
2009					99,730	61,054	100,228	104,061	51,750		166,812	112,674
2010						114,012		107,142				210,105
2011						107,767		102,089				130,665
2012						45,667	50,180	91,985	12,384		45,000	127,070
2013					257,404	123,416	181,327	113,784				195,882
2014					138,889	92,727	79,864	78,866			211,726	141,752
2015						52,922		109,107				116,011
2016					234,718	121,190	80,910	134,559				70,734
2017						101,987		14,203				154,024
2018						120,668	96,900	86,556				101,254
2019						97,920		85,694				105,405
2020						90,614		96,933				73,038
Totals	802,419	711,732	266,802	0	2,827,880	2,398,003	2,413,365	2,133,498	818,865	25,962	1,714,949	2,110,880

*DMF report indicates Phase-I fish were stocked in the Tar-Pamlico in 1974, but records have not been located.

Table 1.3. Striped bass and hybrid striped bass stocked by the NC Wildlife Resources Commission in B. Everett Jordan Reservoir located in the Cape Fear River basin, 1988–2020.

	Striped bass	Hybrid striped bass			
Year-Class	Phase-I	Fry	Phase-I	Phase-II	Total
1988			42,517		42,517
1989			30,000	96	30,096
1990			12,114		12,114
1991			96,887		96,887
1993			214,710	21,447	236,157
1994		600,000			600,000
1995	21,780		50,600		50,600
1996	15,867		29,000		29,000
1997	35,000		35,000		35,000
1998	37,766		13,692		13,692
1999	51,567		37,330		37,330
2000	42,150		42,118		42,118
2001	35,000		35,000		35,000
2002	70,000				
2003	70,000				
2004	70,000				
2005	70,000				
2006	70,000				
2007	70,000				
2008	70,000				
2009	70,000				
2010	70,000				
2011	70,000				
2012	100,000				
2013	100,000				
2014	100,000				
2015	78,000				
2016	78,000				
2017	100,000				
2018	128,164				
2019	120,000				
2020	120,000				
Totals	1,863,294	600,000	638,968	21,543	1,260,511

Fry production

North Carolina hatcheries use established striped bass culture techniques adapted from Harrell et al. (1990). At the hatchery, male and female striped bass are injected with human chorionic gonadotropin (hCG) hormone to induce spawning. One female to three or four males are placed in a circular spawning tank and allowed to spawn. Eggs are collected by gravity and flow in a secondary circular tank equipped with an extra fine mesh egg retention screen equipped with a bubble curtain to prevent eggs from contacting the screen. Water-hardened eggs are transferred to McDonald style hatching jars at a density of 75,000 to 125,000 eggs per jar and supplied with flow-through well water to keep eggs in suspension. Incubation typically takes 48 hours, and as eggs hatch, fry are collected in aquaria. At 2 days post-hatch, fry are transferred to circular tanks and inventoried. During the period of 4–7 days post-hatch, fry are fed brine shrimp Artemia nauplii through an automated feeding system for first feeding. Fry are then transferred to earthen production ponds for phase-I fingerling production.

Fingerling production

Fry are stocked into fertilized production ponds where they feed on naturally produced zooplankton. Supplemental feeding begins 15 days after stocking. Harvest of phase-I fingerling ponds is scheduled after a 35–45-day pond culture period. Phase-I fingerlings are then cultured inside in raceways for 30–45 days. They are then graded to similar size, and advanced fingerlings are pond-stocked at a rate of 15,000–20,000 fingerlings/acre for a final pond grow-out period. Advanced fingerlings are fed sinking pellet food, and phase-II production ponds are typically treated to control algae and aquatic vegetation and to offer protection from birds. Harvest of phase-II fingerling ponds is scheduled after a 120–130-day pond culture period. Harvested fingerlings range from 5–8 fingerlings/lb. Stocking of phase-II fingerlings typically occurs from October–December yearly.

EARLY STOCKING EVALUATIONS

The DMF striped bass tagging program provided an opportunity to evaluate the contribution of stocked fish to commercial and recreational fisheries. Prior to 1980, however, striped bass stockings in coastal North Carolina systems were not formally evaluated. Winslow (2010) analyzed tag-return data for phase-II fish stocked from 1981–2008 and found stocked phase-II fish contributed to the commercial and recreational fisheries as well as the spawning stock in the Tar-Pamlico and Neuse rivers.

Studies evaluating OTC marks were conducted by WRC to estimate the contribution of stocked phase-I and phase-II fish to the spawning stocks in the Tar-Pamlico and Neuse rivers in the early 2000s. Otoliths from adult striped bass from 2000–2004 in the Neuse River and from 2002–2004 in the Tar-Pamlico River were analyzed for the presence of an OTC mark (Barwick et al. 2008). Results suggested striped bass stocked in the Tar-Pamlico and Neuse rivers contributed little to the spawning stocks in these systems. In the Tar-Pamlico River in 2004 and Neuse River from 2000–2002, no stocked juveniles were recaptured as spawning adults. Fewer than three stocked fish were recaptured as adults in other years. However, results from this study may have been impacted by low mark retention.

With low abundance of stocked striped bass documented on the spawning grounds, WRC research efforts shifted to evaluating the contribution of stocked phase-I fish to seine and electrofishing samples conducted in the Neuse River. During the summers of 2006 and 2007, beach seining and electrofishing was conducted at estuarine and inland sampling locations (Barwick and Homan 2008). No juvenile striped bass were collected in 2006 and only five were collected in 2007. Three were collected close to the stocking location near New Bern, N.C. and two without OTC marks were collected upstream, all were hatchery fish. Results from this project suggested limited benefit of phase-I stocking as a management option to supplement striped bass populations in the Neuse River. In addition, the overall low number of juveniles indicated poor reproductive success, poor survival, or a combination of these two factors (Barwick and Homan 2008).

In response to a research need identified in Amendment 1 to determine factors impacting survivability of stocked fish in each system (NCDMF and NCWRC 2013), Bradley et al. (2018) acoustically tagged 100 hatchery-reared phase-II juveniles stocked in the Neuse River to estimate mortality and monitor movement and seasonal distribution. Annual discrete total mortality of phase-II stocked striped bass juveniles was 66.3% and was not related to seasonal variation in dissolved oxygen, temperature, or salinity. High observed mortality could be related to inadequate feeding or lack of predator avoidance. Future research should address whether changes in hatchery protocols could improve survival of stocked fish.

PARENTAGE-BASED TAGGING STOCKING EVALUATION

In 2010, WRC began using PBT to evaluate contributions of stocked striped bass to the populations in the Tar-Pamlico, Neuse, and Cape Fear rivers. PBT method uses genetic microsatellite markers to match stocked fish with broodfish used in hatchery production (Denson et al. 2012). Evaluating stocking with PBT is non-lethal as it requires a small fin clip. Fish are permanently marked with PBT without the issues of poor mark retention seen with OTC and without having to physically tag every fish with external tags. However, PBT cannot distinguish the origin of non-hatchery striped bass. Fish determined to not be of hatchery origin could be the result of wild reproduction in any system. Additionally, striped bass stocked prior to 2010 are not identifiable using this technique.

The WRC and DMF began collecting striped bass fin clip samples for PBT analysis in 2011. Fin clips are processed and analyzed by the South Carolina Department of Natural Resources Hollings Marine Laboratory. Samples in the early years focused on small fish, but as more PBT year-classes became available, fin clip samples were analyzed from all size-classes of striped bass. PBT analysis of samples collected on the spawning grounds and internal coastal fishing waters of the Tar-Pamlico, Neuse, and Cape Fear rivers revealed stocked striped bass can make up greater than 90% of the fish sampled some years (O'Donnell and Farrae 2017); however, results from 2017 and 2018 indicated a noticeable decrease in contribution of hatchery-stocked fish in the Tar-Pamlico and Neuse rivers (Farrae and Darden 2018).

Tar-Pamlico River

In 2012, WRC began collecting fin clips in the Tar-Pamlico River during annual spawning area surveys for PBT evaluation. DMF began collecting additional samples from adult striped bass in lower portions of the Tar-Pamlico River in 2016. Annual hatchery contribution from 2012–2019 ranged between 38%–94% (Table 1.4) and were similar between WRC and DMF samples (Table 1.5). Non-PBT fish overlapped with size-classes of 2010 and 2011 stocked cohorts (Figure 1.1 and 1.2). These results indicate stocked fish heavily contribute to the Tar-Pamlico striped bass population, but there is some evidence of natural recruitment, particularly in 2014 and 2015 (Figure 1.2). It is possible these recruits were migrants from the Albemarle-Roanoke stock or some other source as a DMF telemetry study indicated non-PBT fish tagged in the Tar-Pamlico River migrated to the Albemarle Sound, suggesting mixing in the systems (NCDMF unpublished data). Continued sampling to document young-of-the-year production will be required to verify natural recruitment in the Tar-Pamlico River.

Table 1.4. Parentage-based tagging results for Tar-Pamlico, Neuse, and Cape Fear River at-large striped bass samples collected by WRC and DMF, 2011–2019. Data presented here do not include results for hybrids, broodfish, duplicates, and errors.

		Hatchery Cohort											
River Basin	**Sample Year**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Unknown**	**Total**	**Hatchery Percentage**
Tar-Pamlico	2012	19	12								14	45	69%
	2013	99	41								23	163	86%
	2014	55	112	5							29	201	86%
	2015	22	79	56	34						12	203	94%
	2016	28	102	101	98	6					51	386	87%
	2017	7	35	17	86	24	1	1			78	249	69%
	2018	4	11	6	38	43	3	21	9		225	360	38%
	2019		7	1	7	9	4	57	11	4	85	185	54%
Neuse	2011	36									0	36	100%
	2012	24	8								1	33	97%
	2013	123	5	2	1						69	200	66%
	2014	96	77	20	99						55	347	84%
	2015	31	53	34	11						55	184	70%
	2016	20	25	42	83	22	1				42	235	82%
	2017	16	30	35	70	65	5	1			78	300	74%
	2018	14	19	26	35	67	76	39			117	393	70%
	2019	3	10	5	19	21	42	158	6	9	57	330	83%
Cape Fear	2011	55									0	55	100%
	2012	72	35								3	110	97%
	2013	109	27	14							92	242	62%
	2014	39	42	75	67						65	288	77%
	2015	45	31	32	41	10					66	225	71%
	2016	18	24	59	84	25					28	238	88%
	2017	17	9	37	46	51	18	1			17	196	91%
	2018	12	8	26	50	38	34	13	10		24	215	89%
	2019	6	2	10	10	7	7	25	85	115	31	298	90%

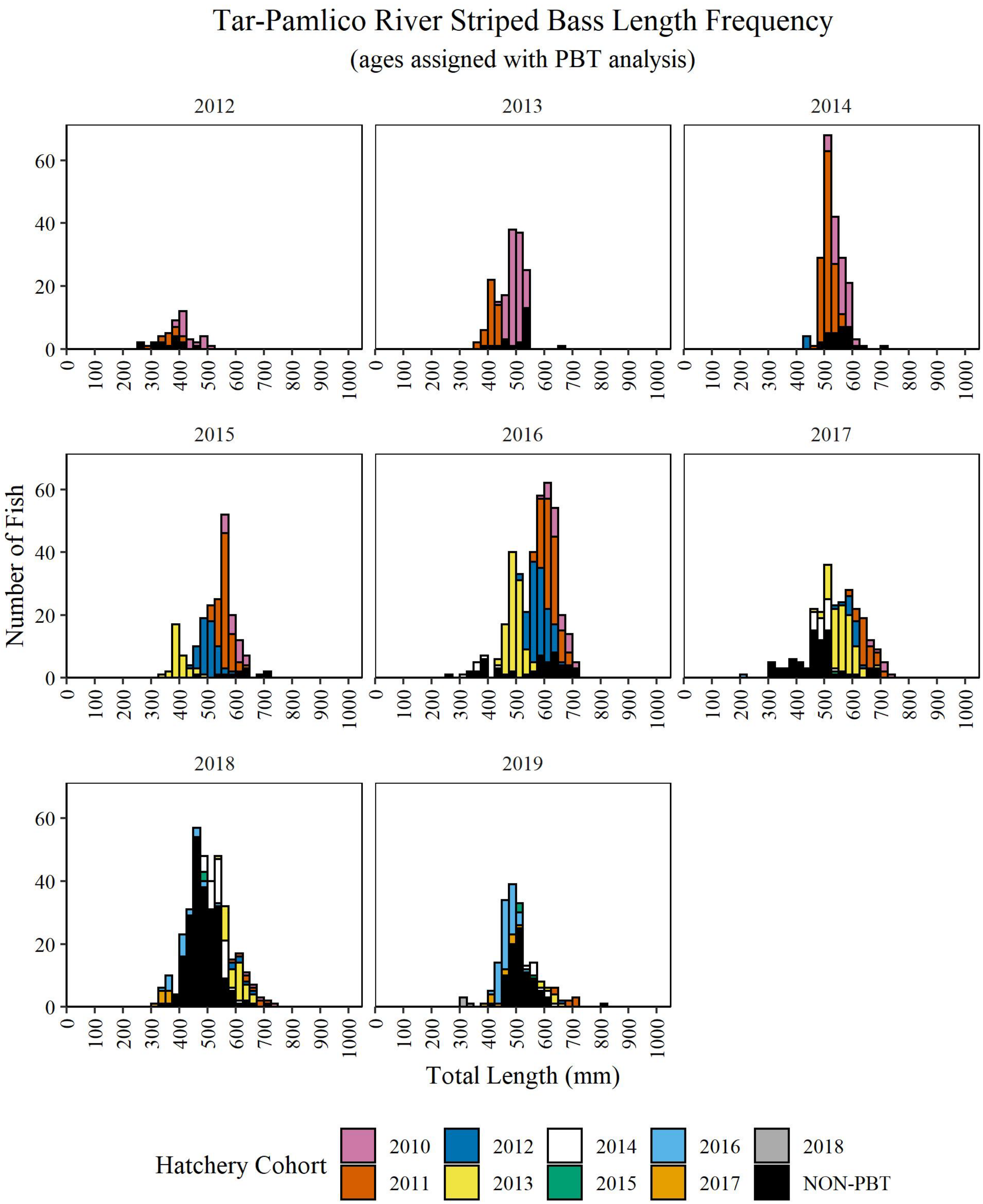


Figure 1.1. Length-frequency histograms for at-large striped bass collected in the Tar-Pamlico River by WRC and DMF, 2012–2019. Hatchery cohorts identified by parentage-based tagging analysis (PBT) are plotted within each 25-mm length group. Fish identified as non-PBT were not assigned to a hatchery cohort because they did not match to a broodstock pair.

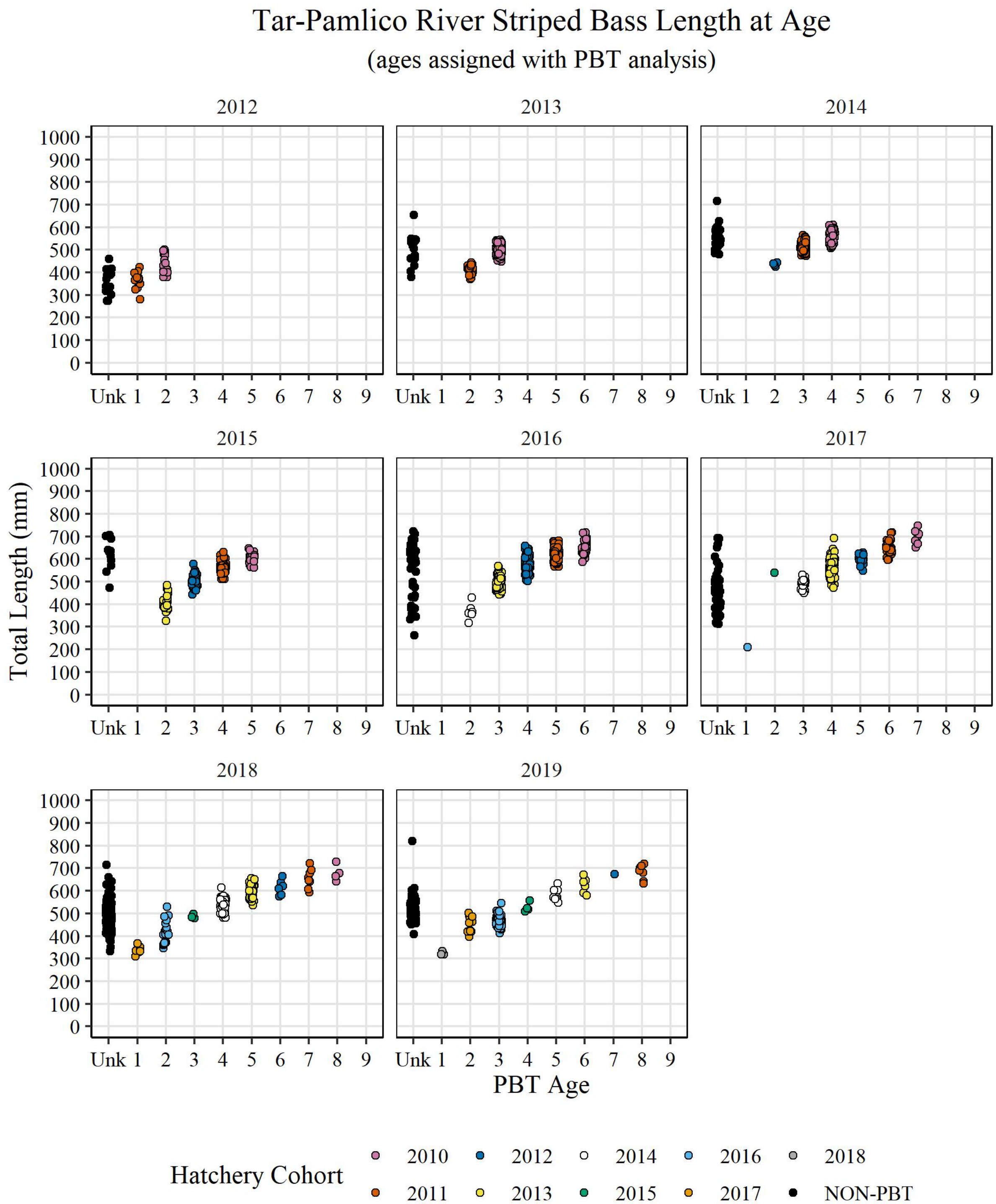


Figure 1.2. Length at age for at-large Tar-Pamlico River striped bass collected by WRC and DMF, 2012–2019. Ages were identified using parentage-based tagging (PBT) analysis. Those fish with an unknown age (Unk) each year were not identified as hatchery cohorts by PBT analysis and could not be assigned an age. Points are jittered about each age column to clarify overlapping data points. Outliers were removed before plotting.

Table 1.5. Parentage-based tagging hatchery contribution for at-large samples (excluding hybrids, broodfish, duplicates, and errors) collected by WRC during the Tar-Pamlico River spawning area survey and by DMF in downstream portions of the Tar-Pamlico River basin.

	WRC Samples			DMF Samples		
Year	Non-PBT	Total	Hatchery Percentage	Non-PBT	Total	Hatchery Percentage
2016	25	196	87%	26	190	86%
2017	31	100	69%	47	149	68%
2018	93	154	40%	132	206	36%
2019	26	78	67%	59	107	45%

Neuse River

WRC began collecting fin clips from the Neuse River spawning area survey in 2011. DMF began collecting additional samples in lower portions of the Neuse River basin in 2016. Annual hatchery contribution from 2011–2019 ranged between 66%–100% (Table 1.4; Figures 1.3–1.4). Non-PBT contribution estimated in early years of this study may have fish from age classes before 2010. Results from 2019 are more likely to accurately reflect actual hatchery contribution for the Neuse River striped bass population and indicate non-PBT recruitment in 2014 and 2015 is contributing to the Neuse River striped bass population. The non-hatchery fish from the 2014 and 2015 year-classes could be wild-spawned fish from the Neuse River or another system. Telemetry studies conducted by DMF documented that striped bass tagged in the lower Neuse River migrated to the Albemarle Sound (NCDMF unpublished data), suggesting mixing in these populations. Additionally, hatchery contribution was much higher for WRC samples collected on the Neuse River spawning grounds compared to DMF samples collected in the lower Neuse River in 2017–2019 (Table 1.6). The lower hatchery contribution for the downstream samples could indicate striped bass from the Albemarle-Roanoke population mix with the Neuse River population. Nevertheless, results indicate some non-PBT fish from the 2015 year-class are participating in the upstream spawning migration.

Table1.6. Parentage-based tagging hatchery contribution for at-large samples (excluding hybrids, broodfish, duplicates, and errors) collected by WRC during the Neuse River spawning area survey and by DMF in downstream portions of the Neuse River basin.

	WRC Samples			DMF Samples		
Year	Non-PBT	Total	Hatchery Percentage	Non-PBT	Total	Hatchery Percentage
2016	34	85	60%	8	150	95%
2017	26	182	86%	52	118	56%
2018	77	307	75%	40	86	53%
2019	23	228	90%	34	102	67%

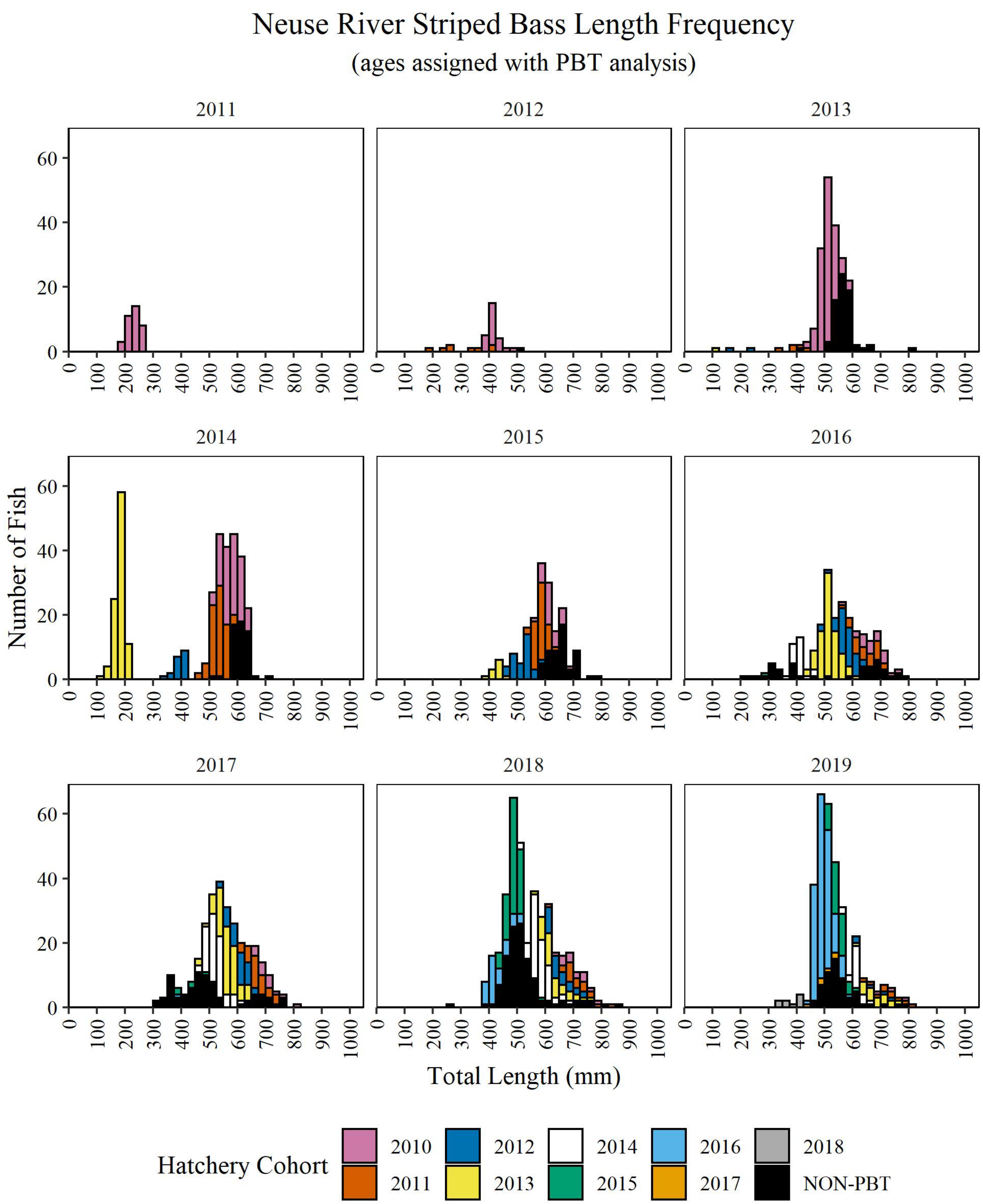


Figure 1.3. Length-frequency histograms for at-large striped bass collected in the Neuse River basin by WRC and DMF, 2011–2019. Hatchery cohorts identified by parentage-based tagging analysis (PBT) are plotted within each 25-mm length group. Fish identified as non-PBT were not assigned to a hatchery cohort because they did not match to a broodstock pair.

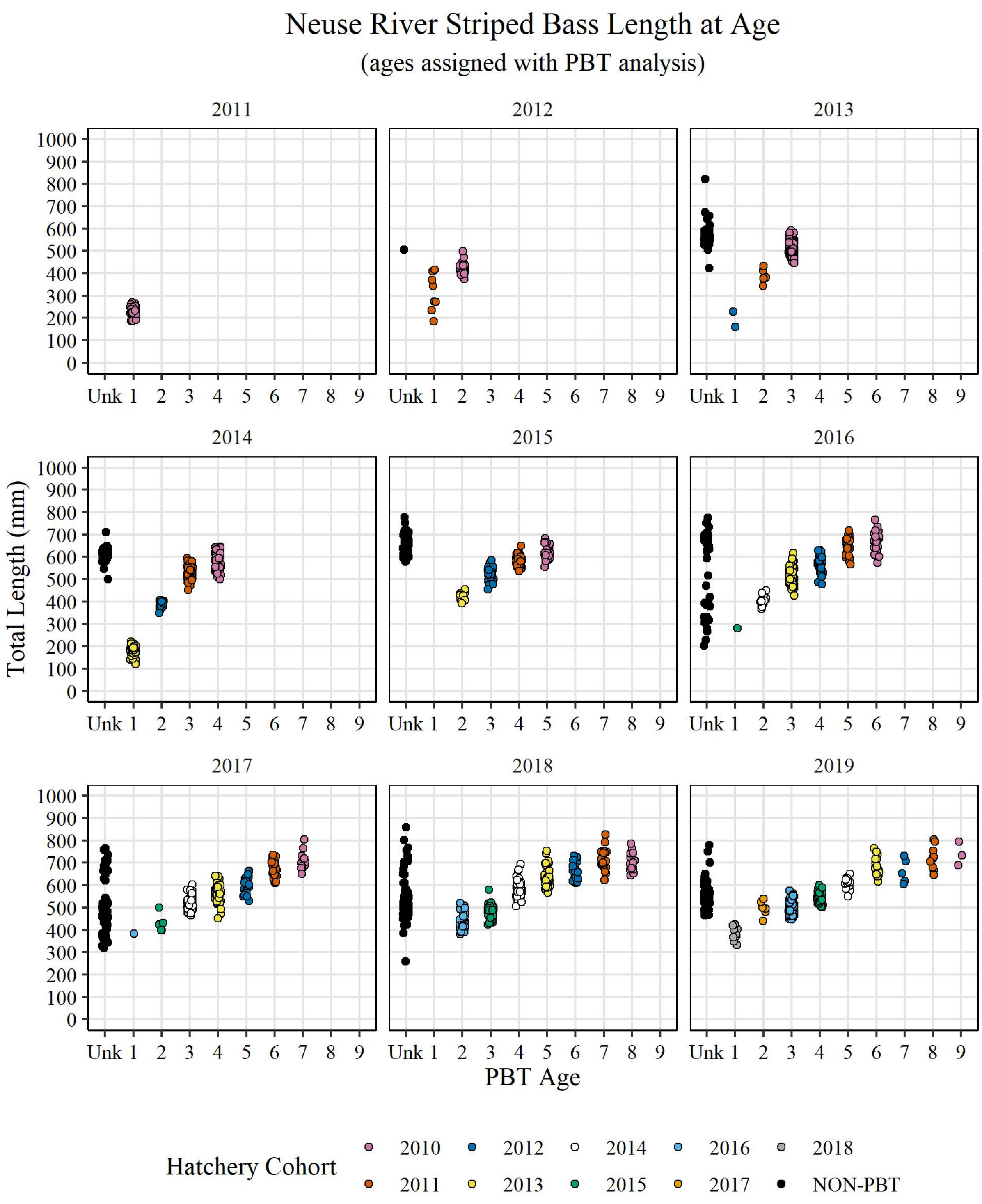


Figure 1.4. Length at age for at-large Neuse River striped bass collected by WRC and DMF, 2011–2019. Ages were identified using parentage-based tagging (PBT) analysis. Those fish with an unknown age (Unk) each year were not identified as hatchery cohorts by PBT analysis and could not be assigned an age. Points are jittered about each age column to clarify overlapping data points. Outliers were removed before plotting.

Cape Fear River

In 2011, WRC began annual PBT analysis of striped bass captured in the Cape Fear spawning survey. DMF provided samples from the lower Cape Fear River in 2011 and 2012. Starting in 2017, DMF began collecting additional samples from adult fish in the lower portion of the Cape Fear River during winter months. Additionally, DMF tested fin clips from five young-of-the-year striped bass collected in the Northeast Cape Fear River during 2018. Results of PBT analysis from both agencies combined show hatchery-origin fish comprise between 62%–100% of the fish tested annually with increasing percentage of hatchery-origin fish each year since 2013 (Table 1.4). Despite the high hatchery contribution in 2019, there was evidence of wild recruitment in the 2018 year-class (Figures 1.5 and 1.6). Juveniles collected in the Northeast Cape Fear River in 2018 were not of hatchery origin suggesting limited natural reproduction

Escapement of striped bass stocked in Jordan Reservoir is the source of most striped bass found in the Cape Fear River upstream of the locks and dams. PBT analysis revealed an increasing proportion of fish stocked in upriver reservoirs in later year-classes, increasing as sites move upriver (Figure 1.7). The Jordan Reservoir striped bass fishery is entirely hatchery supported to provide recreational fishing opportunities in the reservoir. Due to low survival and low angler participation, WRC fisheries biologists stopped striped bass stocking in Jordan Reservoir in 2021 (C. Oakley, WRC, personal communication). Future striped bass stock enhancement decisions in the Cape Fear River need to account for the loss in contribution from striped bass escapement from Jordan Reservoir. Additionally, stocking decisions regarding hybrid striped bass in Jordan Reservoir should consider escapement potential and effects on the Cape Fear River.

MANAGEMENT CONSIDERATIONS

Historically, many hatchery programs have operated as harvest augmentation or production hatcheries with the primary goal of producing as many fish as possible for put-grow-take fisheries (Trushenski et al. 2015, 2018). Conversely, supplementation hatchery programs compensate for poor recruitment caused by limitations related to habitat quantity or quality, environmental quality, or intense harvest pressure (Trushenski et al. 2015). Many anadromous fish stocking programs have experienced a shift since 2000 (Trushenski et al. 2018), using a hatchery model with increased emphasis on producing fish genetically equivalent to wild fish with a long-term goal of producing a self-sustaining, naturally spawning population. The Amendment 1 objective of the striped bass stocking program in North Carolina coastal rivers (NCDMF and NCWRC 2013) employs an integrated hatchery program model "to increase spawning stock abundance while promoting self-sustaining population levels appropriate for various habitats and ecosystems."

Hatchery rearing, stocking, and stocking evaluation methods vary depending upon stocking program goals. Lorenzen et al. (2010) identified that lack of clear fishery management objectives, lack of stock assessments, ignoring the need for a structured decision-making process, lack of stakeholder involvement, and failure to integrate flexible and adaptive management into the stocking plan are weaknesses of hatchery programs. When implementing a stocking program, Lorenzen et al. (2010) recommended managers should set goals used to evaluate the potential for stocking, establish appropriate rearing protocols to ensure the genetic and physiological integrity of stocked fish, and define and implement management plans with metrics that can be used to evaluate program success/failure. The cooperative agreement between the USFWS, DMF, and

WRC established the current striped bass stocking program in coastal North Carolina. This agreement should be revisited annually to provide adaptive management and reaffirm program goals and objectives, integrate evaluation results, and update future needs for stocking in each specific system. The contingency plan created for outlining the decision-making process for stocking surplus phase-I fish in the Albemarle Sound provides a template for stocking decisions in other North Carolina coastal river systems, though the process for each system will be unique based on local challenges.

Striped bass stocking practices have likely altered natural population genetics in North Carolina's coastal rivers. Patrick and Stellwag (2001) identified six distinct lineages among striped bass from the Roanoke, Tar-Pamlico, and Neuse rivers; the Tar-Pamlico and Roanoke rivers populations were similar but were significantly different from the Neuse River population. The researchers concluded that stocking practices could potentially affect the natural genetic distribution in these populations and suggested that broodstock should be taken from each specific population, especially when stocking the Neuse River. LeBlanc et al. (2020) showed that Cape Fear River striped bass were genetically similar to the Roanoke River population; and although North Carolina rivers, including the Tar-Pamlico and Neuse rivers, may have once supported genetically distinct populations, evidence suggests there is currently little genetic differentiation between populations (Reading 2020). While maintaining native population genetics is often a goal of restoration stocking programs (Lorenzen et al. 2010), introducing different genetic strains may be beneficial especially if native population genetics have been altered. Potential benefits, consequences, feasibility, and utility of alternative broodstock sources from systems outside coastal North Carolina systems should be thoroughly evaluated before introducing new genetic strains of striped bass.

The effectiveness of the striped bass stocking program in coastal North Carolina river systems has changed throughout the evaluation period of 1980–2019. Initial evaluations indicated limited contribution of stocked fish to commercial and recreational fisheries and little contribution to fish collected during spawning grounds surveys. Results of new evaluation methods indicated striped bass stocks in the Tar-Pamlico, Neuse, and Cape Fear rivers are maintained by phase-II stocking. Natural recruitment is low in these systems, and striped bass stocking has yet to produce self-sustaining populations. Stocking remains a necessary tool for persistence of striped bass populations in the Tar-Pamlico, Neuse, and Cape Fear river systems (Mathes et al. 2020). Stocking strategies should complement management measures that promote natural reproduction and recruitment to sustain the populations.

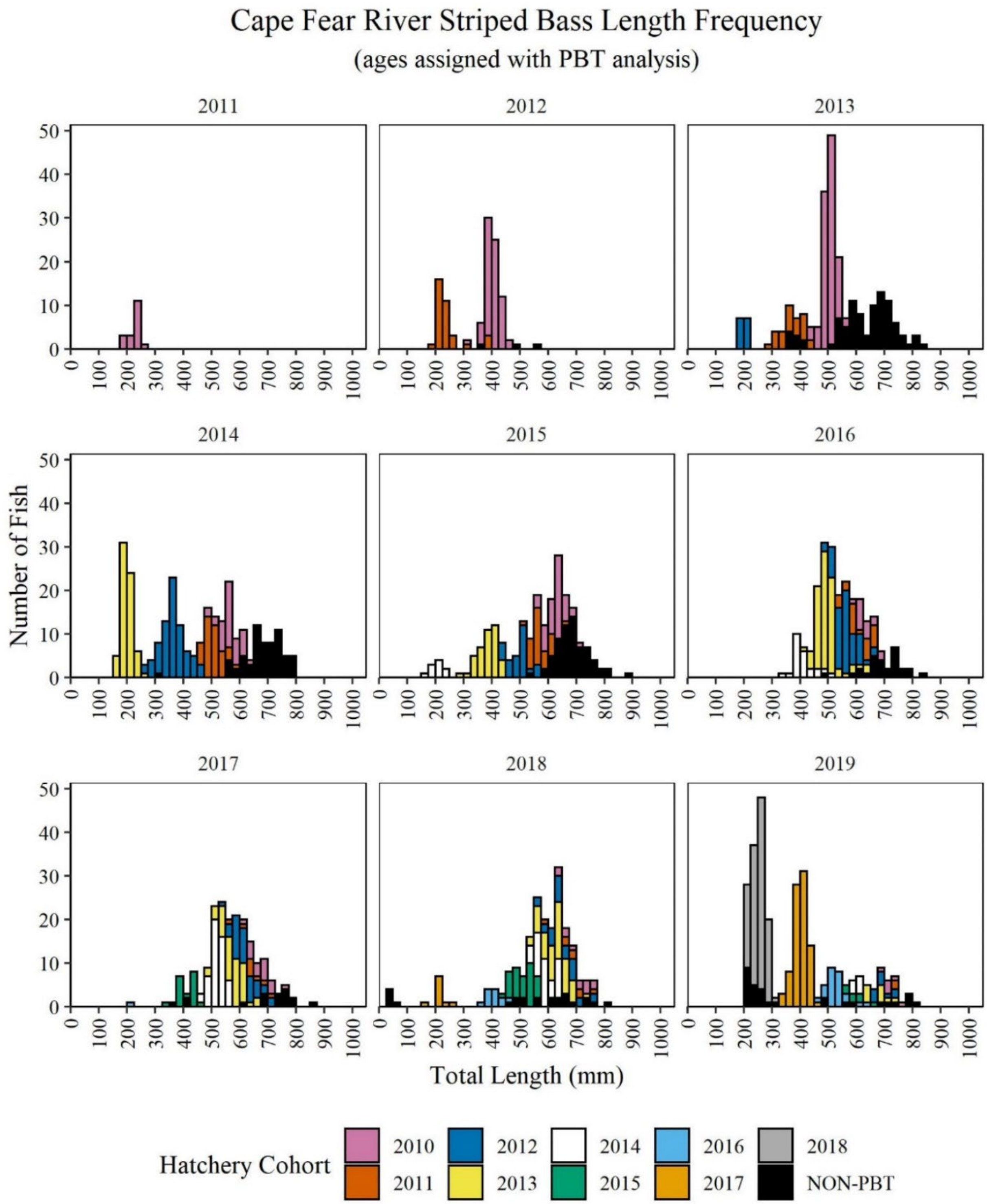


Figure 1.5. Length-frequency histograms for at-large striped bass collected in the Cape Fear River basin by WRC and DMF, 2011–2019. Hatchery cohorts identified by parentage-based tagging analysis (PBT) are plotted within each 25-mm length group. Fish identified as non-PBT were not assigned to a hatchery cohort because they did not match to a broodstock pair.

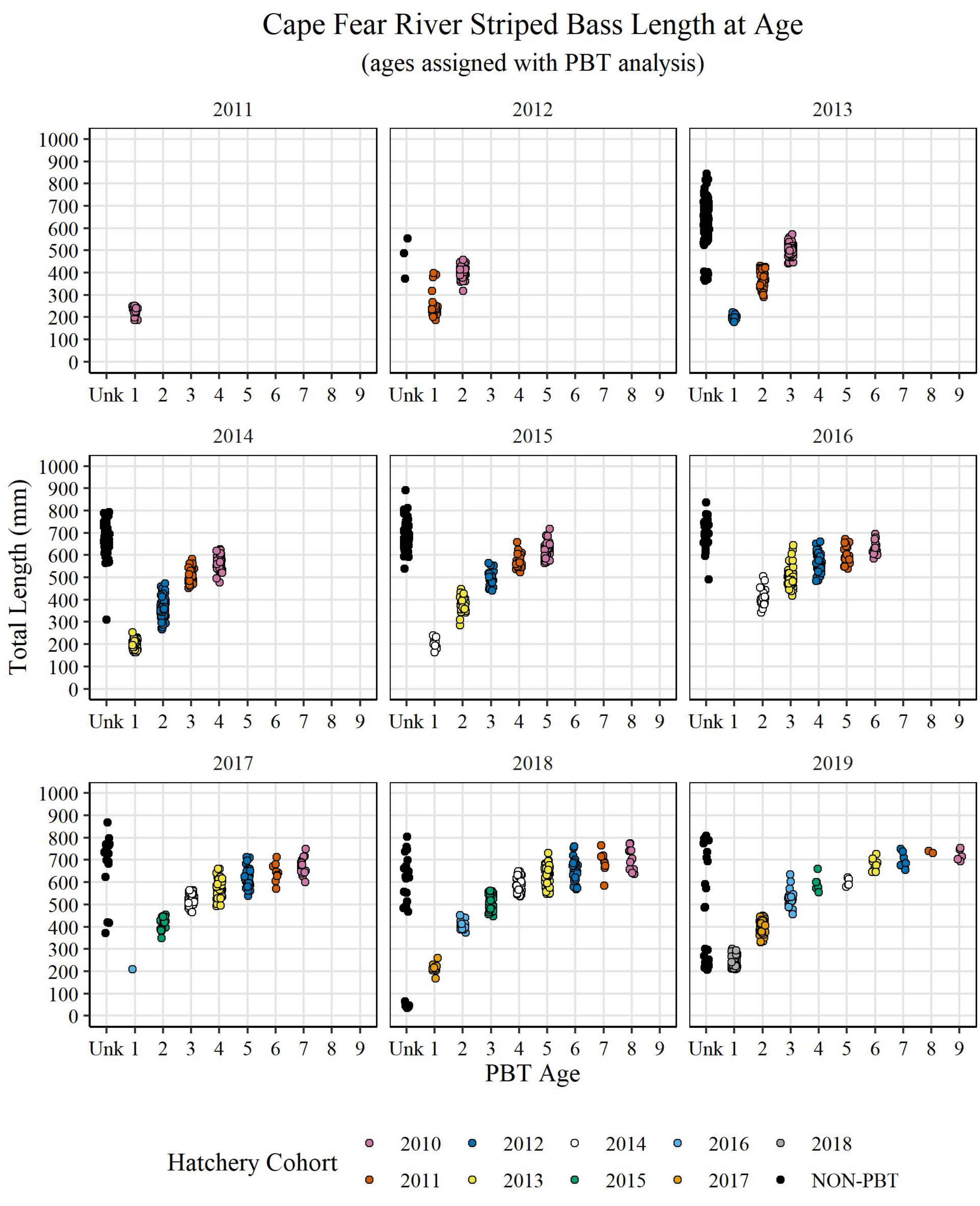


Figure 1.6. Length at age for at-large Cape Fear River striped bass collected by WRC and DMF, 2011–2019. Ages were identified using parentage-based tagging (PBT) analysis. Those fish with an unknown age (Unk) each year were not identified as hatchery cohorts by PBT analysis and could not be assigned an age. Points are jittered about each age column to clarify overlapping data points. Outliers were removed before plotting.

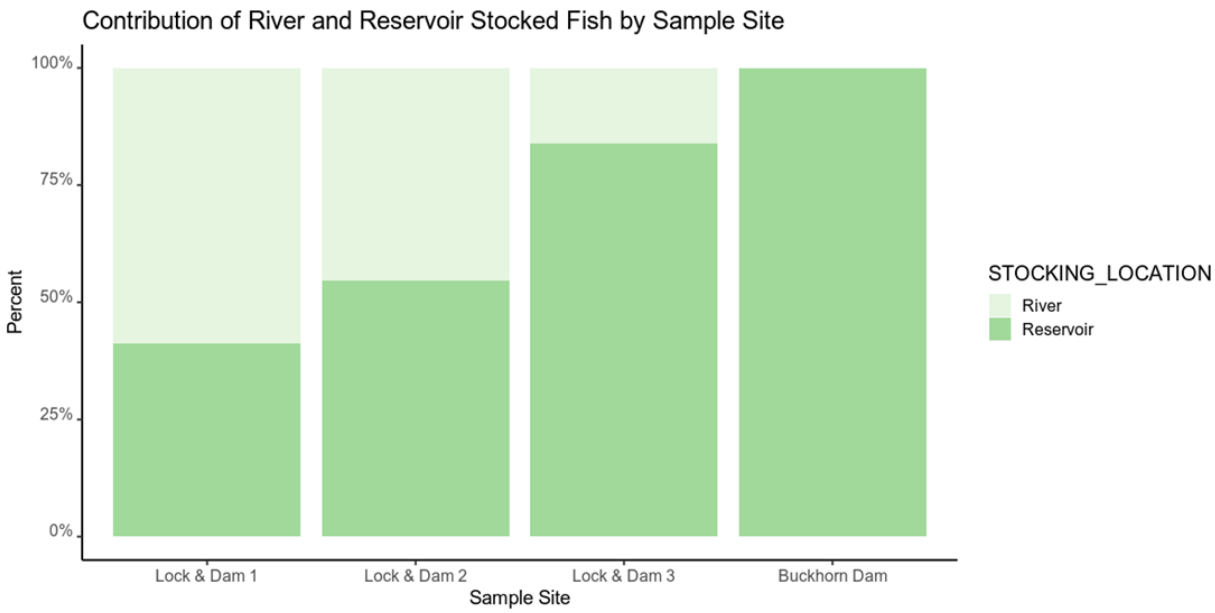


Figure 1.7. Relative contribution of hatchery-origin striped bass by stocking location to each WRC electrofishing sample site in the Cape Fear River, 2015–2019.

ADDITIONAL RESEARCH NEEDS

Parentage-based tagging analysis allows for precise investigation of multiple stocking treatments when using genetically distinct broodstock families. Various stocking treatments, including fry, phase-I, phase-II and different stocking locations, have been attempted in the Tar-Pamlico, Neuse, and Cape Fear rivers. Results from multiple treatments should be analyzed in the future to provide more precise guidance of future stocking decisions.

APPENDIX 1.A. COOPERATIVE AGREEMENT BETWEEN USFWS, DMF AND WRC THAT ESTABLISHED THE CURRENT VERSION OF THE NORTH CAROLINA COASTAL STRIPED BASS STOCKING PROGRAM, 1986.

AGREEMENT NO. 14-16-0004-87-904

COOPERATIVE AGREEMENT

for Anadromous Species Restoration in Historically Significant

Coastal River Basins

Between

U.S. Fish and Wildlife Service

and

Department of Natural Resources and Community Development

and

North Carolina Wildlife Resources Commission

I. Purpose

THIS AGREEMENT is made and entered into by and between the Fish and Wildlife Service, United States Department of the Interior—hereinafter referred to as the "Service," and the Department of Natural Resources and Community Development and the North Carolina Wildlife Resources Commission—hereinafter referred to as the "State," to establish by mutual agreement the restoration of self-sustaining stocks of anadromous species in North Carolina coastal river basins. For the purposes of this agreement, anadromous species shall include striped bass, American shad, hickory shad, blueback herring, and alewife. Principal emphasis shall be on the restoration of self-sustaining stocks of striped bass. The State's authority to engage in this agreement is set forth in Gen. Stat. of NC §§ 113-181 (a) and NC §§ 113-224. The Government of the United States has expressed a national interest in maintaining our fishery resources and has authorized the Service through the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c, as amended) and other related legislation to provide assistance and cooperate with other Federal agencies and the States in the maintenance and development of fishery resources, and has further expressed a particular interest in restoration of anadromous species such as striped bass on the east coast as demonstrated by the Chafee amendment to the Anadromous Fish Conservation Act (16 U.S.C. 757g, as amended) and the Atlantic Striped Bass Conservation Act (P.L. 98-613). The Service, through its Fishery Resources Program's Statement of Responsibilities and Role document, seeks to foster strong and mutually supportive linkages with the States and other Federal agencies to restore and protect depleted nationally significant interjurisdictional fishery resources, with particular emphasis on Atlantic and Gulf anadromous striped bass as well as other anadromous and migratory intercoastal/estuarine fishes.

This agreement also complements an intrast te agreement between the North Carolina Wildlife Resources C mmission and the Department of Natural Resources and Community Development concerning regulations and management of striped bass in Albemarle Sound and the Roanoke River.

II. Mutual Agreement

North Carolina waters are recognized as historically providing major contributions to the coastal stocks of anadromous fishes on the east coast.

River herring (blueback herring and alewife) stocks have declined drastically since the early 1970s, and recovery has been very slow, probably due to poor water quality in the Albemarle Sound spawning areas. Stocks of American shad are much below the levels of the 1960s and earlier throughout the south Atlantic coastal area. Striped bass stocks in North Carolina coastal waters have declined since the mid-1970s and are currently at extremely low levels. The Albemarle Sound stock, which has historically supported important recreational and commercial fisheries, is exceptionally depressed and has shown no ability to rebound.

The State and the Service entered into a pilot program in October 1979 to evaluate the potential for hatchery Phase II striped bass production and stocking to determine (1) effects on the commercial and recreational fisheries, and (2) contributions of stocked fish to spawning runs. Tagging returns, to date, have conclusively shown that these stocked fish have contributed to spawning runs and have recruited into the recreational and commercial fisheries.

The State has the responsibility to manage the fishery resources within its boundaries, including the mixed species fisheries which harvest anadromous fishes along with other species in coastal waters. The State has expressed a desire to continue to stock hatchery-reared striped bass fingerlings as a management tool in the restoration of this species, and the Service has the hatchery capability with which to assist the State in the production of striped bass.

It is the joint desire of the State and the Service to enter into a cooperative program to restore self-sustaining stocks of anadromous fishes in coastal North Carolina waters through a combination of fishery management techniques including stocking, regulations, and assessment.

Therefore, it is mutually agreed that:

1. The Service will produce Phase I and Phase II striped bass fingerlings based on restoration objectives established by the Service and the State for specific rivers in North Carolina.

2. The Service will provide facilities for holding and tagging striped bass, a hatchery truck to transport the fish to the release site(s), appropriate supervision in handling the fish to minimize mortality, and advisory personnel for the tagging project and related technical assistance efforts.

3. The State will provide personnel, tags and equipment for tagging the fish prior to release from hatcheries, tag rewards, and publicity on the cooperative program.

4. The State will evaluate survival and contribution of the hatchery fish to the population and spawning stocks and provide a report annually to the Service.

5. News releases on the cooperative restoration program initiated by the Service will receive prior approval from the State, and news releases initiated by the State will receive prior approval from the Service.

6. As an initial action, the cooperators will jointly develop a Striped Bass Restoration Plan for coastal North Carolina waters including goals, objectives, and milestones reflecting both the restoration as well as the maintenance of stocks. Restoration plans for other anadromous species such as American shad will be developed at a later date.

7. The Service will establish a Project Coordinator in North Carolina to provide liaison with the State for restoration purposes.

8. The principal signatory parties shall meet annually to review project progress and plan future activities.

9. A technical committee with representation from each signatory of this agreement shall meet quarterly and oversee the development of restoration plans and their implementation. Chairmanship of the technical committee will be rotated among the three cooperating agencies. Term of the chairman will be one year.

This agreement shall be contingent upon the availability of funds for the expenditures contemplated herein. The liability of the parties to this agreement, to each other, and to third persons shall be governed by applicable laws and regulations, now and hereafter in force.

The Equal Opportunity clause prescribed in 1-12.803-2 of the Federal Procurement Regulations is hereby incorporated into this agreement by reference and made a part thereof. No members of or delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom.

This agreement will become effective upon the date subscribed by the last signatory and shall continue in force from year to year until cancelled by any signatory party on 30 days' written notice to the other parties. The agreement and its addenda may be amended by mutual consent of all parties.

Date: 11/19/86

By: [signature]
S. Thomas Rhodes, Secretary
North Carolina Department of Natural Resources and Community Development

Date 12/1/86

By: Charles R. Fullwood
Charles R. Fullwood, Jr.
Executive Director
North Carolina Wildlife Resources Commission

Date 12/12/86

By: [signature]
James W. Pulliam, Jr.
Regional Director
U.S. Fish and Wildlife Service
Region 4, Atlanta, GA

TOTAL P.07

APPENDIX 2: ACHIEVING SUSTAINABLE HARVEST FOR THE ALBEMARLE SOUND-ROANOKE RIVER STRIPED BASS STOCK

ISSUE

Implement long term management measures to achieve sustainable harvest, end overfishing, and rebuild the Albemarle Sound-Roanoke River (A-R) striped bass spawning stock biomass.

ORIGINATION

North Carolina Division of Marine Fisheries (DMF) and North Carolina Wildlife Resources Commission (WRC).

BACKGROUND

Albemarle Sound-Roanoke River Striped Bass Stock Status

The 2020 A-R striped bass stock assessment was approved for management use by peer reviewers and the DMF for at least five years. Results indicate in the terminal year (2017) the A-R striped bass stock is overfished and overfishing is occurring, relative to the biological reference points (BRPs). Overfishing BRPs are based on a fishing mortality (F) rate of F_{Target} = 0.13 and $F_{\text{Threshold}}$ = 0.18 and overfished BRPs are based on a level of spawning stock biomass (SSB) of $\text{SSB}_{\text{Target}}$ = 350,371 pounds and $\text{SSB}_{\text{Threshold}}$ = 267,390 pounds (Lee et al. 2020). In the terminal year of the assessment F=0.27, above the $F_{\text{Threshold}}$, meaning overfishing is occurring. Female SSB was 78,576 pounds, below the $\text{SSB}_{\text{Threshold}}$, indicating the stock is overfished. For more details, see the Amendment 2 Stock Status section and Lee et al. (2020).

The Fisheries Reform Act of 1997 requires management measures be enacted to end overfishing within two years and end the overfished status within 10 years with at least a 50% probability of achieving sustainable harvest (NCGS 113-182.1), with exceptions related to biology, environmental conditions, or lack of sufficient data. Amendment 1 to the North Carolina Estuarine Striped Bass FMP and Amendment 6 to the ASMFC Interstate FMP for Atlantic Striped Bass stipulate "Should the target F be exceeded then restrictive measures will be imposed to reduce F to the target level" (NCDMF 2013; ASMFC 2003). Therefore, adaptive management measures were implemented in January 2021 to reduce the total allowable landings (TAL) to 51,216 pounds, a level projected to lower F to the F_{Target}, in one year, and represents a 47.6% reduction in F (NCDMF 2020).

Striped Bass Management Areas and their Fisheries

The striped bass commercial and recreational fisheries in the ASMA and RRMA have been managed with a TAL since 1991 (Table 2.1). Combined landings from both commercial and recreational sectors in the ASMA and RRMA have ranged from 108,432 lb in 2013 to 460,853 lb in 2004. Landings followed the TAL closely until 2003 for the recreational sectors and 2005 for the commercial sector. During 2003–2014, when the TAL was increased to 550,000 lb, neither sector reached their TAL (Figure 2.1; Table 2.2). The low level of landings observed in some of these years was due to multiple poor year classes produced since 2001. For more information on the commercial and recreational fisheries see the Amendment 2 Description of the Fisheries section.

Table 2.1. Total allowable landings (TAL) in pounds for the Albemarle Sound and Roanoke River Management Areas (ASMA & RRMA) 1991–2021.

Years	Total Allowable Landings (lb)	ASMA Commercial (lb)	ASMA Recreational (lb)	RRMA Recreational (lb)
1991—1997	156,800	98,000	29,400	29,400
1998	250,800	125,400	62,700	62,700
1999	275,880	137,940	68,970	68,970
2000—2002	450,000	225,000	112,500	112,500
2003—2014	550,000	275,000	137,500	137,500
2015—2020	275,000	137,500	68,750	68,750
2021	51,216	25,608	12,804	12,804

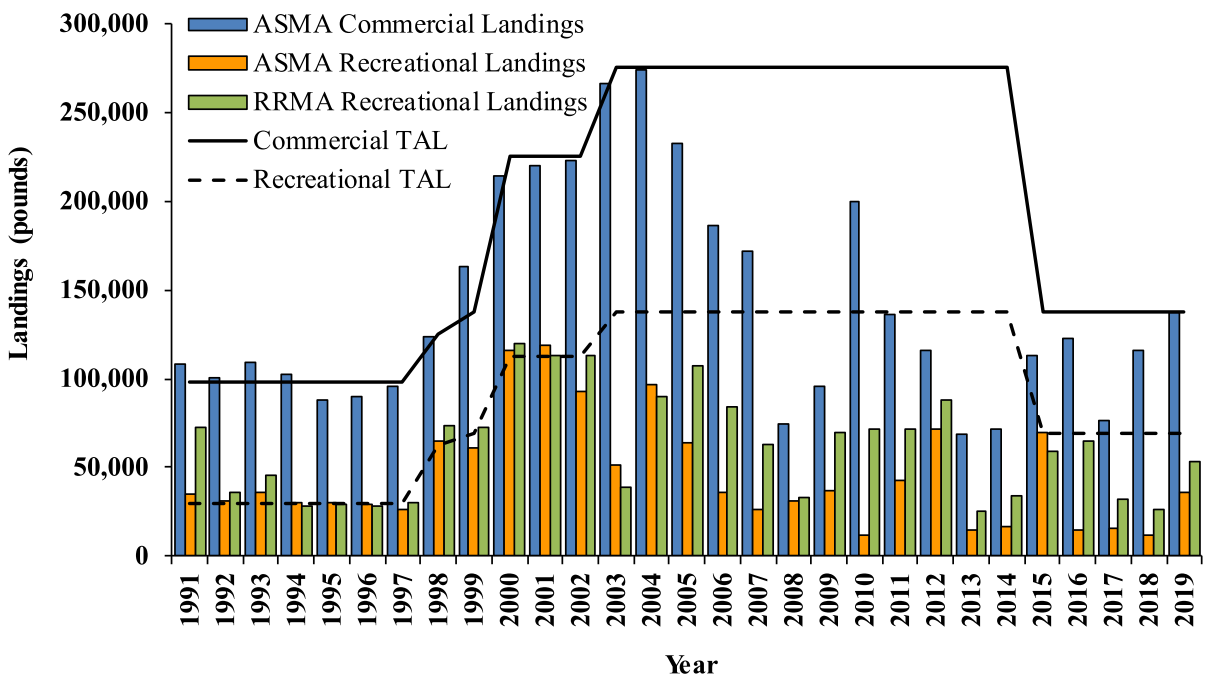


Figure 2.1. Striped bass landings from the Albemarle Sound Management Area (ASMA) commercial and recreational sectors, the Roanoke River Management Area (RRMA) recreational sector, and the annual total allowable landings (TAL) by sector, 1991–2019.

Table 2.2. Total allowable landings (TAL) and the annual harvest in pounds for striped bass from the commercial and recreational sectors in the Albemarle Sound Management Area (ASMA) and Roanoke River Management Area (RRMA). Bolded and underlined numbers indicate a TAL that was lowered due to previous year's overage, and red numbers in parentheses indicate landings that exceeded the respective TAL. (See NCDFM 1993, 2004)

	ASMA Commercial			ASMA Recreational			RRMA Recreational			Total	Total
Year	TAL	Landings	(+)/-	TAL	Landings	(+)/-	TAL	Landings	(+)/-	TAL	Landings
1991	98,000	108,460	(10,460)	29,400	35,344	(5,944)	29,400	72,529	(43,129)	156,800	(216,333)
1992	98,000	100,549	(2,549)	29,400	30,758	(1,358)	29,400	36,016	(6,616)	156,800	(167,323)
1993	98,000	109,475	(11,475)	29,400	36,049	(6,649)	29,400	45,145	(15,745)	156,800	(190,669)
1994	98,000	102,370	(4,370)	29,400	30,217	(817)	29,400	28,089	1,311	156,800	(160,676)
1995	***93,630***	87,836	5,794	***28,583***	30,564	(1,981)	29,400	28,883	517	***151,613***	147,283
1996	98,000	90,133	7,867	***27,419***	29,186	(1,767)	29,400	28,178	1,222	***154,819***	147,497
1997	98,000	96,122	1,878	***27,633***	26,581	1,052	29,400	29,997	(597)	***155,033***	152,700
1998	125,400	123,927	1,473	62,700	64,580	(1,880)	62,700	73,541	(10,841)	***250,800***	(262,048)
1999	137,940	162,870	(24,930)	***67,090***	61,338	5,752	68,970	72,967	(3,997)	***274,000***	(297,175)
2000	***200,070***	214,023	(13,953)	112,500	116,158	(3,658)	112,500	120,091	(7,591)	***425,070***	(450,272)
2001	***211,047***	220,233	(9,186)	***108,842***	118,506	(9,664)	112,500	112,805	(305)	***432,389***	(451,544)
2002	***215,814***	222,856	(7,042)	***102,836***	92,649	10,187	112,500	112,698	(198)	***431,150***	428,203
2003	***267,958***	266,555	1,403	137,500	51,794	85,706	137,500	39,170	98,330	***542,958***	357,519
2004	275,000	273,565	1,435	137,500	97,097	40,403	137,500	90,191	47,309	550,000	460,853
2005	275,000	232,693	42,307	137,500	63,477	74,023	137,500	107,530	29,970	550,000	403,700
2006	275,000	186,399	88,601	137,500	35,997	101,503	137,500	84,521	52,979	550,000	306,917
2007	275,000	171,683	103,317	137,500	26,663	110,837	137,500	62,492	75,008	550,000	260,838
2008	275,000	74,921	200,079	137,500	31,628	105,872	137,500	32,725	104,775	550,000	139,274
2009	275,000	96,134	178,866	137,500	37,313	100,187	137,500	69,581	67,919	550,000	203,028
2010	275,000	199,829	75,171	137,500	11,470	126,030	137,500	72,037	65,463	550,000	283,336
2011	275,000	136,266	138,734	137,500	42,536	94,964	137,500	71,561	65,939	550,000	250,363
2012	275,000	115,605	159,395	137,500	71,456	66,044	137,500	88,271	49,229	550,000	275,332
2013	275,000	68,338	206,662	137,500	14,897	122,603	137,500	25,197	112,303	550,000	108,432
2014	275,000	71,372	203,628	137,500	16,867	120,633	137,500	33,717	103,783	550,000	121,956
2015	137,500	113,475	24,025	68,750	70,008	(1,258)	68,750	58,962	9,788	275,000	242,445
2016	137,500	123,108	14,392	68,750	14,487	54,263	68,750	65,218	3,532	275,000	202,813
2017	137,500	75,990	61,510	68,750	15,480	53,270	68,750	32,569	36,181	275,000	124,039
2018	137,500	115,711	21,789	68,750	11,762	56,988	68,750	26,796	41,954	275,000	154,269
2019	137,500	137,156	344	68,750	29,005	39,745	68,750	53,379	15,371	275,000	219,540

Stock Concerns

Annual recruitment is influenced by spawning stock biomass, egg and larval transport to nursery areas, predation, food availability, and optimum water quality conditions. The occurrence of recruitment failures since 2001, especially since 2017, is thought to be a function of spring flooding events in the upper Roanoke basin during critical periods of egg and larval transport. Extended periods of flood or high flow releases during the critical spawning period (May through early June) negatively impact successful transport and delivery of eggs and fry down the Roanoke River and into the western Albemarle Sound nursery area. There is high year-to-year variability regarding flow releases and year-class strength. Consequently, all years with documented high flow rates (2017, 2018, 2020) had very low juvenile abundance index values, indicating poor spawning success (NCDMF 2020). It should also be noted the last year of data in the stock assessment was 2017, so poor recruitment from 2018–2021 impacts have not been modeled.

AUTHORITY

The MFC and the WRC implemented a Memorandum of Agreement in 1990 to address management of the A-R striped bass stock in the Albemarle Sound and Roanoke River (see Appendix I in DMF 1993). This was the first agreement between the two agencies to jointly manage the A-R striped bass stock. North Carolina's existing fisheries management system for estuarine striped bass is adaptive, with rulemaking authority vested in the MFC and the WRC within their respective jurisdictions. The MFC also may delegate to the fisheries director the authority to issue public notices, called proclamations, suspending or implementing, in whole or in part, particular MFC rules. Management of recreational and commercial striped bass regulations within the ASMA are the responsibility of the MFC. Within the RRMA commercial regulations are the responsibility of the MFC while recreational regulations are the responsibility of the WRC. The commercial harvest of striped bass in the RRMA is prohibited by 15A NCAC 03M .0202 (b). It should also be noted that under the provisions of Amendment 1 to the North Carolina Estuarine Striped Bass FMP the DMF Director maintains proclamation authority to establish seasons, authorize or restrict fishing methods and gear, limit quantities taken or possessed, and restrict fishing areas as deemed necessary to maintain a sustainable harvest. The WRC Executive Director maintains proclamation authority to establish seasons.

NORTH CAROLINA GENERAL STATUTES

N.C. General Statutes

G.S. 113-132.	JURISDICTION OF FISHERIES AGENCIES
G.S. 113-134.	RULES
G.S. 113-182.	REGULATION OF FISHING AND FISHERIES
G.S. 113-182.1.	FISHERY MANAGEMENT PLANS
G.S. 113-221.1.	PROCLAMATIONS; EMERGENCY REVIEW
G.S. 113-292.	AUTHORITY OF THE WILDLIFE RESOURCES COMMISSION IN REGULATION OF INLAND FISHING AND THE INTRODUCTION OF EXOTIC SPECIES.
G.S. 143B-289.52.	MARINE FISHERIES COMMISSION—POWERS AND DUTIES
G.S. 150B-21.1.	PROCEDURE FOR ADOPTING A TEMPORARY RULE

NORTH CAROLINA RULES

N.C. Marine Fisheries Commission Rules 2020 and N.C. Wildlife Resources Commission Rules 2020 (15A NCAC)

15A NCAC 03H .0103 PROCLAMATIONS, GENERAL

15A NCAC 03M .0201	GENERAL
15A NCAC 03M .0202	SEASON, SIZE AND HARVEST LIMIT: INTERNAL COASTAL WATERS
15A NCAC 03M .0512	COMPLIANCE WITH FISHERY MANAGEMENT PLANS
15A NCAC 03Q .0107	SPECIAL REGULATIONS: JOINT WATERS
15A NCAC 03Q .0108	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT WATERS
15A NCAC 03Q .0109	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 03Q .0202	DESCRIPTIVE BOUNDARIES FOR COASTAL-JOINT-INLAND WATERS
15A NCAC 03R .0201	STRIPED BASS MANAGEMENT AREAS
15A NCAC 10C .0107	SPECIAL REGULATIONS: JOINT WATERS
15A NCAC 10C .0108	SPECIFIC CLASSIFICATION OF WATERS
15A NCAC 10C .0110	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT WATERS
15A NCAC 10C .0111	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 10C .0301	INLAND GAME FISHES DESIGNATED
15A NCAC 10C .0314	STRIPED BASS

DISCUSSION

The November 2020 Revision to Amendment 1 implemented a lower TAL calculated to end overfishing in one year. Management measures developed in Amendment 2 will be implemented to ensure long term sustainable harvest and end the overfished stock status within 10-years as required by law. If adopted in Amendment 2 adaptive management measures will allow the flexibility outlined in this issue paper.

Option 1. Manage for sustainable harvest through harvest restrictions

The General Statutes of North Carolina require that a FMP specify a time period not to exceed two years from the date of the adoption to end overfishing (G.S. 113-182.1). The statutes also require that a FMP specify a time period not to exceed 10 years from the date of adoption and at least a 50% probability to achieve a sustainable harvest. A sustainable harvest is attained when the stock is no longer overfished (G.S. 113-129). The statutes allow some exceptions to these stipulations related to biology, environmental conditions, or lack of sufficient data.

Sustainable harvest levels for the A-R striped bass stock have been determined using stock assessments and stock projections since the 1995 assessment (Gibson 1995).

Option 1.A. Continue to use stock assessments and stock assessment projections to determine the TAL that achieves a sustainable harvest for the A-R stock

A TAL is a management measure used to set harvest levels for a stock with the goal of preventing overfishing and ensuring the stock does not get in an overfished state. The 1991 TAL was set at 156,800 pounds, which was 20% of the average harvest from 1972–1979, (see Appendix I in NCDMF 1993). Under Amendment 1, the TAL for the A-R stock is determined through stock assessments and stock assessment projections. Projections are used to calculate the annual amount of harvest that maintains SSB at its target level and provides for long-term sustainable harvest. In the event the stock assessment results indicate fishing mortality is above the F_{Target}, adaptive management allows for calculation of a new TAL to reduce F back to the F_{Target} in one year, as was done with the November 2020 Revision to Amendment 1. Adaptive management allows managers to quickly address overfishing while allowing for and monitoring fishing. See adaptive management in this issue paper for more information on determining the TAL. The use of a TAL is a management option proven effective in recovery of the striped bass stock.

A key component of successfully using a TAL is the ability to accurately monitor recreational and commercial harvest in a timely manner and close fishing sectors when harvest is nearing the sector TAL. The DMF and WRC use agency-run creel surveys specifically designed to estimate recreational striped bass catch and effort in the ASMA and RRMA. Data is available 1–2 weeks after collection. It is important to note, harvest estimates calculated with one or two weeks of data have greater uncertainty than harvest estimates calculated monthly. Striped bass dealer permits are required for dealers to purchase commercially harvested striped bass and dealers must report daily the number and pounds of striped bass bought to the DMF. The ability to monitor harvest from the recreational and commercial sectors in a timely manner means the DMF and WRC have a greater likelihood of keeping annual harvest below the TAL in their respective management areas.

Flexibility in authority given to the DMF Director and the Executive Director of the WRC is used to prevent harvest from exceeding the TAL. Harvest seasons have been closed early in the RRMA by proclamation in years when the harvest estimate approached the TAL. Conversely, proclamation authority has also been used to extend the harvest season beyond April 30 by a few days. The decision to extend the season in the RRMA is based on availability of remaining landings within the TAL and environmental conditions, such as flood control operations and water temperatures. Due to much higher mortality of striped bass discards when the water temperature is warmer, both recreational and commercial harvest seasons have been closed during the summer months, typically May–September, since 1991.

Daily possession limits for the recreational and commercial sectors have been used since 1991 to limit or expand harvest opportunities and keep landings below the TAL. The DMF Director has proclamation authority to change the daily possession limits in the ASMA throughout the harvest seasons. The WRC can change daily possession limits and size limits in the RRMA through permanent or temporary rulemaking processes. In the absence of proclamation authority to change size limits or creel limits, temporary rulemaking can be used by the WRC to expedite conservation measures. Recreational sector daily possession limits have ranged from 1 to a maximum of 3 fish per person per day since 1991. Daily possession limits for the commercial sector have ranged from 3–25 fish per day per commercial operation.

Over the long-term, combined use of a TAL with other management measures has maintained landings in the A-R striped bass fisheries below or near the TAL. However, if actual recruitment is less than the estimated recruitment used in projections, stock abundance will not support harvest of the TAL and the F_{Target} may be exceeded and SSB may fall below the $\text{SSB}_{\text{Threshold}}$, as the 2020 stock assessment currently indicates. Continuing use of a TAL with the ability to monitor harvest, adjust harvest seasons, and change daily possession limits to provide the greatest likelihood of keeping harvest below the TAL allows a balance of conservation needs and stakeholder access to the resource while the stock is rebuilding.

Option 1.B. Implement a harvest moratorium

A complete harvest moratorium could potentially recover the striped bass stock more quickly than if a low level of harvest is allowed. However, any anchored, set gill net fisheries occurring in the ASMA and recreational catch-and-release for striped bass, will continue to contribute to discard mortality. Discard mortality in the anchored set gill net fishery for American shad would be substantial if that fishery was to continue to operate with a striped bass harvest moratorium in the ASMA. If poor environmental conditions persist on the spawning grounds during May and early June, recovery may not occur even with a harvest moratorium.

The A-R stock has experienced several years of poor recruitment since 2000. The juvenile abundance index (JAI) during 2017–2020 indicated few eggs and larval striped bass survived. However, the recent five years of poor recruitment (2017–2021) do not compare to chronic spawning failures the stock experienced during 1978–1992 (Figure 2.2). When a TAL was implemented in 1991, it was set at nearly three times the 2021 TAL. In 2014 and 2015, the stock produced year classes above the long-term average level of recruitment (FMP Figure 2), indicating that with favorable environmental conditions during the spawning period the stock can produce strong year classes even during periods of low SSB. Based on past trends, stock abundance can increase quickly under the right conditions. The 2020 stock assessment indicated SSB increased from 145,962 pounds in 1996 to above the SSB_{Target} (350,371 pounds) in two years (FMP Figure 2.3). However, future stock conditions, driven by continued poor recruitment and decreasing stock abundance, may warrant a harvest moratorium.

Projections evaluated overfishing with trends in SSB under the existing TAL and a complete harvest moratorium. Discards were assumed equal to the terminal year of the stock assessment and three recruitment scenarios were input to account for the uncertainty and the variability of recruitment observed in the stock; 1) the average level of recruitment for the entire time series of the assessment, 1991–2017, 2) a high level of recruitment observed in years 1991–2001, and 3) a low level of recruitment as observed in years 2004–2017. Under the harvest moratorium the stock would no longer be overfished in 2024, while under the current TAL the stock would no longer be overfished in 2026 (Figure 2.3).

Option 2. Management of striped bass harvest in the commercial fishery as a bycatch fishery

The commercial fishery for striped bass in the ASMA has been managed as a bycatch fishery since 1995. Often the term "bycatch" is associated with species captured in a fishing operation that were not intended and are discarded and is generally considered something that should be avoided. However, a bycatch fishery management strategy in multi-species fisheries means a portion of overall landings must be landed in order to land striped bass. The striped bass bycatch provision requires 50% of commercial landings by weight be other finfish species.

The bycatch provision was implemented as a management tool in the ASMA striped bass commercial fishery to prevent fishers not already participating in the American shad and southern flounder gill net fisheries from entering to specifically target striped bass. The idea being, that if additional participants entered the striped bass fishery, the TAL would be caught more quickly and the large mesh gill net fisheries continuing to operate would have higher numbers of striped bass discards. However, daily landings limits discourage fishers from targeting striped bass in the same fashion, making it less profitable to sell only striped bass each day without additional finfish catch.

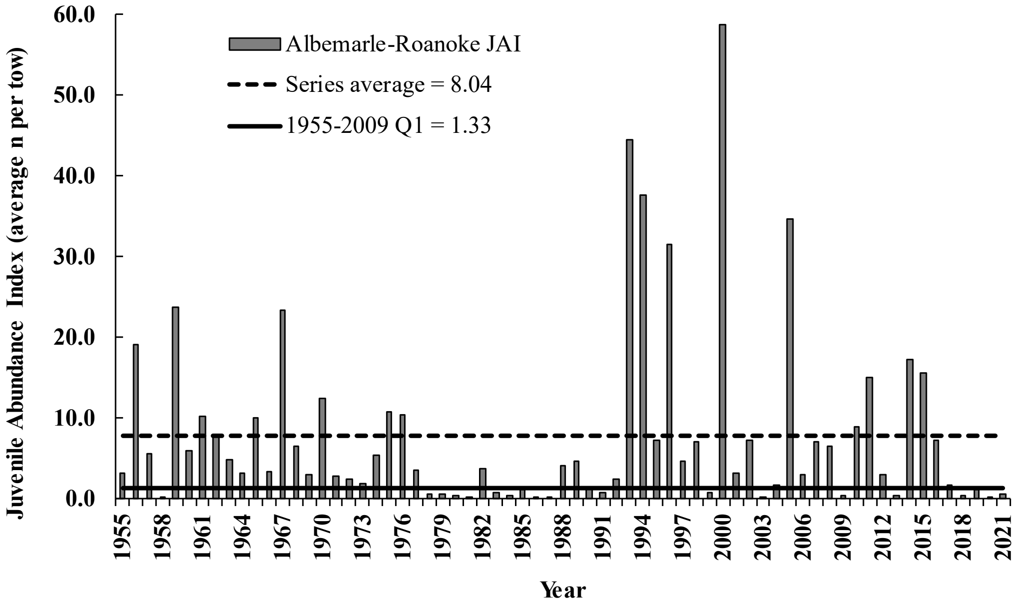
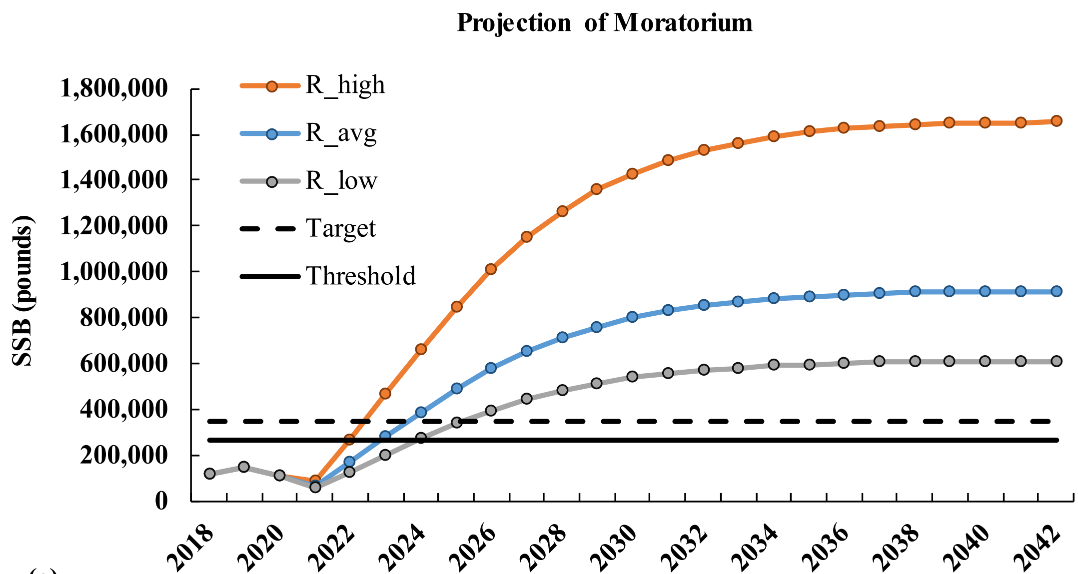


Figure 2.2. The juvenile abundance index (JAI) for Albemarle Sound-Roanoke River striped bass, North Carolina, 1955–2021. A JAI value below the first quartile (Q1 solid black line) is considered a spawning failure.

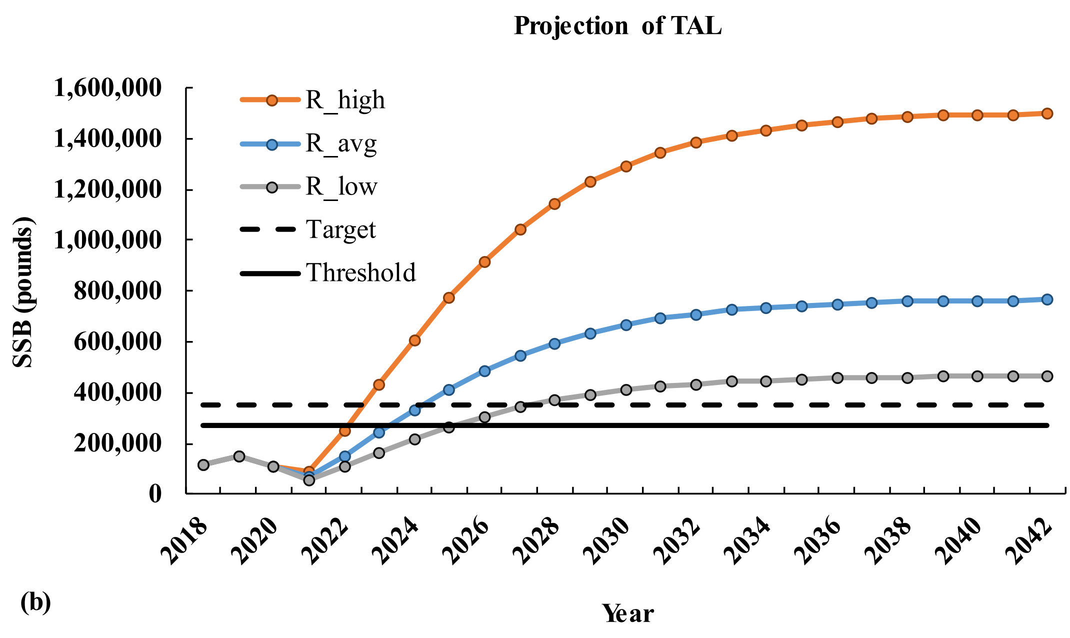
The gill net fisheries have changed considerably since the early 1990s and the bycatch provision may no longer be necessary. The number of participants that landed striped bass in the ASMA peaked at nearly 450 in 2000 but has decreased to just more than 150 in 2019. The number of fishers and trips taken each year in the American shad and flounder gill net fisheries has also declined steadily to less than 83 and 143 participants respectively in 2019 (Tables 2.3 and 2.4). The harvest season for American shad since 2015 has been March 3–March 24, whereas prior to 2015 it was open January 1–April 14. Floating gill nets are not allowed in the ASMA outside of shad season. In addition, the harvest season for southern flounder in 2021 was September 15–October 1 in the ASMA, whereas the harvest season previously was open 11–12 months each year.

Currently, gill nets configured for harvesting flounder are removed from the water when flounder harvest season is closed (NCDMF 2019).

If the bycatch provision for harvesting striped bass were removed, it is possible there would not be a significant increase in participants in the striped bass fishery because the daily landings limit and TAL would still apply. Removing the bycatch provision associated with harvesting striped bass makes it easier to allow hook and line as a commercial gear (see the Hook and Line Issue Paper for more information). If, however, the option is chosen to stop requiring 50% of other finfish species associated with striped bass harvest, and a large number of participants did enter the fishery, adaptive management could stipulate the DMF Director may reinstitute the bycatch requirements at any time through proclamation authority. There has also been concern expressed from some commercial participants that removing the bycatch provision could potentially reduce the price per pound of striped bass and/or some of the most commonly landed species associated with striped bass catch. Since 2010 the top five species landed on trip tickets along with striped bass in the ASMA include southern flounder, American shad, white perch, catfishes, striped mullet, yellow perch, and spotted seatrout.



(a)



(b)

Figure 2.3. Projections of spawning stock biomass (SSB) in pounds for the Albemarle Sound-Roanoke River striped bass stock under the current total allowable landings (TAL) of 51,216 lb (a) and a harvest moratorium (b). Average recruitment (R_avg), low recruitment (R_low), and high recruitment (R_high) refer to the three recruitment scenarios used in the projections.

Table 2.3. Number of gill net trips, number of participants, total pounds of seafood landed, and dockside value from gill net trips that landed American shad in the ASMA, 2010–2019.

Year	Trips	Participants	Seafood sold (lb)	Dockside value
2010	2,520	176	539,233	$444,350
2011	1,960	138	481,801	$384,421
2012	1,922	139	391,407	$368,776
2013	1,953	132	411,081	$436,262
2014	714	92	206,733	$153,559
2015	817	98	252,993	$193,043
2016	587	73	178,947	$150,806
2017	601	73	167,906	$148,854
2018	387	55	109,855	$96,226
2019	690	83	215,279	$167,537

Table 2.4. Number of gill net trips, number of participants, total pounds of seafood landed, and dockside value from gill net trips that landed southern flounder in the ASMA, 2010–2019.

Year	Trips	Participants	Seafood sold (lb)	Dockside value
2010	5,389	323	801,426	$1,111,612
2011	1,990	204	325,799	$327,779
2012	5,661	324	821,383	$1,558,772
2013	7,417	335	1,202,078	$2,210,127
2014	5,772	297	818,565	$1,373,840
2015	3,289	234	506,042	$819,664
2016	2,306	181	368,867	$613,572
2017	3,321	193	368,709	$894,733
2018	2,681	164	294,802	$682,719
2019	2,001	143	259,438	$486,475

Option 3. Accountability Measures to Address TAL Overages

Fisheries managed with a TAL commonly include accountability measures to address situations when the TAL is exceeded. One common and simple option is to subtract the number of pounds the TAL was exceeded in one year from the following year's TAL. A more complex option is to adapt accountability measures to current stock status. For example, if *F* and SSB targets are being met, accountability measures may include management measures to reduce harvest the following year without subtracting overages from the TAL. However, if the stock is in an overfished or overfishing state accountability measures will be more conservative.

In most quota-managed fisheries, unused quota is not added to the following year's quota. The reasoning for this is twofold: 1) any amount of uncaught quota will benefit the stock in the long-term and 2) if the quota is not being caught because stock abundance is declining and can no longer support the current quota, then increasing the quota also increases the likelihood of causing the stock to become overfished and/or cause overfishing to occur. The TAL for the A-R striped bass stock in Amendment 1 is allocated with a 50/50 split to the recreational and commercial fisheries. The ASMA commercial fishery receives 50% of the TAL with the RRMA recreational and the ASMA recreational fisheries each receiving a 25% allocation of the TAL. The current accountability measures for TAL overages under Amendment 1 are:

<u>Short-term Overages:</u> point harvest estimate exceeds the total TAL by 10 percent in a single year, overage deducted from the next year and restrictive measures implemented in the responsible fishery(ies).

<u>Long-term Overages:</u> five year running average of point estimate exceeds the five-year running average of the total TAL harvest by 2 percent, the responsible fishery exceeding the harvest limit will be reduced by the amount of the overage for the next five years.

The requirement that harvest must exceed the total TAL by 10% before a reduction in the succeeding year's TAL is imposed was adopted in the 2004 FMP and re-adopted in Amendment 1 (NCDMF 2013). The rationale was that because recreational harvest estimates are generated from a statistical survey with uncertainty it was argued that as long as the lower bounds of the harvest estimate encompassed the TAL, then the harvest estimate was not statistically different from the TAL, and there was no overage to repay. The 10% buffer is roughly equivalent to a 90% confidence interval when PSE = 10%, which indicates the point estimate lies within the reported range with 90% certainty. In order to keep a buffer to account for the uncertainty in the recreational creel estimates yet recognize the need to ensure harvest levels are sustainable, an additional option for the short-term overages is to reduce the TAL buffer from 10% to 5%. In this situation with such a low buffer the PDT feels there will not be a need to address long-term overages. A third option is to evaluate overages and potential paybacks for each of the management area's fishery(ies) TAL individually rather than the evaluating at the level of the combined TAL. The final and most conservative option is to remove the buffer altogether and use the point estimate of harvest to determine if the TAL has been exceeded and subtract any overages from the succeeding year's TAL.

Option 4. Size limits to expand the age structure of the stock

Size limits are a common management measure to limit and focus harvest on a specific size and age class(es) of fish in the stock. The overall management objectives for a stock and associated fisheries and the life history of the species inform managers of what size limit should be implemented. By setting a minimum size limit based on length at maturity, managers can ensure a portion of the females in the stock have a chance to spawn at least once before harvest. For long-lived fish, a slot limit ensures fish that grow out of the slot will reproduce many times. Female A-R striped bass are 27% mature at age-3 and 97% mature by age-4. The length at maturity is 50% mature at 16.8 inches and 100% mature at 18.8 inches (Boyd 2011; Table 2.5). The current minimum size limit of 18 inches total length (TL) ensures about 75% of females have spawned at least once before subject to harvest.

Table 2.5. Percent mature at age and length (inches) of female Albemarle-Roanoke striped bass.

Percent Mature at Age		Percent Mature at Length	
Age	**Percent Mature**	**Length**	**Percent Mature**
1	0%	16.8	50%
2	1%	17.4	75%
3	27%	18.8	100%
4	97%		
5+	100%		

It is critical to the resiliency of the stock (i.e., the ability to recover SSB after times of poor recruitment), that to maintain a wide range of age classes in the population. Stocks with multiple age classes can withstand several years of poor spawning success. A-R striped bass of 23 and 31 years of age have been observed in the past 5 years based on tag return data from fish tagged on the spawning grounds. Female striped bass also produce more eggs and of higher quality as they get older (Boyd 2011). Female striped bass from the A-R stock produce between 176,873–381,998 eggs at ages 3–6. For ages 8–16, egg production ranges from 854,930 to 3,163,130 eggs (Boyd 2011; Figure 2.4).

Secor (2000) suggested striped bass populations can persist during long periods of poor recruitment due to a long reproductive life span as demonstrated by the presence of fish greater than 30 years of age. This longevity and abundance of older fish provided stock resiliency against an extended period of recruitment overfishing. Marshall et al. (2021) indicated that even when rare in a stock, large fish make very strong contributions to total egg production. They also noted harvest slots with minimum and maximum size limits are a way of maintaining large-sized fish within a population, especially if commercial fisheries use gear types which target within the slot size. The different role in replenishment that larger fish play should be better recognized and incorporated in future management approaches to (Marshall et al. 2021).

Increasing minimum size limits will increase the number of dead discards in the recreational and commercial sectors. Most fish harvested in the ASMA recreational sector are between 18–22-inches (Figure 2.5) even though anglers have no upper harvest size limit like in the RRMA. The same is true in the RRMA due to the 18–22-inch TL harvest slot limit and limiting possession to 1 fish greater than 27 inches (Figure 2.6). The fish harvested in the ASMA commercial fishery have a wider length distribution compared to the recreational harvest (Figure 2.7). If the minimum size limit is increased, a significant percentage of harvest will turn into discards, of which a proportion will die. Research from a gill net study in Delaware determined 43% of fish released alive died (ASMFC stock assessment citation). Depending on salinity at the study location and the time of year of numerous hook and line studies, delayed mortality estimates range from 6.4% to 74% (Wilde et al. 2000).

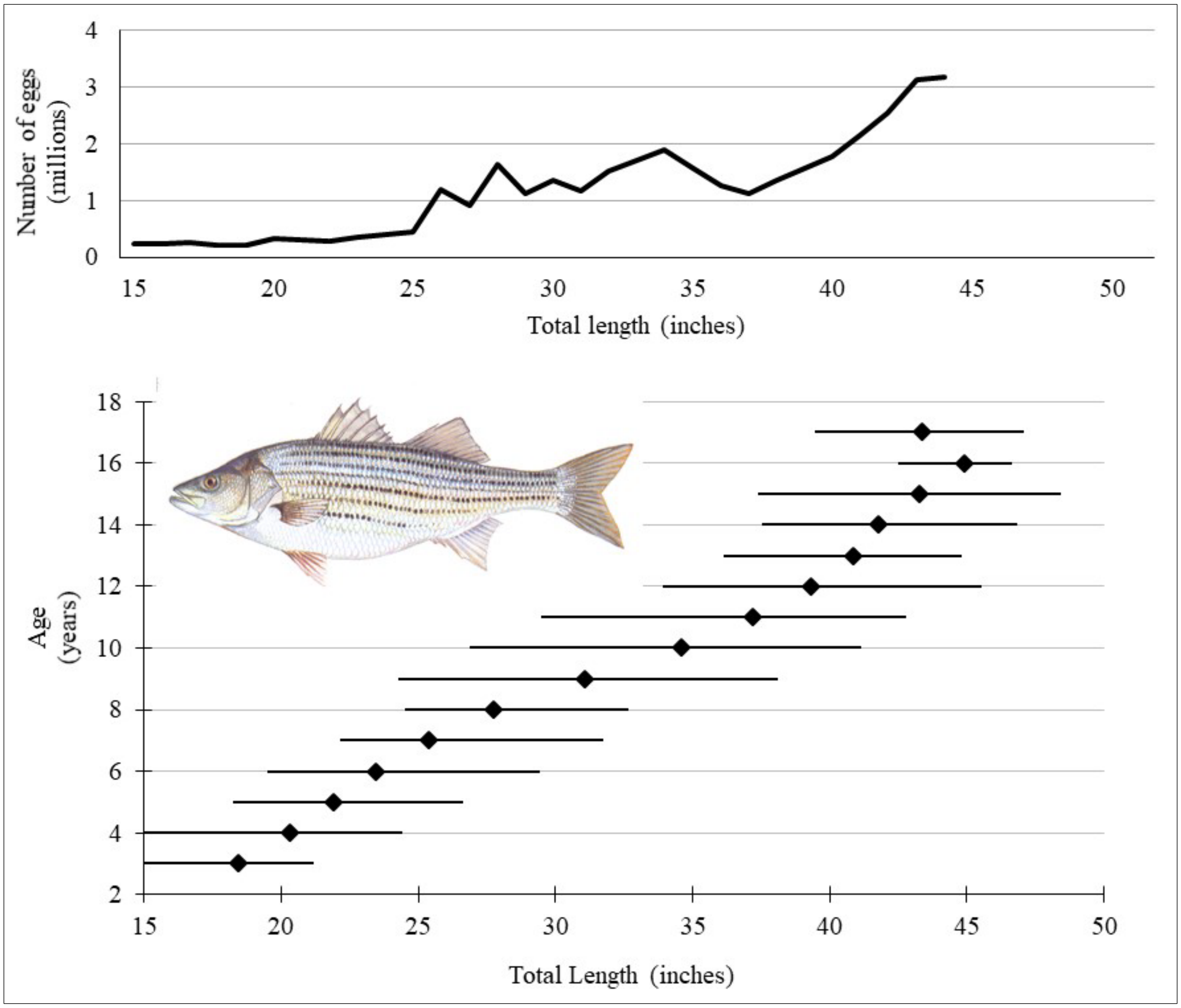


Figure 2.4. Number of eggs produced by female Albemarle-Roanoke striped bass at age and the average length of female striped bass at age. The diamond represents the average total length, and the lines represent the minimum and maximum observed length. Number of eggs at age data from Boyd 2011. Length at age based on annual spawning stock survey in the Roanoke River near Weldon (WRC data).

A harvest slot limit will increase the number of older fish in the population. However, if the slot limit is too wide, savings may be insignificant. A slot limit too narrow will result in additional dead discards if fishing practices do not match the selected slot size. Commercial sampling in the ASMA indicates 86% of the striped bass measured were below 25 inches (Figure 2.9). An 18–25-inch TL harvest slot size limit would include most of the current harvest in both the recreational and commercial sectors and not lead to significant increases in discards, while protecting fish once they grow out of the slot to increase abundance of older and larger striped bass in the A-R stock.

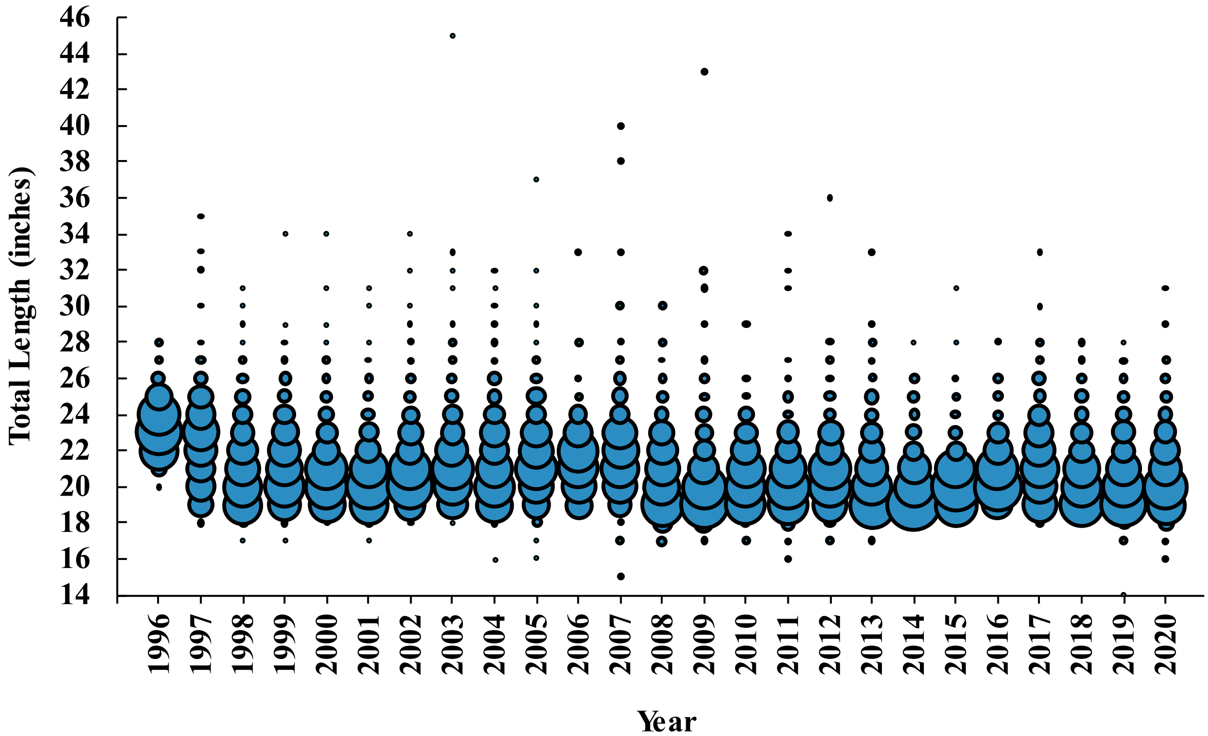


Figure 2.5. Recreational length frequency (total length, inches) of striped bass harvested in the ASMA, NC, 1996–2020. Bubble size represents the proportion of fish at length.

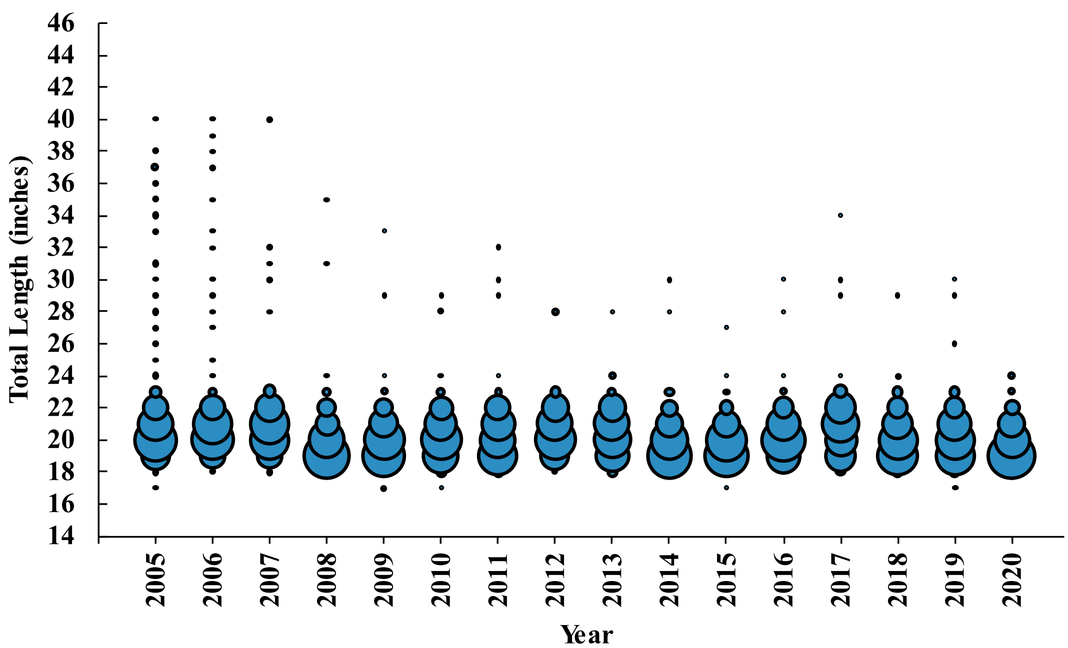


Figure 2.6. Recreational length frequency (total length, inches) of striped bass harvested in the RRMA, NC, 2005–2020. Bubble size represents the proportion of fish at length.

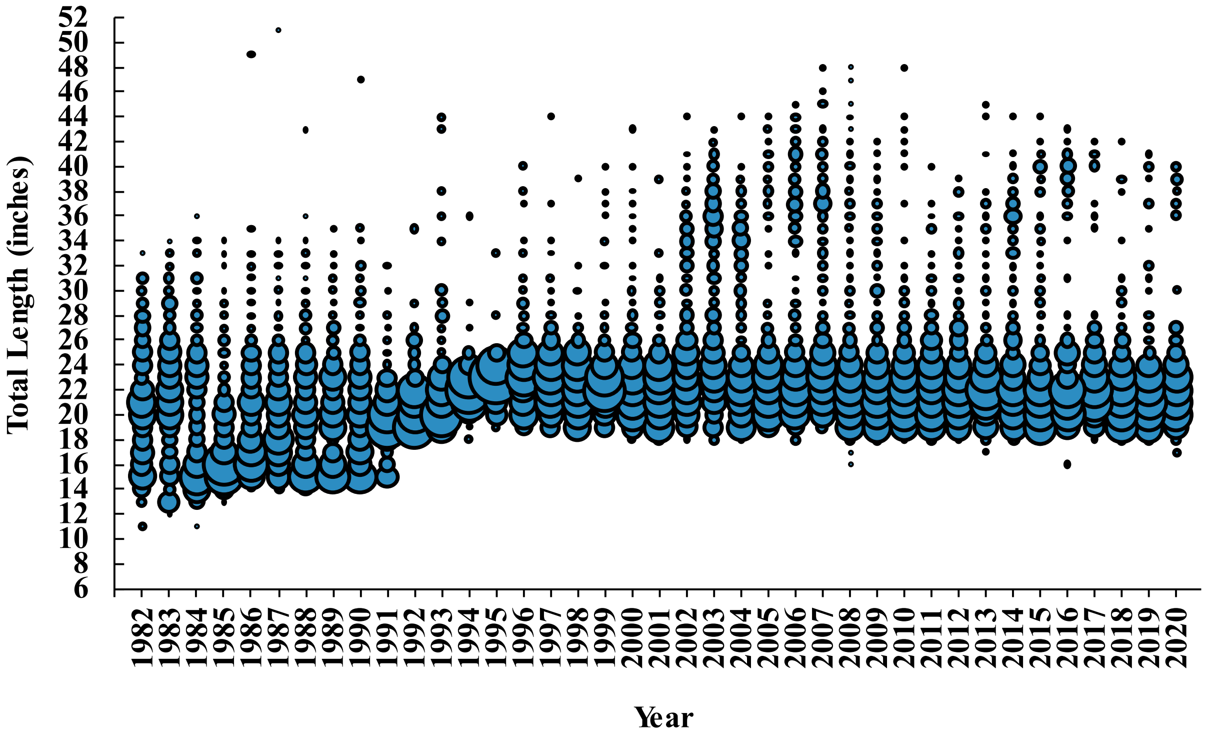


Figure 2.7. Commercial length frequency (total length, inches) of striped bass harvested in the ASMA, NC, 1982–2020. Bubble size represents the proportion of fish at length.

Option 5. Gear modifications and area closures to reduce discard mortality

Commercial Fisheries

To reduce discard mortality from gill nets, gear modifications have included: reducing maximum yardage allowed, restricting mesh sizes, attendance requirements, not allowing harvest during the summer months when water temperatures are higher and discard mortality increases significantly, and requiring tie-downs in the flounder fishery.

Area closures are another tool used to reduce discard mortality. Since 1987 the mouth of the Roanoke River from Black Walnut Point to the mouth of Mackey's Creek has been closed to the use of all gill nets during times of the year when striped bass are present in large concentrations and/or water temperatures are warmer and discard mortality will be high. Other closures have eliminated the use of small mesh gill nets in shallow waters close to shore to reduce undersized discards from large year classes.

The MFC requested analysis to reduce striped bass discard mortality through the elimination of gill net use in the ASMA. While such a measure cannot be pursued in the Estuarine Striped Bass FMP, the MFC does have the authority to eliminate harvest of striped bass with gill nets. However, if the gill net fisheries for American shad and flounder continue, and striped bass cannot be retained, striped bass discards will still occur and will increase. If the large mesh gill net fisheries in the ASMA that create unacceptable levels of striped bass discards are eliminated, serious economic impacts will occur to numerous fishers currently participating in these fisheries. The number of gill net trips, number of participants, pounds of seafood landed at dealers, and dockside value associated with the American shad and southern flounder fisheries in the ASMA are presented in Tables 2.3 and 2.4. The number of gill net trips, number of participants, pounds of seafood landed at dealers, and the dockside value associated with all of the gill net trips (large and small mesh) in the ASMA are presented in Table 2.8.

Table 2.8. Number of gill net trips, number of participants, total pounds of seafood landed, and dockside value from all gill net trips in the ASMA, 2010–2019.

Year	Trips	Participants	Seafood sold (lb)	Dockside value
2010	11,691	420	2,003,385	$1,972,341
2011	7,484	370	1,673,071	$1,280,433
2012	10,253	427	1,860,312	$2,316,010
2013	13,685	432	2,188,732	$3,199,403
2014	9,164	396	1,607,618	$1,903,979
2015	7,855	336	1,614,889	$1,578,145
2016	6,001	268	1,012,693	$1,108,990
2017	6,678	284	1,269,011	$1,521,611
2018	6,340	273	1,318,485	$1,349,733
2019	5,822	234	1,307,117	$1,148,976

At the MFC August 2021 business meeting, a motion passed relative to the Small Mesh Gill Net Rules Modification Information Paper which stated, *"to not initiate rulemaking on small mesh gill nets but refer the issue to the FMP process for each species, and any issues or rules coming out of the FMP process be addressed at that time"*. The Information Paper focused mainly on options that could be implemented to address small mesh gill nets south of Gill Net Management Unit A (roughly the same area as the ASMA), as small mesh gill nets have a long history of being regulated more strictly in the Albemarle Sound area because of the concern over the striped bass stocks during the 1970s–1980s.

Some of the earliest small mesh gill net rules were implemented through proclamation authority in the Albemarle Sound region as early as 1979 (see Appendix 3, 2004 N.C. Estuarine Striped Bass FMP). The intent of issuing small mesh gill net regulations from 1979–1990 was focused on reducing striped bass harvest rather than reducing discards, as the minimum size for striped bass was still 12 inches TL for the commercial sector. Starting in 1991 when the minimum size limit increased to 18 inches TL and a TAL was implemented in the ASMA, the focus of small mesh gill net regulations shifted to reducing dead discards, as most striped bass captured in small mesh nets are under 18 inches TL.

The various gill net regulations implemented in the ASMA since 1979 have focused on closing areas during times of high striped bass concentrations, restricting mesh sizes, requiring tie-downs in deep water for both large and small mesh nets, and implementing mandatory attendance of small mesh gill nets (NCDMF 2004). The mandatory attendance serves a dual purpose to reduce dead discards and reduce effort.

The target species in the anchored, multi-species small mesh gill net fishery in the ASMA has changed significantly over the past 30 years. The biggest change was the moratorium on the harvest of river herring in 2008 (NCDMF 2007 RH FMP). Trip ticket data that included landings of river herring, white perch, striped mullet, spotted seatrout, yellow perch, and spot were used as a proxy to determine a small mesh gill net trip in the ASMA. Analysis indicates an overall, steady decline of anchored, small mesh gill net trips in the ASMA from a high of 9,490 trips in 1999 to a low of 1,589 trips in 2018 (Figure 2.8).

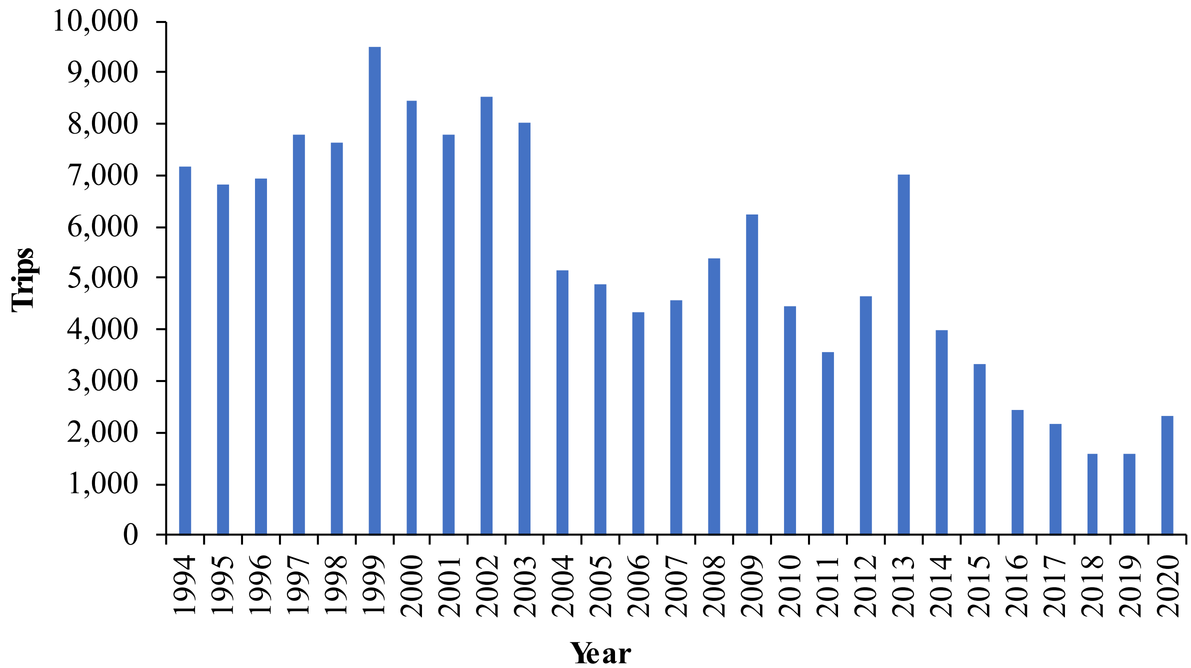


Figure 2.8. Number of anchored gill net trips in the ASMA that landed either river herring, white perch, striped mullet, spotted seatrout, yellow perch, or spot. These species were selected to determine a "small mesh" gill net trip in the ASMA.

Estimating striped bass dead discards in the small and large mesh gill net fisheries in the ASMA is part of the annual compliance with the ASMFC Interstate FMP for striped bass since 1994. The method for estimating striped bass discards has changed through the years based on available on-board observer coverage. Amendment 1 contains a detailed discussion of the methods (NCDMF 2013). Since 2012, striped bass released alive from gill nets have a 48% delayed mortality rate applied. A detailed explanation of discard modeling can be found in the A-R striped bass stock assessment (Lee et al. 2020). Dead discards in the ASMA large and small mesh gill net fisheries have averaged 1,870 fish per year with a high of 6,429 fish in 2013 and a low of 1,175 fish in 2019 (Table 2.9).

Table 2.9. Number of striped bass dead discards from large and small mesh anchored gill net fisheries in the ASMA estimated from on-board observer data and trip ticket data.

Year	Large Mesh (N)	Small Mesh (N)
2012	1,607	3,419
2013	1,846	4,583
2014	1,028	2,850
2015	1,600	3,814
2016	1,311	2,854
2017	1,695	2,260
2018	778	976
2019	465	709
2020	409	1,457

Recreational Fisheries

Since 1997, WRC has required use of single barbless hooks for all anglers during the striped bass spawning season in the inland portions of the RRMA to reduce discard mortality. Reducing discard mortality in the RRMA is particularly important due to recreational fishery discards being many times greater than harvest. Barbless hooks reduce discard mortality by reducing the time it takes an angler to remove the hook from fish and by reducing the damage to the mouth of fish (Nelson 1994).

Use of circle hooks and barbless treble hooks to reduce discard mortality of fish is gaining popularity among the recreational fishing industry. DMF staff presented information on the efficacy of using circle hooks and bent-barbed treble hooks to reduce discard mortality of captured-and-released fish to the MFC at its May 2020 business meeting (see Information on requiring the use of circle hooks and bent-barbed treble hooks in North Carolina NCDMF 2020a). Circle hooks reduce discard mortality compared to traditional J hooks because fish are much less likely to get deep hooked (Cook et al. 2021; Kerstetter and Graves 2006). Circle hooks are required in the Atlantic Ocean waters of North Carolina when fishing for striped bass or sharks and using natural bait. Amendment 1 to the North Carolina Red Drum FMP (NCDMF 2008) requires the use of circle hooks in certain times and areas of the Pamlico Sound when anglers target large red drum using natural bait to reduce deep hooking and release mortality (Aguilar 2003, Beckwith and Rand 2004).

Although less research has been done on the effects of bent or barbless treble hooks on the survival of captured-and-released fish, the same reasons are thought to reduce hook trauma when using single barbless hooks applies. However, as noted in the May 2020 circle hook information paper, the promotion of barbless treble hooks as a conservation measure has largely been replaced by the use of single inline hooks instead of treble hooks on artificial lures. Use has been encouraged for a variety of reasons including: less damage to fish, ease of unhooking, fish hooked more securely, less likely to collect grass or debris, and angler safety. Many manufacturers have started selling lures rigged with single hooks. This trend is being driven by the tackle industry, retailers, and conservation-minded anglers (NCDMF 2020a).

Area closures could also be implemented in the recreational fisheries to reduce striped bass discards. Catch-and-release fishing for striped bass during the closed harvest season is popular in several areas, including the old Manns Harbor Bridge in Manteo, the highway 32 bridge crossing the Albemarle Sound at Pea Ridge, Corey's Ditch located in the Mackay Island National Wildlife Refuge in Currituck, and in the Roanoke River. While data do not exist to determine the exact extent of economic losses, closing areas to the use of recreational hook and line when striped bass harvest is not allowed would impact numerous industries that rely in part or whole on recreational fishing. Closing an area to targeting striped bass is unenforceable.

An area closure on the spawning grounds to eliminate the harvest and catch-and-release of striped bass as they gather in large numbers and spawn also serves to reduce discard mortality. Releases after the harvest period has closed on the spawning grounds has ranged from 9,754–271,328 fish (FMP Table 5). Closing the spawning grounds to the harvest of fish is a common practice in many fisheries to protect the spawning stock, although there is no research on the impacts of catch-and-release fishing on the quality or amount of egg production for striped bass. Based on experience, the A-R striped bass stock has recovered from low stock abundance and produced strong year classes under catch-and-release fishing practices on the spawning grounds.

Option 6. Adaptive management

Adaptive management is a structured decision-making process when uncertainty exists, with the objective to reduce uncertainty through time with monitoring. Adaptive management is based on a learning process to improve management outcomes (Holling 1978). Adaptive management provides flexibility to incorporate new information and accommodate alternative and/or additional actions. As flexibility increases, so do the resources needed to acquire and analyze data, as well as to implement and enforce complexities of management. These elements create trade-offs that must be balanced for all users.

The ASMFC uses annual juvenile abundance indices as an indicator of year class strength and a trigger for management evaluations (ASMFC 2010). If the JAI is below 75% of the other JAI values for three consecutive years, the ASMFC Striped Bass Technical Committee will review the state's data and make a recommendation to the ASMFC Striped Bass Management Board about possible causes for the spawning failures and if management action is needed. The A-R striped bass juvenile abundance index met this trigger in 2020, the third year in a row the index value was below the 75% threshold (Figure 2.2).

Adaptive management for the A-R stock and fisheries in the ASMA and RRMA encompass the following measures:

- Use of peer reviewed stock assessments and updates to recalculate the BRPs and/or TAL if assessment results deem it necessary. Stock assessments will be updated at least once between benchmarks. Changes in the TAL will be implemented through a Revision to the Amendment.
- Use estimates of F from stock assessments to compare to the F BRP and if F exceeds the F_{Target} reduce the TAL to achieve the F_{Target} in one year through a Revision to the Amendment.

- Ability to change daily possession limits in the commercial and recreational fisheries to keep landings below the TAL.
- Ability to open and close recreational harvest seasons and commercial harvest seasons and areas to keep landings below the TAL and reduce interactions with endangered species.
- Ability to require commercial and recreational gear modifications including, but not limited to, the use of barbless or circle hooks, area closures, yardage limits, gill net mesh size restrictions and setting requirements to reduce striped bass discards.

MANAGEMENT OPTIONS AND IMPACTS

(+ Potential positive impact of action)
(- Potential negative impact of action)

1. Manage for Sustainable Harvest through harvest restrictions
   A. Continue to use stock assessments and stock assessment projections to determine the TAL that achieves a sustainable harvest for the A-R stock.

      + The best option to maintain harvest at a sustainable level when mechanisms exist to monitor recreational and commercial harvest in near real-time and close fisheries when the TAL is calculated to be reached.
      + Maintains a sustainable harvest if the TALs are set appropriately and updated at regular intervals.
      - Will not achieve sustainable harvest if TALs are set too high and not updated at regular intervals.
      - Does not allow for increased harvest based on year class strength if TALs are not updated often enough through stock assessments.

   B. Implement a harvest moratorium

      + Would eliminate all harvest which would likely reduce fishing mortality to the stock even more than the current TAL of 51,216 pounds
      + Would likely increase abundance and further expand the age structure
      - Mortality associated with discards in other commercial and recreational fisheries would still occur and likely increase
      - May not achieve the desired results if environmental factors have a greater influence than the level of SSB on the formation of strong year classes
      - Would have significant economic impacts across the commercial sector if fisheries and gears that interact with striped bass were also eliminated
      - Would have significant economic impacts to businesses across the recreational sector supported by recreational fishing for striped bass

2. Management of striped bass harvest in the commercial fishery as a bycatch fishery
   A. Status quo: continue managing the ASMA striped bass fishery as a bycatch fishery

      + Consistent with regulations since 1995

+ May still discourage additional participants from entering the fishery and harvesting striped bass quota that don't normally participate in the other multi-species large mesh gill net fisheries in the ASMA
- Makes it more difficult to implement hook-and-line as a commercial gear

B. Stop managing the ASMA striped bass fishery as a bycatch fishery

+ Would reduce enforcement issues for Marine Patrol
+ Would make it easier to implement hook and line as a commercial gear by not requiring bycatch provisions for one gear and not another
+ Would have no impact on the other management measures (e.g., daily possession limits) intended to maintain harvest below the TAL
+ Would offer a more resource friendly gear that has less discard mortality than gill nets and would have less interactions with endangered species compared to gill nets
+ Would be an additional gear available to the commercial sector to harvest striped bass when gill nets may not be allowed due to excessive interactions with endangered species are because of harvest reductions needed in other FMPs (e.g. southern flounder and American shad)
- Could potentially lead to increased participants in the commercial fishery which would possibly decrease the annual income received per participant in the fishery
- Could potentially lead to increased participants in the commercial fishery which could cause the TAL to be reached quicker and cause gill net fisheries for other species (e.g., American shad) to close earlier than planned

3. Accountability Measures to Address TAL Overages (Examples in Table 2.10)

A. Single Year Overages: if the landings from the management area/sectors three fisheries combined (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds the total TAL by 10% in a single calendar year, then each fishery that exceeded their allocated TAL will have their allocated TAL reduced the next calendar year. The reduction required for a fishery will be equal to the percent contribution that fishery made to the combined TAL overage.

Chronic Overages: if the five-year running average of the landings from the management area/sectors three fisheries combined (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds the five-year running average of the total TAL by 2%, the fishery(ies) exceeding their allocated TAL will deduct the annual average overage from their annual TAL for the next five years.

+ Allows for a buffer around the TAL to account for the uncertainty associated with estimates of recreational harvest
+ Could prevent constantly changing the TAL each year if overages are below the 10% buffer
+ Will be less confusing to anglers if regulations do not change often
- Exceeding the TAL by less than the prescribed buffer, would potentially reduce the ability to maintain a sustainable harvest

B. If the landings from the management area/sectors three fisheries combined (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds the total TAL by 5% in a single calendar year, then each fishery that exceeded their allocated TAL will have their allocated TAL reduced the next calendar year. The reduction for a fishery will be equal to the percent contribution that fishery made to the combined TAL overage.

The same positives and negatives apply to this option, it is just a more conservative buffer than option 3.A.

C. If the landings in any one of the management areas' three fisheries (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds their allocated TAL by 5% in a calendar year, any landings in excess of their allocated TAL will be deducted from that fisheries' allocated TAL the next calendar year.

D. If the landings in any one of the management areas' three fisheries (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds their allocated TAL in a calendar year, any landings in excess of their allocated TAL will be deducted from that fisheries' allocated TAL the next calendar year.

+ Is the most conservative approach to managing a TAL and will provide the greatest chance at rebuilding the stock and maintaining a sustainable harvest
- Does not incorporate statistical uncertainty in inherent to recreational harvest estimates
- Can lead to very short seasons, or no season at all for some years, if TALs are exceeded often and/or by significant amounts when TALs are low
- Can cause confusion among users if regulations change every year

For all overage options: overages will be deducted from the management area/sectors fishery(ies) TAL, not the management area/sectors fishery(ies)TAL plus a buffer; if paybacks to a fishery exceed the next year's allocated TAL for that fishery, paybacks will be required in subsequent years to meet the full reduction amount; in situations where a fisheries allocated TAL has been reduced from a previous year's overage, if the reduced TAL is exceeded, any required paybacks the subsequent year are reduced from the fisheries' original allocated TAL, not from the reduced TAL.

Managing agencies will implement strategies, including proclamations to close harvest seasons, to prevent landings from exceeding the TAL, rather than attempting to harvest the TAL and the buffer.

Table 2.10. EXAMPLES of Accountability measures to address TAL Overage.

Option	Buffer	When Payback Is Required	Management Area/Sector	Area/Sector TAL	TAL + Buffer	Area/Sector Landings	Landings Over/Under TAL	Total Payback Required	Percent Contribution to Overage	Payback	Next Season Area/Sector TAL (lb)	Explanation
3.A.	10% over TAL	Overall landings are greater than (Overall TAL + Buffer)	RRMA recreational	12,804	14,084	27,546	14,742	12,197	88%	12,197 x 88% = 10,733 lb	2,071	Total TAL+10% exceeded so payback is necessary.
			ASMA recreational	12,804	14,084	8,258	-4,546		0%	12,197 x 0% = 0 lb	12,804	
			ASMA Commercial	25,608	28,169	27,609	2,001		12%	12,197 x 12% = 1,464 lb	24,144	
3.B.	5% over TAL	Overall landings are greater than (Overall TAL + Buffer)	RRMA recreational	12,804	13,444	17,804	5,000	0	100%	0	12,804	Despite RRMA recreational exceeding TAL, Total TAL+5% not exceeded so no paybacks are necessary.
			ASMA recreational	12,804	13,444	4,000	0		0%	0	12,804	
			ASMA Commercial	25,608	26,888	25,608	0		0%	0	25,608	
3.C.	5% over Fishery TAL	Fishery landings are greater than (Fishery TAL + Buffer)	RRMA recreational	12,804	13,444	12,000	-804	Not Applicable		0	12,804	ASMA recreational landings exceeded TAL+5% so must pay back full overage. ASMA commercial exceeded TAL by less than 5% buffer so no paybacks are necessary.
			ASMA recreational	12,804	13,444	14,000	1,196			1,196 lb	11,608	
			ASMA Commercial	25,608	26,888	26,200	392			0	25,608	
3.D.	No Buffer	Landings greater than Fishery TAL	RRMA recreational	12,804	12,804	12,954	150			150 lb	12,654	Each area/sector exceeded their TAL and must pay back all landings in excess of their TAL.
			ASMA recreational	12,804	12,804	13,494	690			690 lb	12,114	
			ASMA Commercial	25,608	25,608	25,825	217			217 lb	25,391	

4. Size limits to expand the age structure of the stock

+ Will provide resiliency to the stock during times of poor recruitment
+ Can provide anglers with the opportunity of a "trophy" fishery, even if it is catch-and-release only
- Can reduce the number of fish available for harvest depending on the size limit chosen
- Can increase the number of dead discards from fisheries depending on the size limit chosen

A. Status Quo-maintain the current minimum size limit of 18-inch TL in the ASMA, and in the RRMA maintain the current harvest size limit of a minimum of 18-inch TL to 22-inch TL maximum, with a no harvest slot of fish 22–27 inches, with only one fish in the daily creel being greater than 27 inches

+ Is consistent with management since the 1990s
+ Provides some harvest protection of females in the 22–27 inch no harvest slot while on the spawning grounds
- Does not offer as much protection of fish greater than 27 inches as a harvest slot with a maximum allowed harvest size would

B. Increase the minimum size limit in all sectors in the ASMA and RRMA

+ Could increase chances of achieving a sustainable harvest by allowing females to spawn more times before becoming available to harvest
+ Will provide consistent regulations across all sectors and management areas
- Will lead to greater and greater discards the higher the minimum size limit is raised
- Will decrease the percentage of recreational anglers that will catch and retain the daily limit of striped bass (the greater the increase in the minimum size limit the greater the decrease in the percentage of anglers that keep a daily landing limit)
- Will not allow the harvest of a "trophy" fish by anglers

C. In the ASMA, implement a harvest slot of a minimum size of 18-inches TL to not greater than 25 inches TL in the commercial and recreational sectors

+ Will provide resiliency to the stock during times of poor recruitment
+ Can provide anglers with the opportunity of a "trophy" fishery, even if it is catch-and-release only
- Will reduce the number of fish available for harvest depending on the size limit chosen
- Will increase the number of dead discards from fisheries depending on the size limit chosen
- Will increase the potential to reach TAL quicker in the RRMA if harvest is allowed on larger fish
- Any increase in the abundance of older fish in the population may not be noticeable if the slot is too large

D. In the RRMA, maintain current harvest slot limit of a minimum size of 18-inches TL to 22-inches TL with a no harvest slot of 22–40 inches TL, and the ability to harvest one fish greater than 40 inches per day to allow for harvest of a trophy fish.

E. In the RRMA, maintain current harvest slot limit of a minimum size of 18-inches TL to not greater than 22-inches TL with no harvest allowed on fish greater than 22 inches.

.5. Gear modifications and area closures to reduce striped bass discard mortality

A. Status quo-continue to allow commercial harvest of striped bass with gill nets in joint and coastal waters of the ASMA and continue recreational harvest and catch-and-release fishing in the ASMA and RRMA, including striped bass spawning grounds in the Roanoke River. The requirement that from April 1 through June 30, only a single barbless hook or lure with single barbless hook (or hook with barb bent down) may be used in the inland waters of the Roanoke River upstream of U.S. Highway 258 Bridge will remain in effect.

+ Consistent with management since 1990
+ Allows for harvest with traditional gears and in traditional locations user groups are accustomed to
+ Experience has demonstrated the stock can recover from low levels of abundance and produce strong year classes with these fishing practices in place
- Gill nets interact with endangered species and require incidental take permits to operate
- Catch rates can be extremely high when striped bass are congregated on the spawning grounds
- There has been little research on the effects of catch-and-release fishing to egg production and quality

B. Do not allow the harvest of striped bass with gill nets in the ASMA commercial fishery

+ Will reduce dead discards associated with harvesting striped bass with gill nets
- Will create a significant number of dead discards unless all other gill net fisheries in the ASMA are eliminated
- Will have a significant economic impact to commercial fishers using gill nets to harvest striped bass unless they can easily and inexpensively switch to another gear

C. Do not allow harvest or targeted catch-and-release fishing for striped bass while on the spawning grounds or other areas of high concentration.

+ Would reduce all discards associated with hook and line fishing on the spawning grounds and in other areas of high striped bass concentration
+ Would likely increase abundance and further expand the age structure
- May not achieve the desired results if environmental factors have a greater influence than the level of SSB on the formation of strong year classes

- Would have significant economic impact to all businesses in the areas supported by recreational angling for striped bass while on the spawning grounds and in other areas of high concentration
- Would eliminate access to the resource by the user groups in the area of the spawning grounds and in other areas of high concentration unless they travel to another area to harvest striped bass

D. Implement single barbless hook rule in the remainder of the RRMA during the open harvest season and catch-and-release season

+ Would reduce mortality associated with undersized releases and catch-and-release fishing
- Would have negative impacts on other recreational fisheries mainly largemouth bass fishing in the area and time of year

E. Implement a requirement to use non-offset barbless circle hooks when fishing with live or natural bait in the inland waters of the Roanoke River (upstream of Hwy 258 bridge) from May 1 through June 30

+ Would reduce mortality associated with undersized releases and catch-and-release fishing
- Would require significant angler education on the types of circle hooks that would be required
- Would have significant impact on other recreational fisheries using live bait for other species, such as crickets for bream, if there were not exemptions for certain size J hooks
- Would require significant angler education on the types of J hooks that would be exempted

6. Adaptive Management

Adaptive management for the A-R stock and fisheries in the ASMA and RRMA encompasses the following measures:

- Use peer reviewed stock assessments and updates to recalculate the BRPs and/or TAL. Stock assessments will be updated at least once between benchmarks. Increases or decreases in the TAL will be implemented through a Revision to the Amendment. A harvest moratorium could be necessary if stock assessment results calculate a TAL that is too low to effectively manage, and/or the stock continues to experience spawning failures.
- Use estimates of F from stock assessments to compare to the F BRP and if F exceeds the F_{Target} reduce the TAL to achieve the F_{Target} through a Revision to the Amendment.
- Ability to change daily possession limits in the commercial and recreational fisheries to keep landings below the TAL.
- Ability to open and close recreational harvest seasons and commercial harvest seasons and areas to keep landings below the TAL and reduce interactions with endangered species.

- Ability to require commercial and recreational gear modifications including, but not limited to, the use of barbless or circle hooks, area closures, yardage limits, gill net mesh size restrictions and setting requirements to reduce striped bass discards.

RECOMMENDATIONS

See Appendix 6 for DMF, WRC, and advisory committees recommendations and a summary of online public.

NCMFC Preferred Management Strategy

Options: 1.A., 2.A., 3.D., 4.C., 4.E., 5.A., 5.E., and 6.

APPENDIX 3: ACHIEVING SUSTAINABLE HARVEST FOR THE TAR-PAMLICO AND NEUSE RIVERS STRIPED BASS STOCKS

ISSUE

Consider existing factors that prevent a self-sustaining population in the Tar-Pamlico and Neuse rivers and implement management measures that provide protection for and access to the striped bass resource.

ORIGINATION

North Carolina Division of Marine Fisheries (DMF) and North Carolina Wildlife Resources Commission (WRC)

BACKGROUND

Natural reproduction is the primary process responsible for maintaining self-sustaining fish populations at levels that support harvest. In self-sustaining populations, the numbers of offspring produced by natural reproduction are greater than can be stocked by managers. Striped bass stocks that allow harvest and can self-replace through natural reproduction are considered sustainable. Until there are naturally reproducing populations in these rivers capable of self-replacement, the sustainable harvest objective of this plan cannot be met.

The Tar-Pamlico and Neuse rivers striped bass fisheries have been sustained by continuous stocking to maintain the populations while allowing recreational and commercial harvest (O'Donnell and Farrae 2017; see Appendix 1). Roanoke River origin striped bass have either been stocked or used as broodstock in the Tar-Pamlico and Neuse rivers for decades (Bayless and Smith 1962; Woodroffe 2011). It is likely there are no Tar-Pamlico or Neuse River native strains of striped bass remaining in the river systems; however, striped bass in the Tar-Pamlico and Neuse rivers display genetic differences from other striped bass in North Carolina, which is to be expected given the history of stocking in these systems (Cushman et al. 2018). The need for continued conservation management efforts are supported by persistent recruitment failure, multiple mortality sources, absence of older fish on the spawning grounds, non-optimal environmental conditions on the spawning grounds in the spring, impacts from hatchery reared juveniles and escaped hybrid striped bass, and the high percentage of stocked fish in the populations (Bradley et al. 2018; Rachels and Ricks 2018; Mathes et al. 2020). Reliable population estimates have never been determined for Tar-Pamlico River striped bass. In 2018, Bradley et al. (2018) provided a population estimate of 18,457 for Neuse River adult striped bass; however, the persistence of striped bass populations in these rivers to support recreational and commercial fisheries has been the result of continuous stocking efforts (Mathes et al. 2020; NCDMF 2020a).

Tar-Pamlico and Neuse Rivers Striped Bass Stocks Life History

For a comprehensive review of striped bass life history in the Tar-Pamlico and Neuse rivers see Mathes et al. (2020) and NCDMF (2013).

The age structure of striped bass in the Tar-Pamlico and Neuse rivers remains limited, with few fish over ten years old collected in DMF and WRC surveys. Sampling by WRC in 2007 showed age-4 and age-6 fish were common in both rivers (Barwick et al. 2008). Older, larger individuals were seldom encountered. Since adoption of the Estuarine Striped Bass FMP (NCDMF 2004), there has been little change in the size and age distribution in the Tar-Pamlico and Neuse rivers. However, abundance of age-6 and older striped bass began increasing in 2008, peaking in 2014 (Rachels and Ricks 2015). On the Tar River, abundance of age-6 fish has varied considerably with a peak in 2012 (Rundle 2016). WRC scale-aged fish suggest a maximum age of 17 in the Tar-Pamlico River (Homan et al. 2010), and 11 on the Neuse River (WRC - unpublished data 2017). DMF otolith and genetic age data indicate maximum ages of 12 in both rivers (NCDMF 2020a). Survey data indicates limited numbers of larger striped bass in these systems, though gear selectivity likely excludes larger striped bass. Few striped bass larger than 27 inches are commercially harvested in these systems (NCDMF 2020a); however, fishery independent sampling using gill nets with larger mesh sizes (up to 10 inch stretched mesh) indicates the presence of larger, older striped bass in deeper regions of the Tar-Pamlico River (Cuthrell 2012).

Striped bass populations in the Tar-Pamlico and Neuse rivers primarily remain within their native river system throughout their life history. Tagging data indicates limited movement of striped bass from the Neuse and Tar-Pamlico rivers into other systems or the Atlantic Ocean (Setzler et al. 1980; Rulifson et al. 1982, Winslow 2007; Callihan 2012; Callihan et al. 2014; Rock et al. 2018; NCDMF – unpublished data 2020). Multiple studies have indicated striped bass make spawning migrations in the Tar-Pamlico and Neuse rivers and fertilized eggs have been found, indicating reproduction is occurring; however, there is very limited if any striped bass recruitment to the larval and juvenile life stages (Humphries 1965; Kornegay and Humphries 1975; Jones and Collart 1997; Smith and Rulifson 2015; Rock et al. 2018). Surveys suggest egg abundance in the water column downstream from spawning is not sufficient to provide recruitment of juveniles to the population.

Over the past several decades, few larval and juvenile striped bass have been collected from CSMA systems (Marshall 1976; Hawkins 1980; Nelson and Little 1991; Burdick and Hightower 2006; Barwick et al. 2008; Smith and Rulifson 2015; and Buckley et al. 2019). In 2017, the DMF began an exploratory juvenile abundance survey in the Tar-Pamlico and Neuse rivers using trawl and seine nets. As of 2020, no juvenile striped bass have been collected in this survey (Mathes et al. 2020; Darsee et al. 2020).

Striped bass are broadcast spawners that produce non-adhesive, semi-buoyant eggs that must remain neutrally buoyant in the water column as they float downriver for the best chance of survival to larvae. Sufficient current velocity is critical to keep eggs suspended in the water column for a minimum of 48 hours after fertilization (Bain and Bain 1982) preventing contact with the bottom. Eggs differ among striped bass stocks and are ideally suited for certain river flows. Chesapeake Bay stock eggs are lighter and maintain their position in the water column of calmer tidal waters, whereas Roanoke River stock eggs are heavier and maintain their water column position in the more turbulent, high energy Roanoke River system (Bergey et al. 2003). While Chesapeake Bay stock eggs appear genetically predetermined to being lighter, Roanoke River stock eggs are thought to be more adaptable to varying environmental conditions (Kowalchyk 2020). Neuse River water velocities are variable but appear sufficient to keep heavier striped bass eggs suspended until hatching (Burdick and Hightower 2006; Buckley et al. 2019) based on the minimum required water velocity (30 centimeters per second).

In 2017, North Carolina State University initiated research to provide insight into striped bass recruitment by evaluating genetic and environmental influences on egg development. Results reveal the stock with the heaviest and smallest eggs collected in 2018 and 2019 were from Tar-Pamlico and Neuse rivers striped bass broodstock (Kowalchyk 2020). The Tar-Pamlico and Neuse rivers were also found to have significantly different levels of key proteins required to maintain egg hydration compared to other North Carolina river systems, possibly contributing to differences in buoyancy and critically timed nutrient delivery.

It is clear striped bass reproduction is influenced by complex interactions between population structure, environmental, and physiological factors. In addition, reproductive success is likely impacted because the striped bass stocks in the Tar-Pamlico and Neuse rivers are a non-native strain and the physical environment in these systems has changed through time.

Striped Bass Fisheries

Management measures in Amendment 1 consist of daily possession limits, open and closed harvest seasons, seasonal gill net attendance and other gill-net requirements, minimum size limits, and slot limits to work towards the goal of achieving sustainable harvest. Amendment 1 also maintained the stocking measures in the major CSMA river systems (NCDMF 2013). Supplement A to Amendment 1 (NCDMF 2019) implemented a recreational and commercial no-possession provision for striped bass in the internal coastal and joint waters of the CSMA to reduce mortality on striped bass in these systems. Additionally, commercial gill net restrictions were implemented requiring 3-foot tie-downs and 50-yard distance from shore measures in accordance with Supplement A to Amendment 1 year-round (M-5-2019). Proclamation M-6-2019 maintained the year-round tie-down and distance from shore restrictions for large mesh gill nets and prohibited the use of all gill nets upstream of the ferry lines from the Bayview Ferry to Aurora Ferry on the Tar-Pamlico River and the Minnesott Beach Ferry to Cherry Branch Ferry on the Neuse River to further reduce bycatch of striped bass.

Recreational

The DMF recreational angler survey started collecting recreational striped bass harvest, discard, effort, and economic data for the Tar-Pamlico and Neuse rivers in 2004. Recreational landings fluctuated between 2004–2018, ranging from a low in 2008 (2,990 pounds) to a high in 2017 (26,973 pounds; Figure 3.1; NCDMF 2020a). Only 959 pounds were harvested in 2019 because the season closed early when Supplement A (February 2019) was approved. From 2016–2017, recreational trips and hours spent targeting striped bass increased with a decline in 2018. On average 3,327 fish were harvested annually from the Tar-Pamlico and Neuse rivers combined. (NCDMF 2020a). Recreational releases during 2009–2018 averaged 43,255 fish per year (Mathes et al. 2020). Due to the number of undersized striped bass available in 2017, there was a large increase in discards during this year.

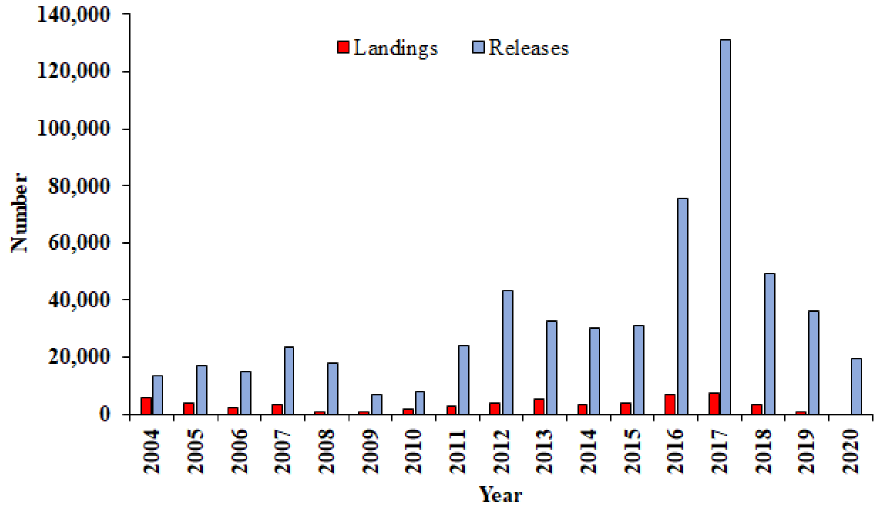


Figure 3.1. Annual recreational catch (harvested and/or released) of striped bass in the CSMA, 2004–2020. There was a limited recreational harvest season in 2019 prior to the closure, lasting from January 1 to March 19, 2019.

Commercial

Supplement A closed the commercial striped bass fishery in 2019. From 1994–2018 commercial landings in the CSMA were limited by an annual total allowable landings (TAL) of 25,000 pounds. The TAL was nearly met in all years except for 2008, when less than half of the TAL was landed (Figure 3.2). From 2004–2018, the commercial season opened March 1 and closed when the TAL was reached.

Stock Concerns

Lack of natural recruitment is the biggest factor affecting sustainability of striped bass stocks in the Tar-Pamlico and Neuse rivers. There has been no measurable year class in the Tar-Pamlico and Neuse rivers systems in decades, and therefore, the stocks require continuous stocking to sustain the populations. A model was developed for striped bass in the CSMA to evaluate stocking and management strategies (Mathes et al. 2020). Stock evaluation results from the model provide further evidence that natural recruitment is the primary limiting factor influencing Tar-Pamlico and Neuse rivers stocks and if stocking was stopped the populations would decline (Mathes et al. 2020). Stock evaluation results indicate that striped bass populations in the CSMA are depressed to an extent that sustainability is unlikely at any level of fishing mortality, and that no level of fishing mortality is sustainable (Mathes et al. 2020).

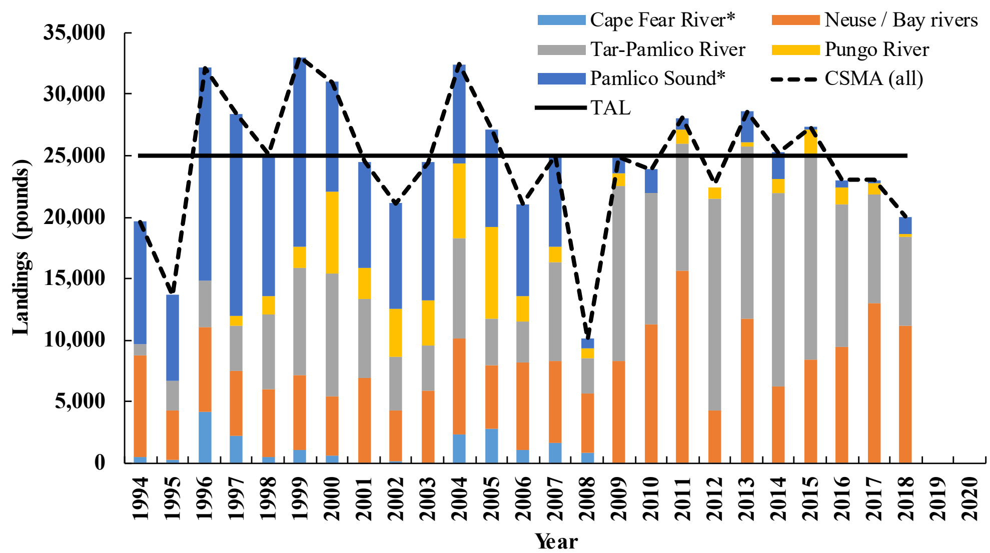


Figure 3.2. Commercial striped bass harvest by system, and the TAL in the CSMA, 1994–2020. There has been a harvest no-possession measure in the Cape Fear River since 2008 and in the CSMA since 2019. *Landings data for the Cape Fear River (2001) and for the Pamlico Sound (2012) are confidential.

Female striped bass in these systems are 100% mature at age-4 (Knight 2015), and fish up to age-8 are not uncommon, providing mature females in these populations that should be capable of producing annual natural recruitment. In the Roanoke River, consistent, measurable year classes are detected in fishery independent surveys even during poor flow years with periods of low spawning stock biomass. Additionally, in the Northeast Cape Fear River, juveniles are captured despite very low stock abundance and limited age structure (Darsee et al. 2020; Lee et al. 2020).

Reasons for low recruitment

Several factors have been suggested as potentially affecting natural recruitment in the Tar-Pamlico and Neuse rivers including spawning stock abundance, truncated age structure (Bradley et al. 2018; Rachels and Ricks 2018; Buckley et al. 2019), and egg abundance. In addition, the absence of older individuals in the populations may not be sufficient to provide natural recruitment because of lower egg production from younger, smaller fish.

Eggs produced by hatchery stocked fish produced by Tar-Pamlico and Neuse rivers broodstock are very small, heavy (dense) eggs, which are more likely to sink than float (Kowalchyk 2020). Figure 3.3 shows that eggs produced from fish residing in the Tar-Pamlico and Neuse rivers are statistically less buoyant than Roanoke River or Santee-Cooper striped bass eggs. Egg densities have been shown to be influenced by both genetic and environmental factors (Kowalchyk 2020). Spawning grounds in these river systems are shallow (between 0.2 and 1.0 meters), so the potential for heavy eggs to contact bottom sediment and die is increased. Additionally, because many of the streams and creeks in these systems have been altered by channelization, rapid flow increases can occur shortly after a rainfall event begins followed by a rapid return to base conditions after the end of the rainfall event (NCDWQ 2009; NCDWQ 2010).

Flows during the spring striped bass spawning season are an important factor affecting successful striped bass natural reproduction; however, unlike on the Roanoke River, there are no agreements with the U.S. Army Corp. of Engineers (USACE) to maintain adequate flows for striped bass spawning in the Tar-Pamlico or Neuse rivers. The USACE is consulted weekly regarding water releases in the Neuse River from Falls Lake in Raleigh, but due to the watershed and storage capabilities, it is not possible to manipulate flows in these rivers. Flows on the Tar-Pamlico River are based on pulse rainfall events. The ability to manipulate releases may become important as we get more information on flows in these systems. If flows are too low during the spawning period, heavy eggs may be more likely to contact the bottom before hatching successfully.

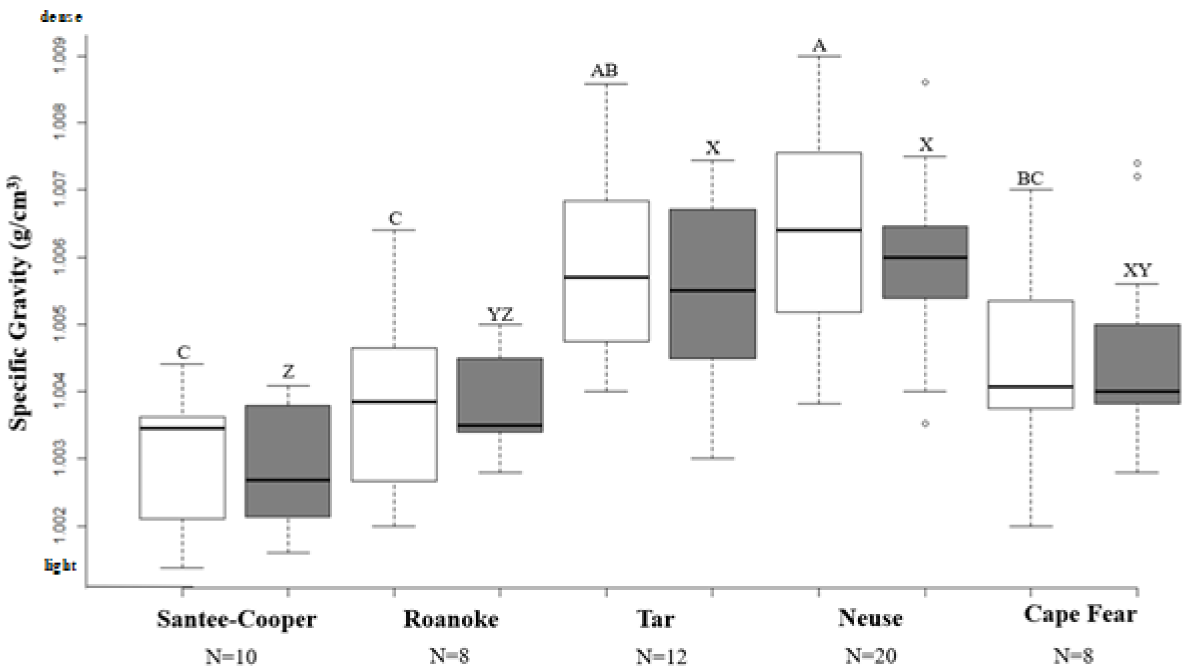


Figure 3.3. Specific gravity (buoyancy; g/cm^3) measurements from stage 1 (white boxes) and 4 (gray boxes) fertilized eggs from 2018/2019 hatchery broodstock sampling. Tukey pair wise comparisons are labeled above the boxplots with ABC indicating stage 1 significant differences and XYZ indicating stage 4 significant differences (Tukey HSD, α=0.05). N represents number of females spawned.

Stocking Considerations

Stocking of striped bass is addressed through the North Carolina Interjurisdictional Fisheries Cooperative annual work plan between DMF, WRC, USFWS (COOP; see Appendix 1). Specific objectives for stocking striped bass include attempts to increase spawning stock abundance while promoting self-sustaining population levels appropriate for various habitats (see Amendment 1, Section 11.2; NCDMF 2013). The annual number stocked was increased starting in 2010 to a goal of 100,000 hatchery reared striped bass in each of the major river systems (Tar-Pamlico, Neuse, and Cape Fear rivers).

Stocking will continue to play a key role recovering striped bass populations. As part of the COOP, consideration of future stocking measures should include evaluation of stocking striped bass with eggs adapted to environmental conditions in the rivers. In addition, because management and stocking strategy simulation results show the populations would likely benefit from stocking more striped bass, discussions related to the number of striped bass stocked annually should be considered as part of the COOP agreement. See Appendix 1 for additional stocking considerations.

AUTHORITY

North Carolina's existing fisheries management system for striped bass is adaptive, with rulemaking authority vested in the MFC and the WRC within their respective jurisdictions. The MFC also may delegate to the fisheries director the authority to issue public notices, called proclamations, suspending or implementing, in whole or in part, particular MFC rules that may be affected by variable conditions. Management of recreational and commercial striped bass regulations within the Tar-Pamlico and Neuse rivers are the responsibility of the MFC in Coastal and Joint Fishing Waters, and recreational regulations are the responsibility of the WRC in Joint and Inland Fishing Waters. It should also be noted that under the provisions of Amendment 1 to the North Carolina Estuarine Striped Bass FMP the DMF Director maintains proclamation authority to establish seasons, authorize or restrict fishing methods and gear, limit quantities taken or possessed, and restrict fishing areas as deemed necessary to maintain a sustainable harvest. The WRC Executive Director maintains proclamation authority to establish seasons.

NORTH CAROLINA GENERAL STATUTES

N.C. General Statutes

G.S. 113-132.	JURISDICTION OF FISHERIES AGENCIES
G.S. 113-134.	RULES
G.S. 113-182.	REGULATION OF FISHING AND FISHERIES
G.S. 113-182.1.	FISHERY MANAGEMENT PLANS
G.S. 113-221.1.	PROCLAMATIONS; EMERGENCY REVIEW
G.S. 113-292.	AUTHORITY OF THE WILDLIFE RESOURCES COMMISSION IN REGULATION OF INLAND FISHING AND THE INTRODUCTION OF EXOTIC SPECIES.
G.S. 143B-289.52.	MARINE FISHERIES COMMISSION—POWERS AND DUTIES
G.S. 150B-21.1.	PROCEDURE FOR ADOPTING A TEMPORARY RULE

NORTH CAROLINA RULES

N.C. Marine Fisheries Commission and N.C. Wildlife Resources Commission Rules 2020 (15A NCAC)

15A NCAC 03H .0103	PROCLAMATIONS, GENERAL
15A NCAC 03M .0201	GENERAL
15A NCAC 03M .0202	SEASON, SIZE AND HARVEST LIMIT: INTERNAL COASTAL WATERS
15A NCAC 03M .0512	COMPLIANCE WITH FISHERY MANAGEMENT PLANS
15A NCAC 03Q .0107	SPECIAL REGULATIONS: JOINT WATERS
15A NCAC 03Q .0108	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT WATERS

15A NCAC 03Q .0109	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 03Q .0202	DESCRIPTIVE BOUNDARIES FOR COASTAL-JOINT-INLAND WATERS
15A NCAC 03R .0201	STRIPED BASS MANAGEMENT AREAS
15A NCAC 10C .0107	SPECIAL REGULATIONS: JOINT WATERS
15A NCAC 10C .0108	SPECIFIC CLASSIFICATION OF WATERS
15A NCAC 10C .0110	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT WATERS
15A NCAC 10C .0111	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 10C .0301	INLAND GAME FISHES DESIGNATED
15A NCAC 10C .0314	STRIPED BASS

DISCUSSION

The Tar-Pamlico and Neuse rivers populations are not self-sustaining and in the absence of stocking cannot support any level of harvest (Mathes et al. 2020). Increasing spawning stock biomass and advancing the female age-structure to older individuals may lead to improved natural recruitment (Goodyear 1984). Based on modeling, a 10-year closure was most effective at increasing adult (age 3+) and old adult (age 6+) abundance (Figure 3.4; Mathes et al. 2020). Model results indicate old adult abundance does not increase for the first five years of the simulation regardless of fishing strategy. The next best fishing strategy consisted of a 5-year closure followed by a 26-inch minimum size limit. However, the 10-year closure resulted in more than two times the number of old adult striped bass than the next best fishing strategy (Figure 3.4).

After the 10-year closure, alternative harvest strategies including minimum size limits, slot limits, and bag limits should be evaluated prior to opening of the fishery. A sufficient time period will be required to achieve an expansion of the age structure and to increase abundance of older fish to promote natural recruitment. This time period should be minimally 10-years from the adoption of Supplement A (2019). Evaluations must account for natural fluctuations in striped bass spawning success due to environmental conditions.

<u>Continue or discontinue the no-harvest measure</u>

Management measures implemented in Supplement A closed the fishery to commercial and recreational harvest and must be incorporated into Amendment 2 to be maintained. If Supplement A management measures are not maintained, alternative management strategies to promote sustainable harvest must be considered.

Closing the fishery to commercial and recreational harvest provides the opportunity to evaluate the population response to management without fishing mortality. If there are no other significant mortality sources (i.e., natural mortality or discard mortality) or population losses (i.e., emigration from the system), no-harvest should allow for expansion of the age structure to include fish greater than age-10.

The no-possession measure in the internal coastal and joint waters of the CSMA was implemented based on genetic evidence suggesting two successful natural spawning events occurred in the Tar-

Pamlico and Neuse rivers in 2014 and 2015 (NCDMF 2019). This potential successful recruitment was an unusual event for Tar-Pamlico and Neuse rivers stocks. Rulifson (2014) concluded 53% of fish sampled from the Neuse River in 2010 were not of hatchery origin providing anecdotal evidence that sporadic, low levels of natural recruitment may occur in these systems. Supplement A was adopted to protect striped bass from the 2014- and 2015-year classes from harvest as they mature and contribute to the spawning stock.

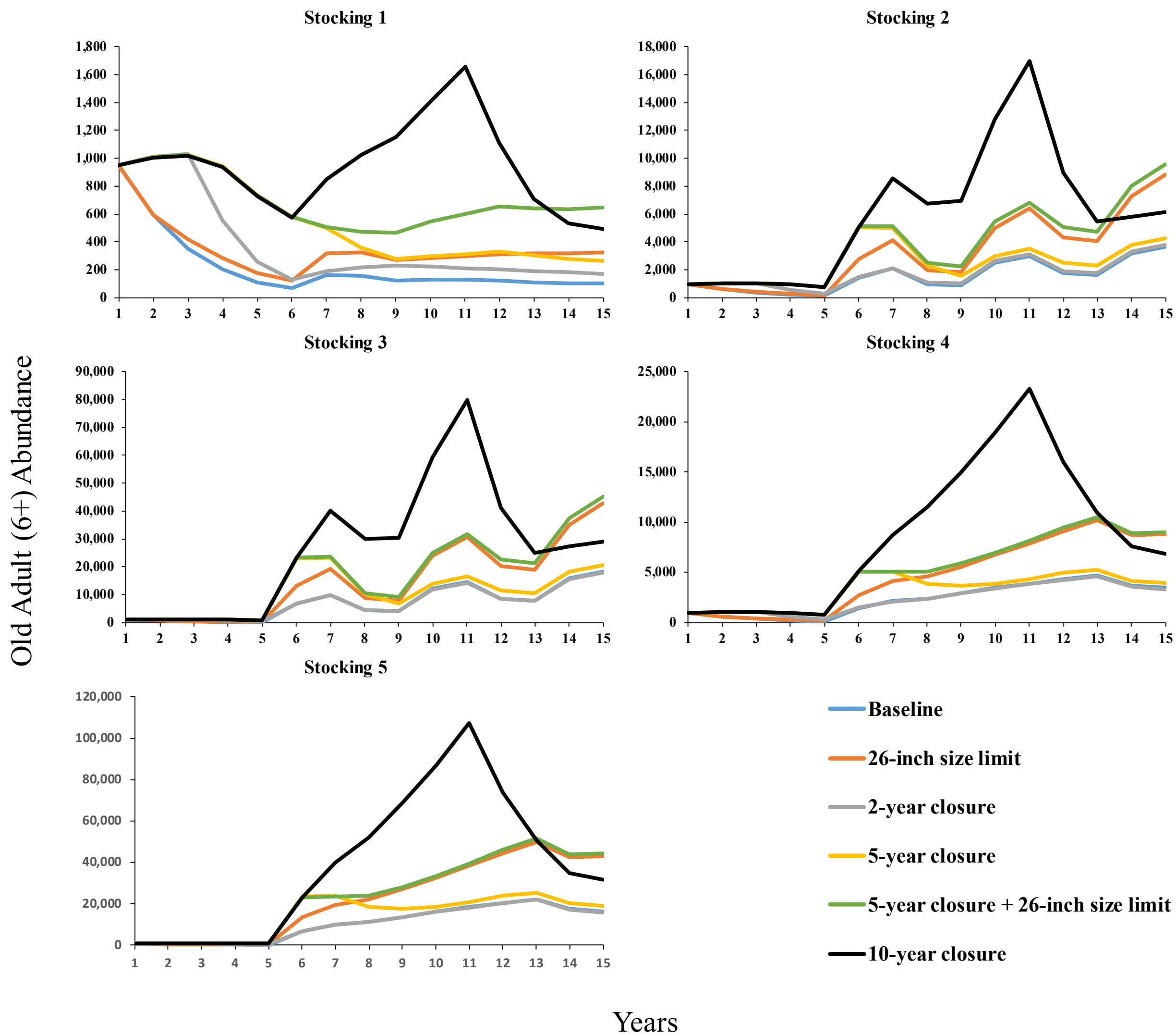


Figure 3.4. Abundance of old adults (age 6+) projected under five stocking strategies and six fishing strategies. Stocking 1 - no stocking; Stocking 2 - stocking 100,000 fish per year with 2-year stocking and 2-year no stocking alternating for 15 years (8 years of stocking in total); Stocking 3 - stocking 500,000 fish per year with 2-year stocking and 2-year no stocking alternating for 15 years (8 years of stocking in total); Stocking 4 - stocking 100,000 fish per year with 8-year continuous stocking; Stocking 5 - stocking 500,000 fish per year with 8-year continuous stocking. Lines show the median from 10,000 iterations.

Based on matrix model results, no level of fishing mortality is sustainable. Continuing the no-possession measure is important to increase the age structure and abundance of Tar-Pamlico and Neuse rivers striped bass, which should promote natural reproduction (Mathes et al. 2020). Fishing activities typically select larger fish, increasing fishing mortality disproportionally. Fishing activities impact the abundance of older fish, limiting the age structure of the population and reproductive contribution (Mathes et al. 2020). Past management measures may have maintained an artificially young age structure for a species documented to live up to age 30 (Greene et al. 2009).

An additional potential benefit of no-harvest in the CSMA is protection of A-R striped bass using juvenile and adult habitats in the Pamlico Sound and the Tar-Pamlico and Neuse rivers systems. Conventional tag return data has documented movement of smaller A-R stock striped bass into CSMA rivers (Callihan et al. 2014) and preliminary acoustic tag results from 30 adult (ages 4–5), non-hatchery origin striped bass tagged in the Tar-Pamlico and Neuse rivers indicates 63% were detected in the Albemarle Sound or on the Roanoke River spawning grounds in spring 2020 and 2021 (NCDMF unpublished data).

If the no-possession measure is discontinued in Amendment 2, alternative management strategies must be considered to manage harvest. Prior to 2019, management measures limited harvest seasons to cooler months to reduce discard mortality. Recreational fishers were subject to a two fish per person per day creel limit and commercial fishers were subject to a 10 fish per person per day limit with a maximum of two limits per commercial operation. Commercial and recreational fishers were subject to an 18-inch total length (TL) minimum size limit for striped bass, and a protective measure in joint and inland waters made it unlawful for recreational fishers to possess striped bass between 22- and 27-inches TL. In 2018, a 26-inch TL minimum size limit was established in inland waters. If harvest was allowed, changes to the size limits, or slot limits, could be considered to protect larger, older striped bass.

Among the six fishing strategies evaluated by the matrix model, a 5-year closure combined with a 26-inch TL minimum size limit was the second most effective strategy at increasing the abundance of older fish (Mathes et al. 2020). Additionally, commercial harvest was managed by an annual TAL of 25,000 pounds. With a goal of achieving self-sustaining populations in the Tar-Pamlico and Neuse rivers, lower harvest levels, alternative seasons, or area closures could be considered. Because striped bass populations in the CSMA are at an extent that sustainability is unlikely at any level of fishing mortality (Mathes et al. 2020), alternative management strategies beyond the harvest moratorium are unlikely to result in a self-sustaining stock.

<u>Gear restrictions/limits</u>

In 2004, DMF conducted a fishery independent study to test the effectiveness of various tie-down and gill net setting configurations in reducing striped bass bycatch. Results of these studies indicated distance from shore is a significant factor in striped bass catch rates, with up to a 60% reduction in striped bass catch when nets are set greater than 50 yards from shore (NCDMF 2013). Additionally, the use of tie-downs decreased striped bass catch by 85–99% in water depths greater than 3 feet, depending on season (NCDMF 2013). In 2008, the MFC approved requiring the use of 3-foot tie-downs in large mesh gill nets in internal coastal fishing waters and establishing a minimum setback distance from shore of 50 yards to effectively reduce striped bass discards (NCDMF 2013). After passing Supplement A, the MFC held a special meeting and passed a motion beyond what was contained in Supplement A instructing the DMF Director to issue a proclamation that prohibited the use of all gill nets upstream of the ferry lines on the Tar-Pamlico River and the Neuse River. The tie-down and distance from shore restrictions were maintained year-round for large mesh gill nets in the western Pamlico Sound and rivers below the ferry line (Figure 3.5). The gill net tie-down and distance from shore restrictions will remain in place as part of Amendment 2.

Rock et al. (2016) compared Tar-Pamlico and Neuse rivers striped bass dead discard estimates from observer data before and after the tie-down and distance from shore management measures were implemented (2004–2009 and 2011–2012). Average annual striped bass discards in the commercial gill net fishery were reduced by 75% following implementation. The persistent availability of striped bass within 50 yards of shore as indicated by fishery independent sampling and limited numbers of out of season observations from commercial gill nets indicate the setback and tie-down measures were effective in reducing gill net interactions with striped bass (Rock et al. 2016).

Relative annual variation in commercial gill net effort, commercial harvest, recreational effort, and recreational discards are significant factors contributing to the total mortality of striped bass in the Neuse River (Mathes et al. 2020). Reducing mortality, including dead discards, may increase spawning stock biomass and expand the age structure of spawning females (Rachels and Ricks 2018). Estimates of commercial striped bass total dead discards in the Tar-Pamlico River were greater than in the Neuse River (Mathes et al. 2020). From 2012 to 2018, commercial striped bass dead discards in these rivers averaged 1,606 fish per year; however, after the ferry line gill net closures were implemented, the average number of striped bass dead discards reduced to 522 fish per year (2019–2020; Table 3.1). In addition to the gill net closure above the ferry lines, there has also been an overall decline in large mesh gill net trips resulting from the adoption of Amendment 2 to the Southern Flounder FMP in 2019. Overall, relatively small estimates of dead discards are an indicator that distance from shore and tie-down requirements enacted in 2008 have been successful in reducing the number of striped bass discards in the commercial gill net fishery in the Tar-Pamlico and Neuse rivers (Rock et al. 2016). Lowering mortality on a stock that cannot sustain itself at any level of fishing mortality is likely to have benefits to the population.

Table 3.1. Recreational and commercial estimates of striped bass discards in Central Southern Management Area rivers, 2012–2020.

Year	Recreational Dead Discard Numbers	Commercial Dead Discards Numbers
2012	2,927	1,255
2013	2,263	1,797
2014	1,967	1,351
2015	2,158	1,536
2016	5,121	1,805
2017	8,657	2,429
2018	3,135	1,066
2019	2,150	371
2020	1,685	672
Total	30,063	12,282

Recreational measures to reduce discard mortality either through gear modifications or reduced angling effort could be considered as a management tool for the Tar-Pamlico and Neuse stocks due to the large number of fishing trips where anglers target striped bass in a catch and release fishery. From 2012 to 2020, recreational striped bass dead discards in the Tar-Pamlico and Neuse rivers averaged 3,340 fish per year. Over the past nine years, the number of recreational dead discards was more than double the number of commercial dead discards (Table 3.1). To reduce injury and stress-induced mortality in the upper Roanoke River, anglers are required to use a single barbless hook or lure from April 1 through June 30 while striped bass are concentrated near the spawning grounds. Similar measures, such as requiring non-offset circle hooks for natural bait and restricting the use of treble hooks, could be considered in the upper portions of the Tar-Pamlico and Neuse rivers. However, striped bass are not abundant in large numbers in the upriver sections of these systems, so the impact would likely be much smaller in magnitude when compared to the Roanoke River. Recreational gear restrictions could be required and focus by area and time of year. Gear restrictions that are targeted at one species in a multi-species fishery are difficult to enforce because one cannot prove intent (see section 11.3 of Amendment 1 to the NC Estuarine Striped Bass FMP).

Recreational angler education and outreach provide a viable option to improve survival of released fish. Practicing ethical angling techniques have been shown to improve survival (see NCDMF Ethical Angling brochure). Learning best management practices for ethical angling will give anglers confidence to release fish in a way that helps protect the resource for future generations. Increasing public awareness, through directed outreach and education will help anglers make informed decisions to minimize their impact to the striped bass population through catch and release mortality.

Anglers can minimize stress and exhaustion to fish by using appropriate tackle suited to the size of desired fish. Using barbless and non-offset circle hooks can increase the likelihood of jaw hooking a fish giving it a greater chance of survival at release. Additionally, handling can be minimized with rubberized landing nets and hook removal devices. When handling striped bass, it is very important to minimize the time out of water. If anglers must remove a fish from the water, return to the water as soon as possible. It's important to support the weight of the fish and never suspend it by the lip. Minimize handling and only touch fish with wet hands, avoiding contact with the eyes and gills. Anglers should resuscitate a sluggish fish by placing it into the water facing the current until it regains strength and can swim away on its own. High air and water temperatures create stressful environmental conditions for striped bass. Anglers should not target striped bass for catch and release on these days.

Commercial gear restrictions have been implemented that significantly reduce the impact of this gear on striped bass but also have other impacts. Year-round gill net closures above the ferry lines on the Tar-Pamlico and Neuse rivers impact commercial harvest of other species, such as hickory shad and American shad. The hickory shad commercial season in the Tar-Pamlico and Neuse rivers occurs from January 1–April 14. The American shad season occurs from February 15–April 14 and most American shad are harvested during the March striped bass gill net fishery. From 2012 –2017, an average of 16,805 pounds of American shad were harvested in the commercial fishery in January–March in the Tar-Pamlico and Neuse rivers (NCDMF 2013). After the gill net closure in March 2019, commercial landings and the number of trips were greatly reduced in both river systems (NCDMF 2020b). No American shad were harvested in 2019 and 125 pounds were harvested in 2020 in the Tar-Pamlico River. In the Neuse River, commercial harvest of American shad in 2019 was reduced to 1,539 pounds and 109 pounds in 2020.

Tie-downs and Distance from Shore

Proclamation M-6-2019 implemented year-round tie-down and distance from shore restrictions to reduce bycatch of striped bass. The restrictions remain in effect until Amendment 2 is adopted. Prior to the gill net closure, there were no tie-down or distance from shore measures during the commercial shad seasons, large mesh gill net tie-down and distance from shore restrictions were in place once the commercial striped bass season closed. On April 30 annually, or whenever the CSMA striped bass TAL was reached, the 3-foot tie-down and 50-yard distance from shore measures went into effect through December 31.

DMF commercial gill net observer data indicates few striped bass are caught in gill nets set greater than 25 yards from shore above the ferry lines in the Tar-Pamlico and Neuse rivers (Figure 3.6). Observer data indicates clear differences in the spatial distribution of American and hickory shad and striped bass at varying distance from shore. From 2012 to 2018 (Feb 15–April 14), hickory and American shad were caught in all trips observed above the ferry lines that were greater than 200 yards from shore, whereas only 26% of those observed trips caught striped bass. If the gill net closure is removed, requiring large mesh gill nets to be set a minimum distance of 200 yards from shore above the ferry lines would allow the commercial fisheries for hickory and American shad to operate without substantial increases in striped bass discards. Observer coverage would monitor interactions and adaptive management could be used to close the area if necessary.

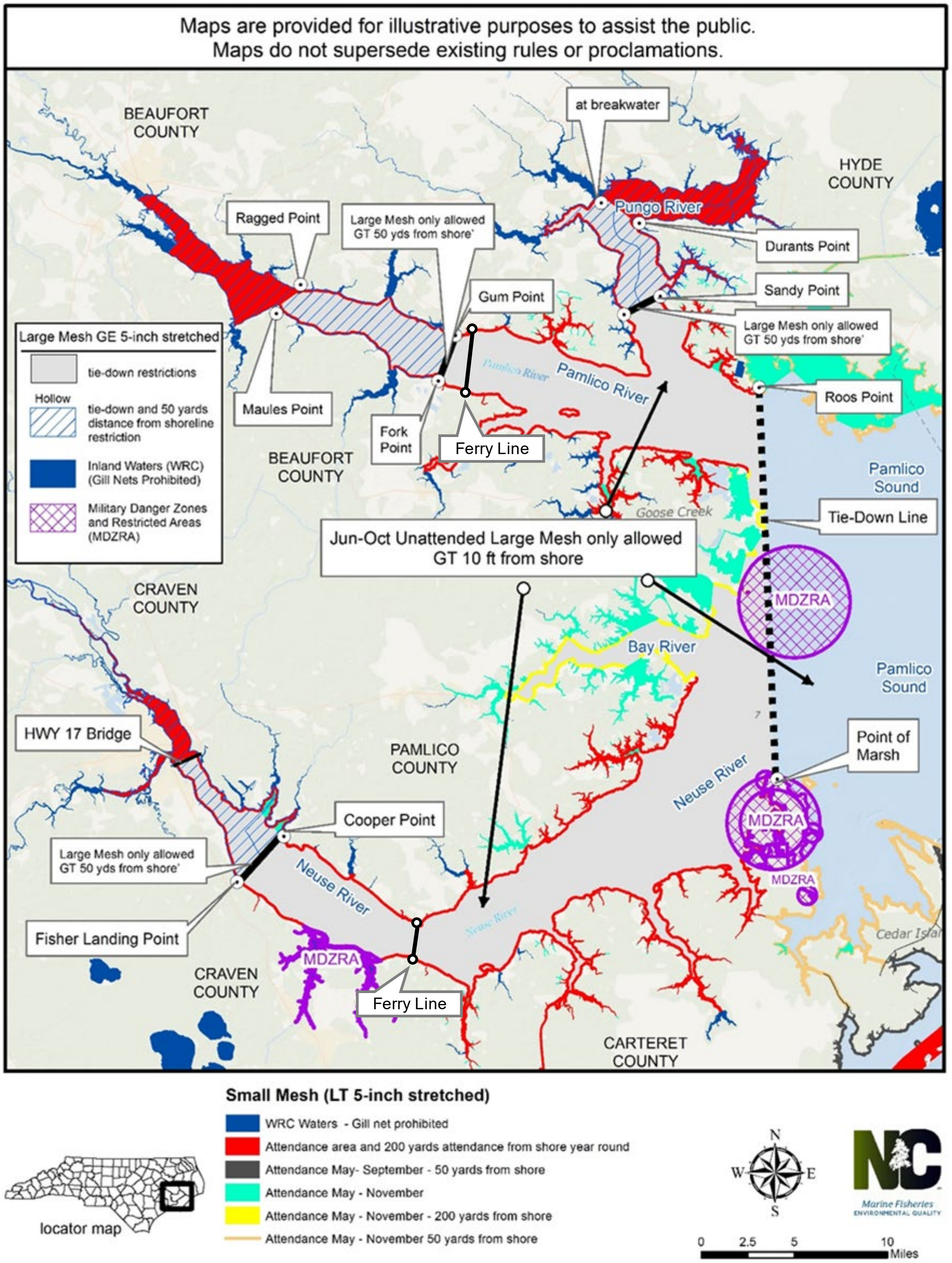


Figure 3.5. Gill net regulation map for various gill net types and seasons in the Central Southern Management Area.

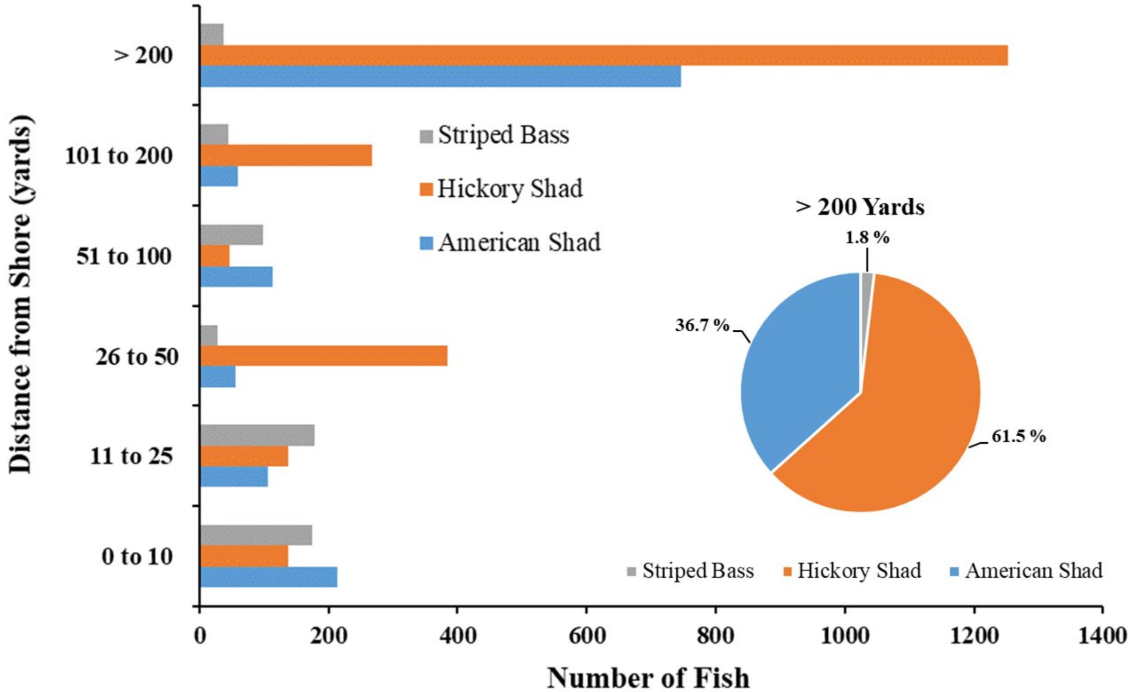


Figure 3.6. DMF observer data for striped bass, hickory shad, and American shad from gill nets set above the ferry lines on the Tar-Pamlico and Neuse rivers (2012–2020; Feb 15 – Apr 14; n=162 trips), separated by the distance from shore (yards). The insert shows the percentage of fish that were observed in gill net sets greater than 200 yards from shore (n=62 trips).

The decision in the Tar-Pamlico and Neuse rivers on opening or closing the striped bass fishery and establishing areas open or closed to gill netting is a tradeoff between providing additional protection to promote self-sustaining populations or providing opportunities to harvest limited numbers of striped bass. If the ferry line gill net closure was not carried forward, commercial gill net restrictions in place before the 2019 closure would be implemented, including the tie-down and distance from shore restrictions. Additionally, rules already in place would require year-round small mesh gill net attendance in the upper portions of the Tar-Pamlico, Pungo, Neuse, and Trent rivers and within 200 yards of shore in the lower portions of the rivers to the western Pamlico Sound. Attendance requirements for small mesh nets were put in place to reduce dead discards in the small mesh gill net fishery. If the harvest moratorium is not maintained, the rationale behind the gill net closure above the ferry lines should be reevaluated along with any additional measures that can potentially allow access to the resource while minimizing the impact on striped bass discards.

Adaptive Management

Adaptive management allows managers to adjust management measures as new information or data becomes available. Management options which are selected during FMP adoption take into account the most up to date data on the biological and environmental factors which affect the stock. After FMP adoption, data through 2024 will be reviewed in 2025 by the striped bass PDT. Trends in key population parameters like adult abundance, age structure, natural recruitment, and hatchery contribution will be evaluated to determine the impact of the 2019 no-possession provision on the stocks. Analysis will also consider environmental conditions (e.g., river flow), changes to stocking strategies, and new life history information. If the data review suggests continuing the no-possession provision is needed for additional stock recovery, no changes in harvest management measures will be recommended until the next FMP Amendment is developed. Adaptive management may be used to adjust management measures including area and time restrictions and gear restrictions if it is determined additional protections for the stocks are needed.

If analysis indicates the populations are self-sustaining and a level of sustainable harvest can be determined, recommendations for harvest strategies will be developed by the PDT. If analysis indicates biological and/or environmental factors prevent a self-sustaining population, then alternate management strategies will be developed that provide protection for and access to the resource.

MANAGEMENT OPTIONS AND IMPACTS

(+ potential positive impact of action)
(- potential negative impact of action)

1. Striped Bass Harvest
   A. Continue the no-possession measure in Supplement A to Amendment 1

      + Provides an opportunity to evaluate the population response in the absence of fishing mortality.
      + Increases abundance and expands the age structure
      + Provides protection of A-R striped bass found in the Tar-Pamlico and Neuse rivers systems
      + Provides the best chance of achieving sustainable harvest
      - Does not allow for limited harvest of the resource by commercial and recreational fishers
      - May not achieve desired results if other factors negatively influence recruitment
      - Discards in commercial and recreational fishery will still occur

   B. Discontinue the no-possession measure in Supplement A to Amendment 1 after reviewing data in 2025 if it can be shown populations are self-sustaining and a level of sustainable harvest can be determined (open harvest)

      + Allows for limited harvest of the resource by commercial and recreational fishers
      + Reduces discards
      +/- Environmental and other factors may prevent natural recruitment from occurring regardless of stock condition
      - Cannot achieve goal of sustainable harvest at any level of fishing mortality

2. Gear Restrictions/Limits

A. Maintain gill net closure above the ferry lines and maintain the 3-foot tie-downs below the ferry lines

+ Reduces dead discards from the gill net fishery
+ Could help increase abundance and expand age structure
+ Maintains reduced protected species interactions
+ Makes it easier for managers to measure any potential impacts
- Impacts commercial harvest of many species, such as, American shad
- May not increase chances of achieving sustainable harvest

3. Adaptive Management

- In 2025, review data through 2024 to determine if populations are self-sustaining and if sustainable harvest can be determined

+ Adaptive management allows for management adjustments to any of the selected management options as new data becomes available
+ Will help achieve the goal of increased abundance and expanded age structure
+ Allow for scheduled review and adjusted of management measure between scheduled FMP reviews

- Creates management uncertainty if not clearly defined

RECOMMENDATIONS

See Appendix 6 for DMF, WRC, and advisory committees recommendations and a summary of online public.

NCMFC Preferred Management Strategy

Options: 1.A., 2.A., and 3.

In addition, the MFC asked that the DMF study the effects of the gill net closure and reevaluate it at the next full amendment review. This research will be conducted, preferably within two years, and this closure be addressed based on that study.

MFC Actions

At its February 2022 business meeting, the MFC approved a motion to send the draft Estuarine Striped Bass Fishery Management Plan Amendment 2 for review by the public and advisory committees with the change of deleting Options 2.B and 2.C. from Appendix 3, leaving only Option 2.A. These options, if selected, provided access above the ferry lines to commercial gill net operations during commercial shad season. Gear, season, and area limitations were included in the options as well as observer monitoring. These options were removed from the draft plan prior to public and advisory committee review.

APPENDIX 4: ACHIEVING SUSTAINABLE HARVEST FOR THE CAPE FEAR RIVER STRIPED BASS STOCK

ISSUE

Consider existing factors that prevent a self-sustaining population in the Cape Fear River and implement management measures that provide protection for and access to the striped bass resource.

The 2020 Central Southern Management Area (CSMA) matrix and tagging models show a consistent decline in abundance estimates for striped bass in the Cape Fear River from 2012 – 2018, even with a total harvest moratorium for striped bass in place since 2008. Population abundance is maintained through stocking efforts, but genetic testing and young-of-the-year (YOY) surveys suggest limited natural striped bass reproduction occurs in the system.

ORIGINATION

North Carolina Division of Marine Fisheries (DMF) and North Carolina Wildlife Resources Commission (WRC).

BACKGROUND

Historically the Cape Fear River system supported self-sustaining populations of multiple anadromous fish species, including striped bass (Yarrow 1874; Earl 1887). Multiple factors are attributed to declines in anadromous fish stocks, including overfishing, loss of habitat, declining water quality, and blockage of upstream spawning migrations (ASMFC 2007; Limburg and Waldman 2009). Construction of three locks and dams on the mainstem of the Cape Fear River between Riegelwood and Tar Heel, NC, was completed between 1915 and 1935 (Figure 4.1). These impediments to migration severely reduced the ability of striped bass to reach historic spawning areas near Smiley's Falls at the fall line in Lillington, NC (Nichols and Louder 1970). In an effort to enhance striped bass abundance in this system, hatchery reared fish have been stocked into the Cape Fear River by management agencies since at least the 1950s (Woodroffe 2011; *Stocking Information Paper*). In 1974, DMF began a study to document and protect critical spawning habitat for anadromous fishes, resulting in the designation of Anadromous Fish Spawning Areas throughout North Carolina. Spawning areas were identified in the Cape Fear River from the mouth of Town Creek upstream to Lillington, NC (Sholar 1977). As a response to low numbers of documented spawning adults and limited evidence of juvenile recruitment, the current commercial and recreational harvest moratorium of striped bass in the Cape Fear River was implemented in 2008.

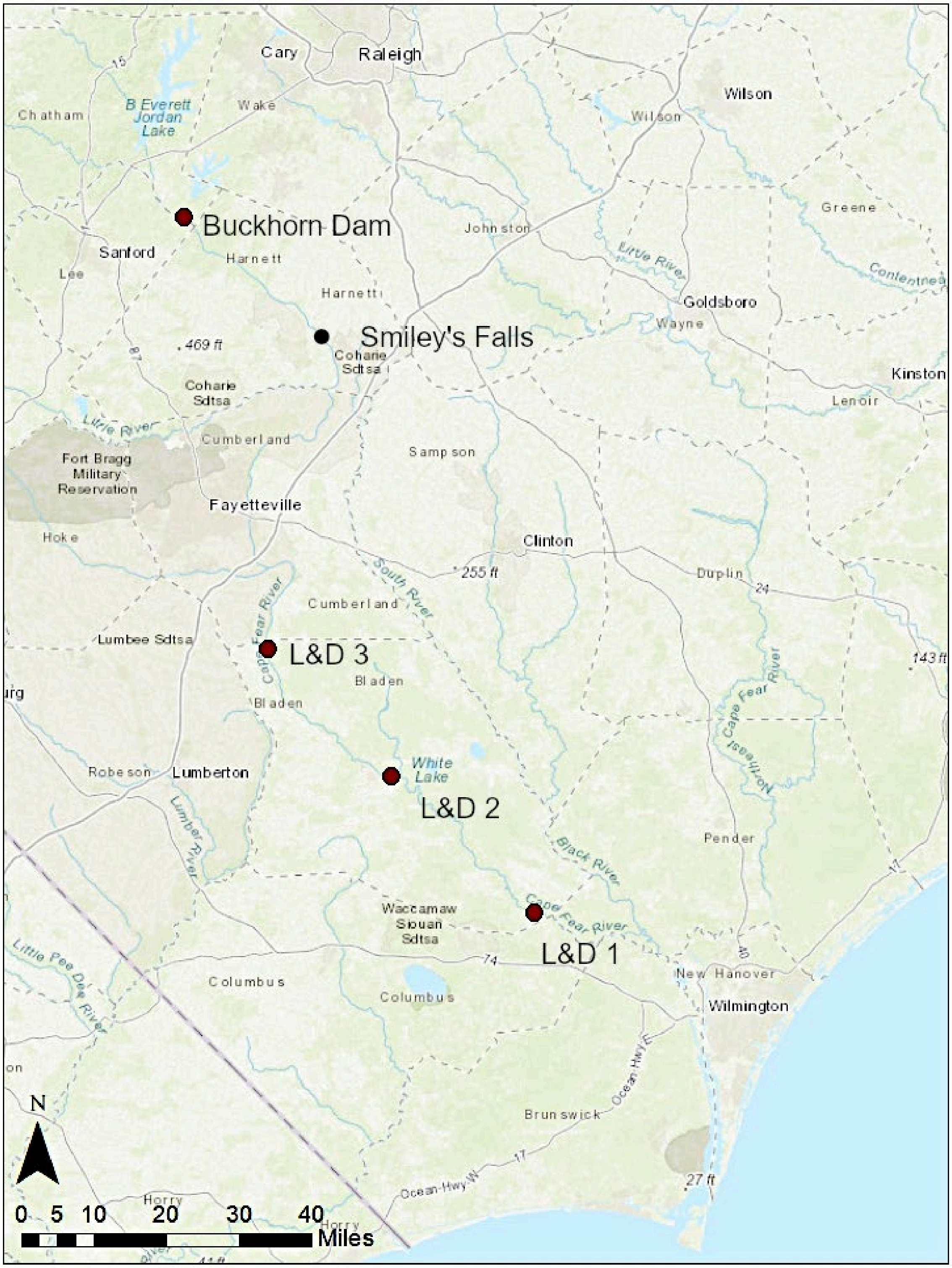


Figure 4.1. A map showing the locations of the three locks and dams on the mainstem of the Cape Fear River downstream of the historic spawning area near Smiley's Falls.

Although evidence of successful striped bass spawning in the Cape Fear River system has been documented by the collection of adult fish in spawning condition and eggs in the water column, few larvae or YOY juveniles have been observed (Hawkins 1980; Winslow et al. 1983; Smith 2009; Smith and Hightower 2012; Dial Cordy and Associates 2017; Morgeson and Fisk 2018; Rock et al. 2018). Limited natural reproduction of striped bass in the Cape Fear River Basin suggests the sustainable harvest of a self-sustaining population of wild fish is not possible at this time (Mathes et al. 2020). Evaluation of stocking efforts using parentage-based testing (PBT) analysis has shown most striped bass sampled in the Cape Fear River during spawning surveys are of hatchery origin (Boggs and Rachels 2021). Restricted access to historic spawning grounds in the mainstem Cape Fear River is likely the primary factor preventing striped bass population recovery in this system. A small amount of natural reproduction is likely occurring in the Northeast Cape Fear River, but the overall contribution to total possible production of striped bass remains unknown. Until passage of striped bass is achieved at all three locks and dams, it is unlikely sustainable harvest of wild fish will be attainable. While strategies are developed to meet passage goals, the potential for harvest of the hatchery supported population of striped bass in the Cape Fear River may be evaluated. For more information on stocking analysis see Appendix 1 Stocking in Coastal River Systems information paper.

Cape Fear River Striped Bass Stock

For a comprehensive review of striped bass life history in North Carolina, as well as the Cape Fear River, see Mathes et al. (2020) and Amendment 2 of the Estuarine Striped Bass Fishery Management Plan. Striped bass populations in the CSMA are generally considered to have an endemic riverine life history and typically do not make any oceanic migrations (Rulifson et al. 1982; Callihan 2012). Acoustic tagging studies in the Cape Fear River Basin show adult fish making seasonal migrations within the drainage and minimal emigration out of the system (Rock et al. 2018; Prescott 2019). Striped bass move upstream during the spawning season (March–May), then return to a core residency area (June–February) focused within 10 kilometers around the confluence of the Northeast and mainstem Cape Fear rivers (Rock et al. 2018; Prescott 2019). Striped bass are observed to show fidelity to either the Northeast or mainstem Cape Fear River for spawning migrations, making spring migrations up the same branch which they used the previous year before returning and mixing in the core residency area (Prescott 2019).

The WRC has conducted annual monitoring of the spawning stock of striped bass on the mainstem of the Cape Fear River since 2006. Sampling occurs weekly below each of the three locks and dams from late February through May. Adult abundance is typically much higher for the station below Lock and Dam #1 compared to the remaining stations, and peak abundance occurs in mid to late May (Figure 4.2). Very few striped bass eggs are collected above Lock and Dam #3 where the historic spawning area is located, with most eggs being collected below Lock and Dam #1 (Dial Cordy and Associates 2017). In 2017, DMF juvenile abundance trawl and seine survey stations were developed for the Cape Fear River system. Zero YOY striped bass have been collected in mainstem sampling. The last documented YOY striped bass collected in the mainstem Cape Fear River were in July 1977 (Hawkins 1980).

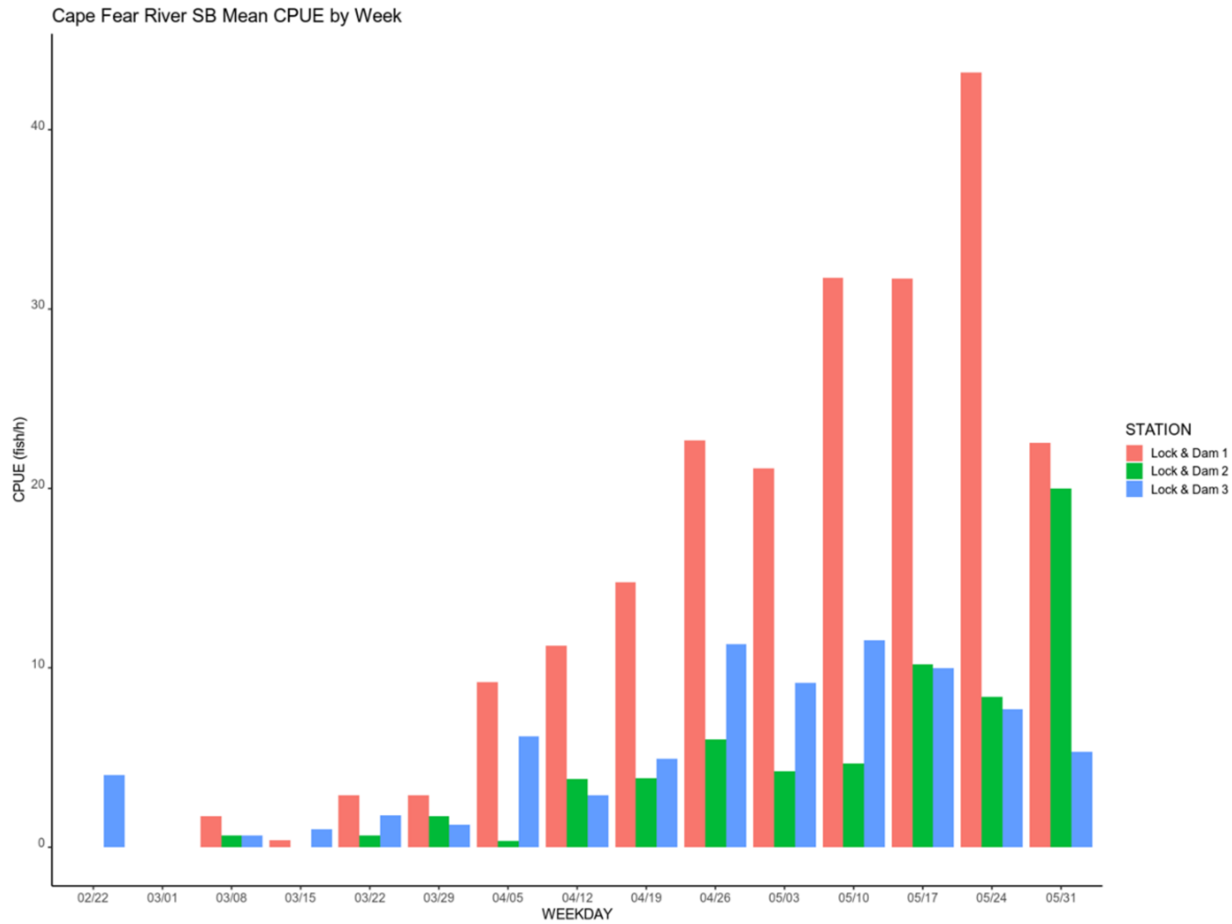


Figure 4.2. Weekly striped bass catch-per-unit-effort (CPUE) by sample site February through May 2008–2019.

In the Northeast Cape Fear River, adult striped bass have been captured and acoustically tagged during the spawning season (April – May) between White Stocking, NC, (kilometer 118) and Chinquapin, NC, (kilometer 168), with potential spawning occurring as far upstream as Hallsville, NC (kilometer 183; Rock et al. 2018). Winslow et al. (1983) documented small numbers of YOY striped bass in the lower Northeast Cape Fear River. DMF sampling collected 24 YOY striped bass in 2018, four were collected in 2019, and two were collected in 2020 at stations in the Northeast Cape Fear River (Darsee et al. 2020).

The first well documented stocking of hatchery origin striped bass into the Cape Fear system began in the 1950s (Wodroffe 2011). For a history of stocking in the Cape Fear River system see Appendix 1 Stocking in Coastal River Systems information paper. State and federal hatcheries have produced striped bass released into the system, and ongoing stocking efforts are made by a cooperative agreement between the USFWS, DMF, and WRC, which has been in place since 1986. Between 1980 and 2009, over 629,000 "phase-II" Roanoke River strain striped bass (approximately 5 – 7 inches total length), were stocked into the Cape Fear River system. Since 2010, an average of 144,000 phase-II striped bass were stocked into the system annually (Table 1.1 and 1.2). Starting in 2010, adult striped bass captured in the Cape Fear River were used as broodstock for stocking efforts into the system. No genetic difference was detected between Cape

Fear and Roanoke fish sampled between 2009–2011, and this was attributed to the previous stocking history of Roanoke hatchery origin fish into the Cape Fear system (Anderson et al. 2014). The extent of impacts from stocking striped bass originating in the Roanoke River into other striped bass populations remain relatively unknown (Rulifson and Laney 1999; Bergey et al. 2003). However, Anderson et al. (2014) suggested that, despite genetic similarity between Roanoke and Cape Fear River fish, natural reproduction of striped bass was likely occurring in the Cape Fear River.

Jordan Reservoir, a large impoundment in the Cape Fear River basin above the fall line and known historic spawning grounds for striped bass, was stocked with hybrid striped bass (*M. chrysops x M. saxatilis*) until the early 2000s. The WRC stopped stocking hybrid striped bass in Jordan Reservoir due to escapement of these fish into the lower Cape Fear River, and evidence that escaped fish would interfere with striped bass restoration efforts (e.g., interbreed with and/or outcompete for resources; Patrick and Moser 2001). Striped bass were stocked into Jordan Reservoir as a replacement for the hybrid striped bass recreational fishery from the mid-2000s until 2020. Evaluation of the stocked striped bass fishery in Jordan Reservoir suggested low survival and low angler participation, resulting in WRC discontinuing this reservoir stocking effort.

Parentage-based tagging (PBT) was implemented by the WRC as a means to determine percent hatchery contribution to the striped bass spawning populations in the CSMA systems starting in 2010. Using known genetic markers from parent brood stock, this method can determine if a fish was produced in a hatchery (Denson et al. 2012). In 2011, WRC analyzed all striped bass captured in their Cape Fear River spawning survey. In 2017, DMF began collecting additional samples in the lower portion of the Cape Fear River and in the Northeast Cape Fear River and mainstem mixing area. Additionally, a subset of the YOY captured in the Northeast Cape Fear River during 2018 and 2019 were tested, and all YOY analyzed were determined to not to be of hatchery origin and likely wild spawned. PBT results show hatchery origin fish comprise between 63% and 93% of the fish tested each year, and the percentage of fish determined to be of hatchery origin increasing annually (Table 1.4). Fish determined to be of unknown origin are not necessarily wild-spawned since parentage-based markers are only available back to the 2010 year-class of stocked fish. The 89% hatchery contribution indicated in 2018 PBT analysis is likely an accurate reflection of actual hatchery contribution to the 2018 Cape Fear River striped bass population, as striped bass aged in the system are typically less than 10 years old. Additionally, an increasing proportion of fish stocked into the upriver reservoirs are represented in the Cape Fear River system (Figure 4.3). The proportion of Jordan Reservoir stocked fish increases upriver and fish collected below Buckhorn Dam are entirely reservoir origin (Figure 4.4).

Striped Bass Fisheries

A total harvest moratorium on striped bass was enacted in 2008 as a management strategy in response to low numbers of documented spawning adults and limited evidence of juvenile recruitment in the Cape Fear River system (NCDMF 2013).

Recreational

Striped bass provide an important and popular recreational angling opportunity in the Cape Fear River. Despite a harvest moratorium, striped bass are targeted by anglers and support a catch-and-release fishery in the system. Recreational charter vessels hired by recreational fishers target Cape Fear River striped bass during the winter months; by April effort typically shifts to other fisheries.

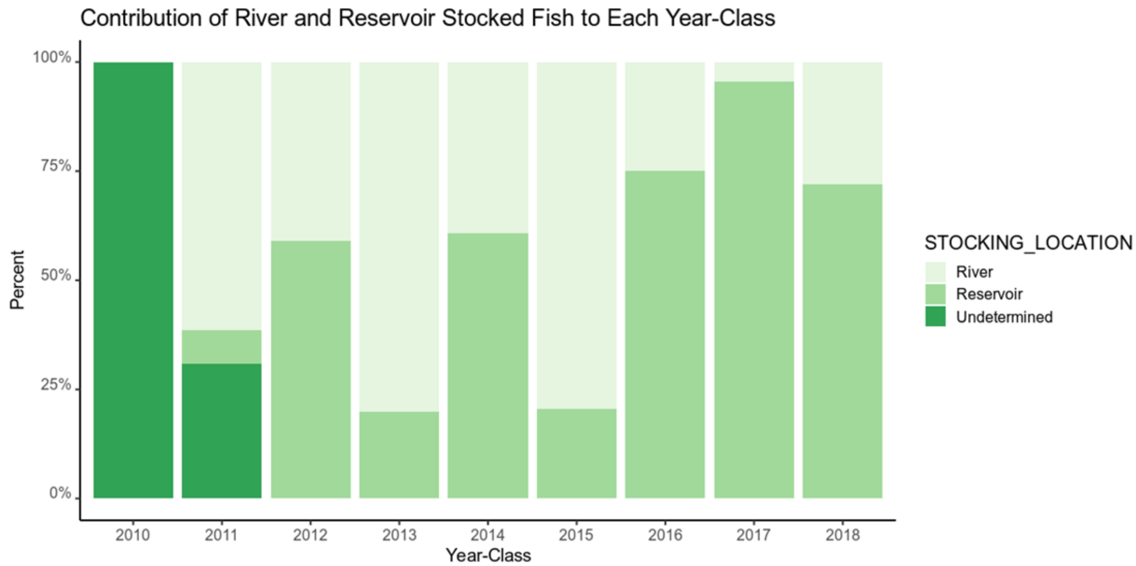


Figure 4.3. Relative contribution of hatchery-origin fish to the hatchery-origin year-class by stocking location of fish collected in WRC electrofishing surveys, 2010–2018.

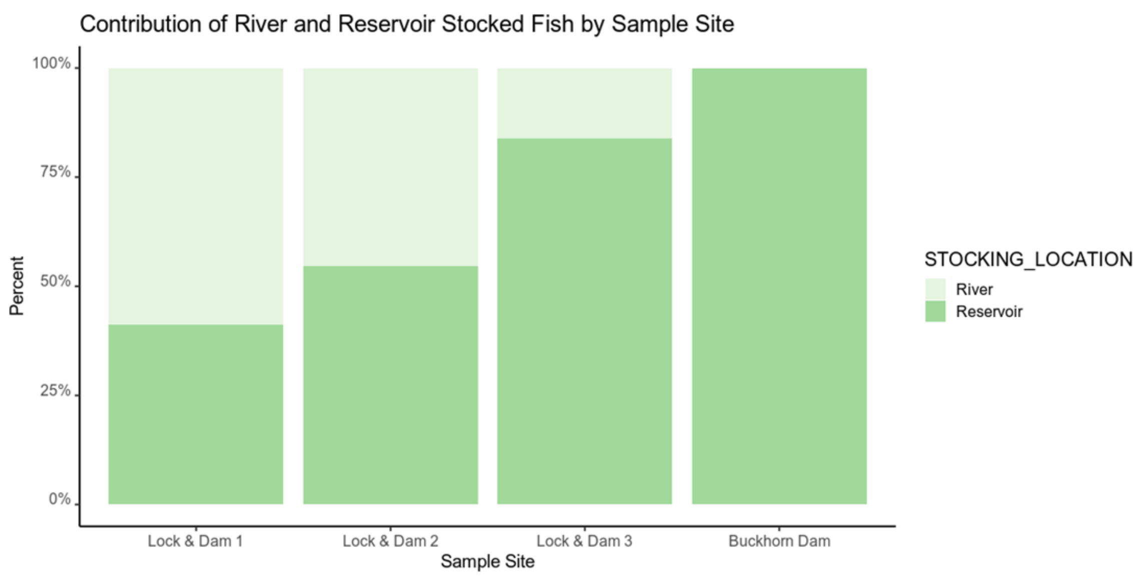


Figure 4.4. Relative contribution of hatchery-origin fish by stocking location to each WRC electrofishing sample site, 2015–2019.

Since 2013, the DMF Coastal Angling Program (CAP) has partnered with WRC on an anadromous creel survey to interview recreational anglers in the Cape Fear River for the purpose of producing effort and catch estimates for striped bass and American shad. Within the Cape Fear River, annual striped bass catch estimates are highly variable and imprecise, ranging between 14 and 1,551 fish from 2013 – 2018 (Table 4.1).

Striped bass in the Cape Fear River have been tagged using external anchor tags since 2011. These tags are highly visible and have instructions for anglers to report and return them to DMF for cash rewards. Beginning in 2015, striped bass were marked with both low ($5) and high reward tags ($100). As anglers may not report all tagged fish captured, the difference in tag returns between high (assumed to have a 100% reporting rate) and low reward tags can be used to calculate corrected low reward tag reporting rates. The percentage of tagged fish in a population which are reported by recreational anglers when taken into consideration with the tag reporting rate can be used to understand the overall recreational fishing catch. In the Cape Fear River from 2011 – 2020, 14.9% of the striped bass tagged with low reward tags were captured by recreational anglers and reported to the DMF and considering the calculated tag reporting rate this number likely represented 51.7% of the overall tagged striped bass caught by anglers during this time (Table 2.). Even though a harvest moratorium is in place, the overall proportion of high reward tagged striped bass caught and reported by recreational anglers in the Cape Fear River (28.9%) is similar to what was reported between 2020 and 2021 for high reward tags in other recreationally important species in North Carolina waters (spotted sea trout 33.3%, southern flounder 29.5%, striped bass statewide 22.4%; NCDMF 2021).

Table 4.1. Effort and catch estimates for Cape Fear River striped bass from Coastal Angling Program anadromous creel survey. PSE values are in parenthesis.

Year	Number of Striped Bass Trips	Striped Bass Trip Hours	Total Striped Bass Catch
2013	257 (48.6)	870 (63.1)	355
2014	433 (42.9)	2140 (45.9)	1,551
2105	209 (50.1)	702 (53)	199
2016	391 (46.4)	1464 (44.4)	628
2017	26 (100)	159 (100)	14
2018	24 (77.1)	61 (71.5)	140

Commercial

Between 1994 and 2008, annual commercial striped bass landings from the Cape Fear River averaged 1,206 pounds and ranged from 68 to 4,138 pounds (Table 4.2). Cape Fear River landings on average comprised less than 5% of the 25,000-pound CSMA Total Allowable Landings (TAL). Additionally, trips which contained striped bass comprised between 0.60% and 11.8% of total annual trips from the Cape Fear River which landed finfish during this time (Table 4.3). Gill nets accounted for 99.9% of the total landings of Cape Fear River striped bass, with the remainder of the landings from hook and line and crab pots (Table 4.4). Between 2011 and 2020, less than

0.01% of the reward tagged striped bass were captured and returned by commercial fishing operations.

Table 4.2. Numbers of striped bass tagged by DMF and then captured and reported by recreational anglers in the Cape Fear River by year and reward type ($5 for low reward, $100 for high reward). Low reward tag corrected reporting rate is calculated with the assumption that high reward tags are 100% reported.

	Low Reward		High Reward		
Year	# Released	% Returned	# Released	% Returned	Low Reward Corrected Reporting Rate
2011	286	4.9	*		
2012	405	6.7	*		
2013	491	9.4	*		
2014	600	13.5	*		
2015	640	18.1	49	36.7	49.3
2016	474	21.1	117	34.2	61.7
2017	349	18.3	9	33.3	55.0
2018	372	12.1	44	9.1	**
2019	259	23.2	12	0.0	**
2020	245	25.3	15	40.0	63.3
Total	4,121	14.9	246	28.9	51.7

*No high reward tags used

**Unable to be calculated

Stock Concerns

In the 2020 Central Southern Management Area (CSMA) Striped Bass Stocks report, Cape Fear River striped bass abundance estimates ranged from 1,578 (2017) to 10,983 (2012) between 2012 and 2018 (Mathes et al. 2020). Abundance estimates consistently declined over this time period, and by 2018 striped bass abundance was reduced to less than 20% of what it was in 2012 (Mathes et al. 2020).

No legal recreational or commercial harvest of striped bass has occurred in the Cape Fear River system since the harvest moratorium was established in 2008, yet adult abundance estimates have continued to decline, indicating natural reproduction in the system has been limited and non-harvest related mortality is high. Specific estimates of discard mortality are unknown in this system.

Two non-native predatory catfish species Blue Catfish (*Ictalurus furcatus*), and Flathead Catfish (*Pylodictis olivaris*) are established in the Cape Fear River system. Both of these catfish have been documented to cause reductions in the abundance and composition of native fish in the systems where they have been introduced. In the Cape Fear River, these two species have been directly observed to prey on anadromous fish, including striped bass (Ashley and Buff 1988, Belkoski et al. 2021). Population level impacts to striped bass via direct predation by introduced catfish, or through competition for the same prey resources remains unquantified in the Cape Fear system.

Table 4.3. Cape Fear River striped bass annual commercial landings in pounds from all gears, percentage that striped bass contributed to the total annual Cape Fear River finfish commercial landings, and percentage of all finfish trips with striped bass landings 1994–2008. DMF Trip Ticket Program.

Year	Landings (lbs.)	% of Total CFR Finfish Landings	% of CFR Finfish Trips With STB Landings
1994	480	0.01	2.21
1995	264	0.26	1.85
1996	4,139	3.81	11.42
1997	2,187	2.21	8.38
1998	501	0.67	6.53
1999	1,001	1.72	8.35
2000	567	0.70	5.75
2001	129	0.18	2.15
2002	173	0.22	2.51
2003	68	0.08	0.60
2004	2,364	2.96	11.80
2005	2,721	3.36	10.86
2006	1,057	1.61	4.64
2007	1,601	2.02	8.59
2008	831	1.07	6.10

Table 4.4. Percentage of total Cape Fear River commercial striped bass landings (weight) by gear, 1994–2008.

Gear	Percentage
Set sink gill net	93.09%
Set float gill net	3.58%
Drift gill net	3.15%
Runaround gill net	0.08%
Crab pot	0.06%
Hook and line	0.04%

Water quality impacts in the Cape Fear River may contribute to poor recruitment of striped bass in this system. Striped bass require dissolved oxygen (DO) levels greater than 5 mg/L (Funderburk et al. 1991), and specific flow conditions are required for the survival of egg, larvae, and juvenile life stages (Rulifson and Manooch 1990). Impacts from urban and agricultural development in the Cape Fear River Basin can negatively impact water quality parameters, and the percentage of land developed for urban and agricultural uses is generally increasing in this system. Nearly 23% of the land in the basin is used for agriculture, such as pork and poultry production (Xian and Homer 2010). Conditions such as elevated temperatures combined with nutrient loading from agricultural and stormwater runoff creates high biological oxygen demand (BOD) and low DO (below 5 mg/L) conditions in the Cape Fear River (Mallin et al. 2006). Striped bass mass mortality caused by poor water quality in the Cape Fear River associated with large storm events have also been observed. In September 2018, water quality impacts from Hurricane Florence led to fish kills in the Cape Fear River. DMF staff observed dead striped bass at multiple locations from Lock and Dam #1 to the Cape Fear River inlet at Caswell Beach and 574 dead striped bass were recovered from Battleship Park (Wilmington, NC) in the week after the storm. Numerous chemical contaminants such as endocrine disrupting compounds (EDCs), heavy metals, per- and polyfluoroalkyl chemicals (PFAS), and other organic pollutants have been found in both the fish and the water of the Cape Fear River (Mallin et al. 2011; Black and Veatch 2018; Guillette et al. 2020). Guillette et al. (2020) found concentrations of PFAS to be 40 times higher in Cape Fear River striped bass than a control group, and these elevated levels were associated with changes to the liver and immune system of the fish.

The construction of the three locks and dams on the mainstem Cape Fear River has significantly reduced the ability of striped bass to reach historic spawning habitat at the fall line. The lowermost lock and dam (river kilometer 95) was completed in 1915 and is located approximately 160 river kilometers downstream of the striped bass spawning habitat at Smiley Falls. By 1935 two more locks and dams were completed above Lock and Dam #1, further restricting possible upriver access to spawning habitat. Fish ladders were constructed at each dam, but striped bass did not successfully use them, and passage over the dam was limited to extreme high flow or locking events (Nichols and Louder 1970). From 1962–2012, the United States Army Corps of Engineers (USACE) operated a daily locking schedule developed by WRC from March through May, with the goal of passing anadromous fish over the dams; however, studies have shown that a large proportion of fish below each dam are unable to pass using the lock chamber (Moser et al. 2000; Smith and Hightower 2012). Based on acoustic telemetry results while the USACE was operating the locking schedule, Smith and Hightower (2012) estimated 77% of striped bass could pass Lock and Dam #1, and only 25% were able to pass all three locks and dams.

In 2012, a rock arch ramp was constructed at Lock and Dam #1 to allow for continuous passage of anadromous fish over the dam without the need for locking. Success criteria for the rock arch ramp was set as 80% passage efficiency for target species by project biologists. Subsequent evaluation of passage at the rock arch ramp resulted in only 25% successful passage of striped bass (Raabe et al. 2019). Despite its failure to improve passage, USACE has not conducted anadromous fish locking at Lock and Dam #1 since construction of the fishway in 2012. Additionally, the lock structures at Lock and Dam #2 and #3 were damaged by Hurricanes Matthew and Florence and have been inoperable since 2018. The rock arch ramp design at Lock and Dam #1 did not meet physical design criteria (e.g., slope, pool dimensions, weir openings) later determined to be required for successful striped bass passage by Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek and Haro 2016). Cape Fear River Watch received a Coastal Recreational Fishing License grant from DMF to modify the rock arch ramp to better meet the required passage criteria for striped bass, and construction was completed in November 2021.

The Cape Fear River Partnership is a coalition of 35 governmental, academic, and conservation organizations with a goal of restoring self-sustaining stocks of migratory fish in the Cape Fear

River. Since its formation in 2011, the Partnership has facilitated cooperation across member organizations to help achieve fish passage objectives through the construction and modification of the rock arch ramp at Lock and Dam #1 and to advance passage goals at the remaining locks and dams. Bladen County government and Cape Fear River Watch have led the efforts to engineer, design, and permit passage structures at Locks and Dams #2 and 3, securing over $3.1 M in necessary funding to date. In 2018, the USACE initiated a Disposition Study on the future of the locks and dams as they are no longer needed for their authorized purpose of maintaining commercial barge navigation between Wilmington and Fayetteville. The USACE released a draft of the Disposition Study in 2020 in which they recommend deauthorizing all three dams and transferring them to a non-federal entity. Removal of Locks and Dams #1 and #3 is unlikely, as they serve as structures to support storage and intake for the public water supplies of the Wilmington and Fayetteville areas. The NC General Assembly has enacted House Bill 2785, in which the State of North Carolina would accept the transfer of all of the locks and dams, however the structures would need to be "properly refurbished" and have fish passage structures in place for the transfer to occur. Both the NC Department of Environmental Quality and Fayetteville Public Works Commission have filed letters of intent with the USACE to take ownership of the three locks and dams if they are decommissioned. However, additional federal study and action are needed to determine the future of the dams.

In 2016 the Cape Fear River Basin was added to the Sustainable Rivers Program, a joint nationwide effort between the USACE and The Nature Conservancy (TNC) to improve the health of rivers by changing dam operations to enhance and protect ecosystems. A workshop of expert stakeholders considered biological flow needs and hydrologic conditions to make a series of environmental flow recommendations (TNC 2019). Beginning in 2020, the USACE adopted the workshop flow recommendations and modified dam release patterns during rainfall events to purposefully release flow from Jordan Reservoir during the anadromous fish migration period (March–April) to fully submerge all three locks and dams (Figure 4.5). With the dams submerged, it is believed that fish may pass without locking or the use of a fish passage structure. Preliminary evaluation of this new approach suggests that striped bass could time upstream movements with these pulsed flows and successfully migrate over the dams without a passage structure present (Bunch 2021). Additional monitoring is required to fully evaluate the efficacy of this passage strategy.

AUTHORITY

North Carolina's existing fisheries management system for striped bass is adaptive, with rulemaking authority vested in the MFC and the WRC within their respective jurisdictions. The MFC may delegate to the fisheries director the authority to issue public notices, called proclamations, suspending or implementing, in whole or in part, particular MFC rules that may be affected by variable conditions. Management of recreational and commercial striped bass regulations within the Cape Fear River are the responsibility of the MFC in Coastal and Joint Fishing Waters, and recreational regulations are the responsibility of the WRC in Joint and Inland Fishing Waters. It should also be noted that under the provisions of Amendment 1 to the North Carolina Estuarine Striped Bass FMP the DMF Director maintains proclamation authority to establish seasons, authorize or restrict fishing methods and gear, limit quantities taken or possessed, and restrict fishing areas as deemed necessary to maintain a sustainable harvest. The WRC Executive Director maintains proclamation authority to establish seasons.

Figure 4.5. Photos showing Lock and Dam #2 at lower flow during the spring anadromous fish migration period (upper image), and fully submerged during the modified dam release flow pulse which is intended to allow fish to pass over the dam without a passage structure present. Photo Credit: Aaron Bunch, Clemson University (Bunch 2021)

NORTH CAROLINA GENERAL STATUTES

N.C. General Statutes

G.S. 113-132.	JURISDICTION OF FISHERIES AGENCIES
G.S. 113-134.	RULES
G.S. 113-182.	REGULATION OF FISHING AND FISHERIES
G.S. 113-182.1.	FISHERY MANAGEMENT PLANS
G.S. 113-221.1.	PROCLAMATIONS; EMERGENCY REVIEW
G.S. 113-292.	AUTHORITY OF THE WILDLIFE RESOURCES COMMISSION IN REGULATION OF INLAND FISHING AND THE INTRODUCTION OF EXOTIC SPECIES.
G.S. 143B-289.52.	MARINE FISHERIES COMMISSION—POWERS AND DUTIES
G.S. 150B-21.1.	PROCEDURE FOR ADOPTING A TEMPORARY RULE

NORTH CAROLINA RULES

N.C. Marine Fisheries Commission Rules 2020 and N.C. Wildlife Resources Commission Rules 2020 (15A NCAC)

15A NCAC 03H .0103	PROCLAMATIONS, GENERAL
15A NCAC 03M .0201	GENERAL
15A NCAC 03M .0202	SEASON, SIZE AND HARVEST LIMIT: INTERNAL COASTAL FISHING WATERS
15A NCAC 03M .0512	COMPLIANCE WITH FISHERY MANAGEMENT PLANS
15A NCAC 03Q .0107	SPECIAL REGULATIONS: JOINT FISHING WATERS
15A NCAC 03Q .0108	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT FISHING WATERS
15A NCAC 03Q .0109	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 03Q .0202	DESCRIPTIVE BOUNDARIES FOR COASTAL-JOINT-INLAND WATERS
15A NCAC 03R .0201	STRIPED BASS MANAGEMENT AREAS
15A NCAC 10C .0107	SPECIAL REGULATIONS: JOINT WATERS
15A NCAC 10C .0108	SPECIFIC CLASSIFICATION OF WATERS
15A NCAC 10C .0110	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT FISHING WATERS
15A NCAC 10C .0111	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 10C .0301	INLAND GAME FISHES DESIGNATED
15A NCAC 10C .0314	STRIPED BASS

DISCUSSION

Maintain Cape Fear River Harvest Moratorium

Despite a total harvest moratorium and annual hatchery support, the 2020 CSMA striped bass stock report shows continued decline in abundance estimates from 2012 – 2018. Passage efficiency has been demonstrated to be poor over the current configuration of the passage structure at the lowermost dam in the Cape Fear River (Raabe et al. 2019) and egg collection studies indicate most striped bass spawning activity in the mainstem occurs below Lock and Dam #1 (Dial Cordy and Associates 2017). PBT analysis suggests low successful recruitment from wild spawned fish and shows increasing proportions of reservoir stocked fish captured in the river, with fish collected below Buckhorn Dam entirely of reservoir origin. Limited upriver access to appropriate spawning habitat may be preventing stock recovery despite limiting fishing mortality via a moratorium. Modifications for the fish passage structure at Lock and Dam #1, designed to improve passage for striped bass (construction in 2021), will potentially allow striped bass to easily migrate an additional 90 river kilometers upstream before reaching Lock and Dam #2. Anecdotal evidence suggests that fish may be able to pass over Lock and Dam #2 during higher flow conditions. Through NGO and management agency partnerships, millions of dollars to construct passage at both Lock and Dams #2 and #3 have been secured and engineering and design options have been completed. However, USACE permits have not been acquired and the total funding to construct passage at both dams remains incomplete, resulting in an undetermined construction timeframe.

The Northeast Cape Fear River does not have blockages to fish passage. However, the importance of this river for striped bass reproduction has remained relatively unexamined. Acoustic telemetry has shown repeated spring spawning migrations and YOY have been captured in this tributary. Acoustic telemetry data also shows a contingent of fish which show fidelity for the Northeast Cape Fear for spawning migrations and return to the core residency area focused within 10 kilometers around the confluence of the Northeast and mainstem Cape Fear Rivers for the rest of the year (Rock et al. 2018; Prescott 2019). This suggests a small subset of striped bass in the Cape Fear River Basin are successfully spawning in the Northeast Cape Fear and are protected from harvest under the current moratorium.

High levels of PFAS have been found in Cape Fear River striped bass (Guillette et al. 2019). While the specific biological impacts to striped bass remain unknown, the consumption of fish is linked to human PFAS exposure (Haug et al. 2010). The Environmental Protection Agency has established the health advisory levels at 70 parts per trillion in drinking water, and the Great Lakes Consortium for Fish Consumption Advisories states for fish with concentrations of greater than 200 µg/kg as "DO NOT EAT". Under a harvest moratorium, striped bass are not retained for consumption. However, DMF and WRC have not placed harvest restrictions on finfish due to consumption advisories, and no specific consumption advisory has been issued for PFOS in striped bass by the Occupational and Environmental Epidemiology Branch of the North Carolina Division of Public Health.

PBT analysis results demonstrate that most of the striped bass sampled in the Cape Fear River are of hatchery origin, and most of the fish sampled above Lock and Dam #1 are hatchery reared fish which have been stocked into the upriver reservoirs. Current WRC inland fishing regulations allow for harvest in the hatchery supported striped bass fisheries of the reservoirs in the Cape Fear basin above Buckhorn Dam. However, as the reservoir stocking of striped bass has been discontinued, the downriver migration of reservoir fish into the Cape Fear River will no longer occur.

WRC management has stated if a harvest moratorium remains in place, the continued allocation of substantial WRC resources to stock striped bass on an annual basis in the Cape Fear River cannot be justified. The North Carolina Interjurisdictional Fisheries annual stocking work plan may be modified in order to best use WRC hatchery resources for stocking other systems. For annual stocking to continue in the Cape Fear River, production of striped bass may need to be shifted to the federal partner.

Allow Seasonal Harvest in All Cape Fear River Fishing Waters

Removing the harvest moratorium for striped bass in the Cape Fear River would require a change to or suspension of MFC Rules 15A NCAC 03M .0202 (a)(b), and 15A NCAC 03Q .0107 (1)(d), as well as a change to WRC Rules 15A NCAC 10C .0107 (1)(d), and 15A NCAC 10C .0314 (h). The remaining MFC rule language would allow commercial or recreational harvest in Joint and Coastal Fishing Waters (Figure 4.6) between October 1 through April 30 and would cap the potential minimum size limit at no less than 18 inches. This rule would also allow for a recreational bag limit of no more than two fish per day. More conservative season dates, size or bag limits, and area restrictions may be specified by proclamation. Any commercial landings of striped bass from the Cape Fear River could count toward a TAL applicable to the CSMA, be managed under a separate TAL, or another strategy depending on other management actions adopted.

Allowing harvest under a hatchery supported striped bass fishery management strategy in the lower river would create equity in management throughout the system. Because very few striped bass in the Cape Fear basin appear to be of wild origin and current impediments to passage limit the ability of striped bass to reach appropriate spawning habitat in the mainstem Cape Fear, fishing mortality would likely have little impact on the amount of wild spawned fish in the system. However, an increase in fishing mortality may exacerbate the decline in abundance of striped bass observed in recent years and potentially further truncate the age structure of the population. Size and possession limits could be established to protect certain age or size classes and could potentially mitigate impacts to population demographics from increased fishing mortality. As strategies to improve passage at the locks and dams are implemented, maintaining sufficient spawning stock biomass with an expanded age structure available to migrate to the spawning grounds will be necessary for striped bass recovery efforts in the Cape Fear River.

Allowing recreational harvest of the predominantly hatchery supported striped bass in the Cape Fear River may be viewed by recreational anglers as a suitable use of the hatchery produced fishery resource. However, opening the Joint and Coastal Fishing Waters to the taking of striped bass would potentially allow for the commercial harvest of this hatchery supported population. Commercial harvest of hatchery supported fish may create user conflicts or be perceived as a poor use of the resource by recreational anglers. The potential harvest by commercial fishers could be accommodated by allocating a small quota to the commercial sector and by using contributions from commercial fishing license sales to help support the hatchery program. While striped bass from the Cape Fear River did not historically contribute much to the overall statewide commercial landings, they were a consistent component of finfish landings from the system. With increased regulation in other commercial fisheries, opening striped bass for commercial harvest in the Cape Fear River may result in a larger percentage of the finfish landings from this waterbody than before the harvest moratorium.

Allowing harvest of striped bass from all waters of the Cape Fear system would increase fishing mortality on the small and relatively unstudied contingent of potentially naturally reproducing fish in the Northeast Cape Fear River, possibly leaving them vulnerable to overharvest or depletion.

Allow Seasonal Harvest in Joint and Inland Fishing Waters in the Mainstem Cape Fear River Above 140 Bridge

Harvest area boundaries can be set with the goal of allowing harvest on hatchery supported striped bass in the Cape Fear River, while protecting the relatively small and unstudied contingent of fish that may spawn in the Northeast Cape Fear. Allowing harvest of striped bass only in the Joint and Inland Fishing Waters of the Cape Fear River above the Highway 140 Bridge (Figure 4.5), would limit the harvest of the Northeast Cape Fear contingent of fish. Opening Joint Fishing Waters above the Highway 140 Bridge to striped bass harvest could allow for the commercial harvest of striped bass in this section of river. A commercial shad drift gillnet fishery operates between February 20 and April 11 each year. Due to protected species interactions, set gill net gear has been prohibited in this section of river. Striped bass may be targeted in this fishery if harvest is allowed. A hook and line commercial fishery could be developed. For more information on hook and line as a potential commercial gear, see Appendix 5 Use of Hook and Line as a Commercial Gear in the Estuarine Striped Bass Fishery.

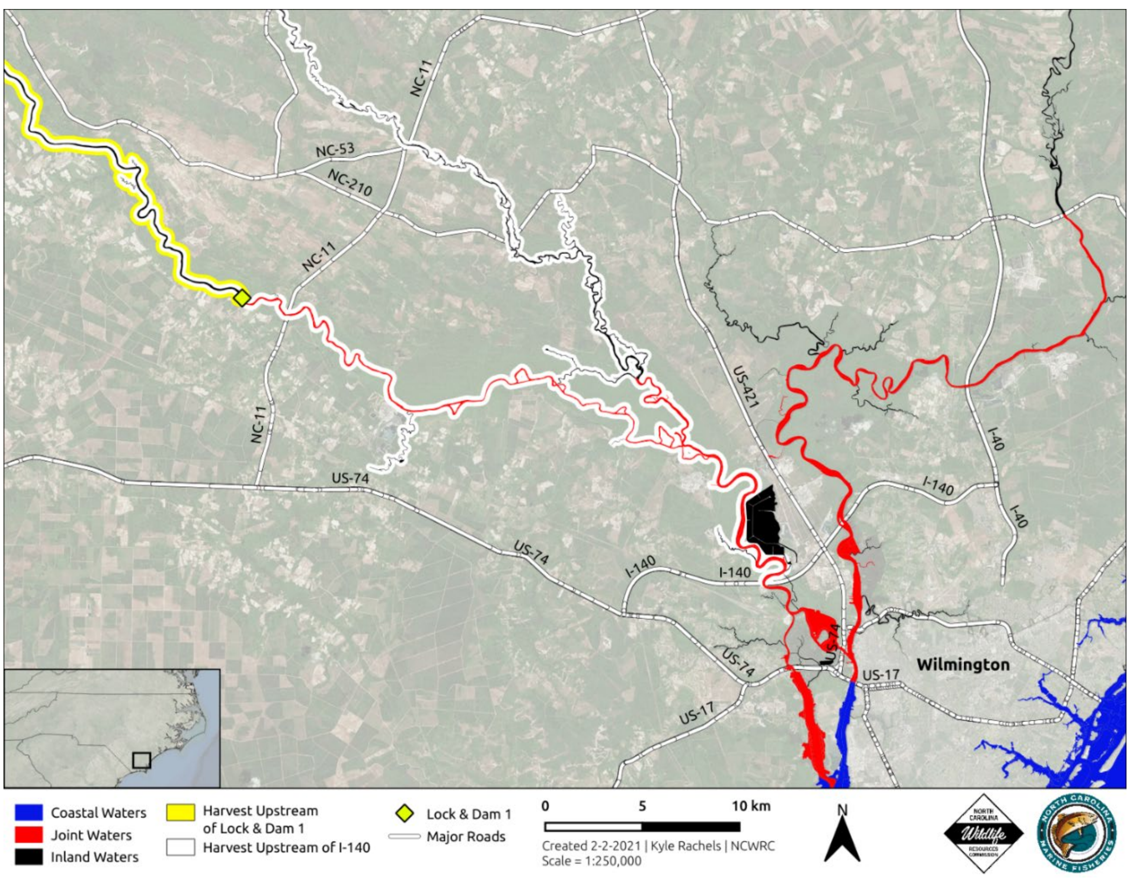


Figure 4.6. A map showing Inland, Joint, and Inland Fishing waters, as well as the harvest area boundaries for the proposed management options.

Allow Seasonal Harvest in Inland Fishing Waters only above the Joint / Inland Fishing Waters boundary on the Mainstem of the Cape Fear River

The Cape Fear River above Lock and Dam #1 is classified as Inland Fishing Waters and the commercial harvest of Inland Game Fish is prohibited in Inland Fishing Waters. Since striped bass is considered an Inland Game Fish, harvest above Lock and Dam #1 would be limited to recreational hook and line only, per inland fishing regulations. Most striped bass captured at stations above Lock and Dam #1 were determined to be hatchery origin fish which had moved down river from reservoirs. However, the discontinuation of striped bass stocking in Jordan Lake may reduce the number of fish in the Cape Fear River upstream of Lock and Dam #1. Stocking locations may be modified in the Cape Fear River to continue to supply hatchery origin fish to locations upriver of the locks and dams.

Adaptive Management

Adaptive management allows managers to change management strategies when new information or data becomes available. Management options, which are selected during the FMP process, take into account the most up to date data on the biological and environmental factors which affect the stock. After the implementation of the FMP, if additional data is available about a fishery or key factors change, adaptive management provides the flexibility to incorporate this new information to inform alternative and/or additional actions needed for sustainable fisheries management. A range of adaptive management actions, as well as criteria for their application can be established within the FMP management framework to improve both short- and long-term management outcomes.

Results from YOY juvenile abundance and distribution surveys, as well as PBT analysis can be used to evaluate natural reproduction of striped bass in the Cape Fear River system. The collection of YOY striped bass from the mainstem Cape Fear or Northeast Cape Fear rivers will be considered evidence for natural reproduction occurring in the branch where the juveniles were collected. The proportion of fish determined to be of unknown origin by PBT analysis will be used to determine the percentage of hatchery contribution to the Cape Fear River striped bass stock.

The proposed adaptive management framework for sustainable harvest of striped bass in the Cape Fear River system consists of the following:

1. Continue YOY surveys and PBT analysis after the adoption of the FMP.

a. If adopted management measures include allowing harvest of striped bass in any waters of the Cape Fear River, and YOY surveys and/or PBT analysis suggest levels of natural reproduction greater than observed up to the time of FMP adoption, then management measures may be re-evaluated and adjusted by proclamation using the authority granted to DMF and WRC directors. Rule changes or suspensions required to allow harvest.

b. If adopted management measures do not allow for harvest of striped bass in the Cape Fear River, and YOY surveys and/or PBT analysis suggest levels of natural reproduction less than observed up to the time of FMP adoption, then management measures may be re-evaluated, and harvest adjusted by proclamation using the authority granted to the DMF and WRC directors. Rule changes or suspensions required to allow harvest.

2. Management measures which may be adjusted include: means and methods, harvest area, as well as season, size and creel limit (as allowed for in rule).

3. Use of the DMF director's proclamation authority for adaptive management is contingent on evaluation of adaptive management measures by the Striped Bass Plan Development Team and consultation with the Finfish Advisory Committee.

MANAGEMENT OPTIONS

(+ potential positive impact of action)
(- potential negative impact of action)

For management of commercial striped bass regulations within Coastal and Joint Fishing Waters of the Cape Fear River, the MFC adopts rules and implements management measures. For management of recreational striped bass regulations within Coastal Fishing Waters (that are not also Joint Fishing Waters) of the Cape Fear River, the MFC adopts rules and implements management measures. For management of recreational striped bass regulations within Inland Fishing Waters of the Cape Fear River, the WRC adopts rules and implements management measures.

For management of recreational striped bass regulations within Joint Fishing Waters of the Cape Fear River, the MFC and WRC have jointly adopted rules. MFC rule 15A NCAC 03Q .0107(d) and WRC rule 15A NCAC 10C .0107(d) state it "is unlawful to possess striped bass or striped bass hybrids taken from the joint fishing waters of the Cape Fear River." If the MFC and the WRC agree to change this management measure as part of final approval of the Estuarine Striped Bass FMP Amendment 2, the corresponding rules would be amended accordingly. If the MFC and the WRC do not agree to change this management measure, the current rules would remain in place for Joint Fishing Waters.

By law, those Coastal Fishing Waters in which are found a significant number of freshwater fish, as agreed upon by the MFC and the WRC, may be classified as Joint Fishing Waters. The MFC and WRC may make joint regulations governing the responsibilities of each agency and modifying the applicability of licensing and other regulatory provisions as may be necessary for rational and compatible management of the marine and estuarine and wildlife resources in Joint Fishing Waters (G.S. 113-132). Those joint rules are found in 15A NCAC 03Q .0100 (MFC) and 10C .0100 (WRC).

1. Striped Bass Harvest
   A. Status Quo: maintain Cape Fear River harvest moratorium
   + maintains protection for Northeast Cape Fear River wild spawning contingent
   + does not increase fishing mortality to population declining in abundance
   +/- no harvest of a primarily hatchery supported stock
   +/- continues current catch and release recreational fishery

B. Allow seasonal harvest in all Cape Fear River fishing waters (proposed season and limits: open season March 1–April 30; 18-inch TL minimum length limit; 2 fish daily creel limit)
+ equity in harvest regulation across the system and user groups
+/- allow harvest of a primarily hatchery supported stock
- potential user conflicts around hatchery supported stock
- allows harvest of Northeast Cape Fear River wild spawning contingent
- may increase fishing mortality to population declining in abundance

C. Allow seasonal harvest in joint and inland fishing waters in the mainstem Cape Fear River above the 140 Bridge (proposed season and limits: open season March 1–April 30; 18-inch TL minimum length limit; 2 fish daily creel limit)
+ offers protection to Northeast Cape Fear River wild spawning contingent
+/- allow harvest of a primarily hatchery supported stock
- creates additional management boundary and regulation complexity
- inequity in harvest regulation across the system by user groups
- potential user conflicts around hatchery supported stock
- may increase fishing mortality to population declining in abundance

D. Allow harvest in inland fishing waters only above the Joint/Inland Waters boundary on the mainstem of the Cape Fear River (proposed season and limits: no closed season; 20-inch TL minimum length limit; 4 fish per day)
+ offers protection to Northeast Cape Fear River wild spawning contingent
+/- allow harvest of a primarily hatchery supported stock
- creates additional regulation complexity using existing management boundary
- inequity in harvest regulation across the system by user groups
may increase fishing mortality to population declining in abundance

2. Adaptive Management

- Continue YOY surveys and PBT analysis after the adoption of the FMP
- If YOY surveys and/or PBT analysis suggest levels of natural reproduction have increased or decreased compared to what was observed up to the time of FMP adoption, then management measures may be re-evaluated using this new information and adjusted by proclamation using the authority granted to DMF and WRC directors. Rule changes or suspensions required to allow harvest.
- Management measures which may be adjusted include means and methods, harvest area, as well as season, size and creel limit (as allowed for in rule)
- Use of the DMF director's proclamation authority for adaptive management is contingent on evaluation of adaptive management measures by the Striped Bass Plan Development Team and consultation with the Finfish Advisory Committee

+ Adaptive management allows for management adjustments to any of the selected management options as new data becomes available

- Creates management uncertainty if not clearly defined

RECOMMENDATIONS

See Appendix 6 for DMF, WRC, and advisory committees recommendations and a summary of online public.

NCMFC Preferred Management Strategy

Options: 1.A. and 2.

APPENDIX 5: THE USE OF HOOK AND LINE AS A COMMERCIAL GEAR IN THE ESTUARINE STRIPED BASS FISHERY

ISSUE

Reevaluating the use of hook and line as a gear in the estuarine striped bass commercial fishery.

ORIGINATION

North Carolina Marine Fisheries Commission (MFC) selected management strategy in Amendment 1 to the North Carolina Estuarine Striped Bass Fishery Management Plan (FMP).

BACKGROUND

In response to a petition for rulemaking received in 2010, the MFC directed the North Carolina Division of Marine Fisheries (DMF) to examine the implications of allowing and promoting a commercial hook and line fishery statewide for all finfish species. An information paper was developed and concluded the use of hook and line as a commercial gear was feasible and should be managed on a fishery-by-fishery basis in conjunction with the FMP process (NCDMF 2010).

Amendment 1 to the North Carolina Estuarine Striped Bass FMP recommended not allowing hook and line as a commercial gear for striped bass unless future restrictions on the use of gill nets necessitate alternative commercial gears (NCDMF 2013). To facilitate the adaptive management aspect of the MFC selected management strategy, the portion of rule 15A NCAC 03M .0201 which prohibited the commercial sale of striped bass taken with hook and line gear was repealed. For more information, see the issue paper titled "Estuarine Striped Bass Fishery Commercial Hook-And-Line" in Amendment 1 of the Striped Bass FMP.

Since the adoption of Amendment 1 and subsequent rule change, the Fisheries Director has used proclamation authority granted in MFC Rule 15A NCAC 03M .0202 (4) to prohibit the use of hook and line in the commercial striped bass fisheries when they occur in the Albemarle Sound Management Area (ASMA) and the Central Southern Management Area (CSMA).

The striped bass fisheries in both the ASMA and CSMA are managed through proclamations or rules designed to keep overall harvest levels below the annual Total Allowable Landings (TAL) for each management area and fishing sector (commercial or recreational). The ASMA commercial striped bass gill net fishery is regulated as a "bycatch fishery", where striped bass landings cannot exceed 50 percent by weight of all other finfish species landed by trip. Most striped bass gill net harvest in the ASMA occurs in conjunction with the American shad *(Alosa sapidissima)*, southern flounder (*Paralichthys lethostigma*), or the invasive blue catfish (*Ictalurus furcatus*) gill net fisheries. Increased gill net regulations implemented to meet sustainability objectives in the American shad and southern flounder fisheries have limited the amount of time gill nets can be set and reduced the opportunity to harvest striped bass in gill net fisheries.

The 2020 Albemarle-Roanoke striped bass benchmark stock assessment indicated the stock is overfished and overfishing is occurring (Lee et. al 2020). An evaluation of CSMA stocks indicates the striped bass populations are depressed to a point where no level of fishing mortality is sustainable (Mathes et al. 2020). As a response to poor stock conditions in the CSMA a no harvest provision has been in place for striped bass in the Cape Fear River since 2008 and in the remainder of the management area since 2019.

The only management area currently open to the commercial harvest of striped bass is the ASMA. The 2020 Revision to Amendment 1 reduced the TAL in the ASMA from 275,000 pounds to 51,216 pounds, with the goal of reducing fishing mortality and ending overfishing (NCDMF 2020). As of January 1, 2021, the commercial TAL for the ASMA was set at 25,608 pounds. The commercial fishery was open for only 16 days in the spring of 2021 and exceeded the TAL by approximately 2,000 pounds (preliminary data NC Quota Monitoring Program).

For more information on the ASMA or CSMA striped bass stocks and fisheries see: Lee et al. 2020, Mathes et al. 2020, as well as Appendices 2, 3, and 4.

Since the implementation of Amendment 1, management actions resulting in additional restrictions on the use of gill nets (e.g., area closures, shorter seasons) have prompted the need to explore the steps required for the implementation of the previously selected MFC adaptive management strategy to allow hook and line as an alternative commercial gear for striped bass. With the moratorium in the CSMA and the relatively small commercial TAL in the ASMA, commercial striped bass harvesters have not had difficulty landing all of the available striped bass TAL in recent years. However, as striped bass stocks recover, harvesters may not be able to take advantage of any future TAL increases given the increasing restrictions on the use of gill nets unrelated to striped bass. This issue paper evaluates the Amendment 1 adaptive management strategy of allowing hook and line as a commercial gear in the striped bass fishery. The proposed approach enhances the ability of DMF to monitor commercial landings, with the goal of maintaining harvest levels below the TAL needed to recover the stock.

Earlier issue papers have identified conflicts and concerns related to harvest and possession limits that arise when allowing hook and line as a commercial gear (NCDMF 2010, 2013). Based on these previously identified concerns, the DMF used the following to address management considerations required to allow hook and line gear in the commercial harvest of estuarine striped bass:

- Determine licensing requirements
- Determine harvest and possession limits
- Consider simultaneous use of hook and line with other gear types
- Distinguish commercial from recreational or for hire trips
- Tagging, landing, and reporting requirements

AUTHORITY

North Carolina General Statutes

GS 113-134	RULES
GS 113-182	REGULATION OF FISHING AND FISHERIES
GS 113-182.1	FISHERY MANAGEMENT PLANS
GS 113-221.1	PROCLAMATIONS; EMERGENCY REVIEW
GS 143B-289.52	MARINE FISHERIES COMMISSION – POWERS AND DUTIES

North Carolina Marine Fisheries Commission Rules

15A NCAC 03H .0103	PROCLAMATIONS, GENERAL
15A NCAC 03M .0201	GENERAL, STRIPED BASS
15A NCAC 03M .0202	SEASON, SIZE AND HARVEST LIMIT: INTERNAL COASTAL WATERS
15A NCAC 03M .0512	COMPLIANCE WITH FISHERY MANAGEMENT PLANS

DISCUSSION

Determine licensing requirements

Standard Commercial Fishing License (SCFL) and Retired Standard Commercial Fishing License (RSCFL) holders are allowed to commercially harvest striped bass by any legal method when the season is open in each management area. No additional licensing requirements are necessary to use hook and line as a commercial gear. However, DMF recommends the creation and requirement of a no cost Hook and Line Striped Bass Permit for SCFL or RSCFL license holders wanting to participate in this fishery. This permit would be required for the commercial harvest of striped bass by hook and line methods and allows for the targeted collection of effort and participation data for this gear type.

Summary: Require SCFL or RSCFL with Striped Bass Hook and Line Permit.

DETERMINE HARVEST AND POSSESSION LIMITS

If striped bass TAL is available for commercial harvest in a management area, the Fisheries Director may use proclamation authority to designate hook and line as a legal commercial gear. The hook and line daily individual limit should be at least the same as the daily commercial limit for gill nets, to not disincentivize this gear as a substitute for gill nets. Additionally, the daily individual limit for the commercial harvest of striped bass by hook and line may be set higher than the gill net limit as a means to encourage the use of hook and line as an alternative gear. A vessel should be limited to two daily hook and line commercial limits when two or more permit holders are on board to align with current gill net limits, both for ease of enforcement and compliance. Having commercial limits that are higher than recreational limits may incentivize latent or dual recreational and commercial license holders to use hook and line to harvest the higher commercial limits, even if these fish were not to be sold. This concern is addressed in the following sections of this paper.

Summary: The Fisheries Director may use proclamation authority to designate hook and line as a legal commercial harvest gear in a management area and set the individual harvest limit to be at least the same for both hook and line and gill net. Commercial hook and line vessels will be restricted to the proclaimed limit of two commercial license holders when two Striped Bass Permit holders are on the vessel.

CONSIDER SIMULTANEOUS USE OF HOOK AND LINE WITH OTHER GEAR TYPES

Current restrictions limit the total weight of striped bass landed in a commercial operation to not exceed 50 percent of the combined weight of the total daily catch of all species. The purpose of managing harvest in this manner is to allow commercial gill net operations targeting other species to land striped bass, reducing discards and maintaining landings below the TAL. Any hook and line only commercial trips for striped bass (no other commercial harvest gear onboard) would not be subject to a 50 percent bycatch provision.

If an area is simultaneously open to the use of commercial hook and line and gill net, both gears could be used simultaneously. This makes it challenging for law enforcement to determine which fish were captured by what gear. Any vessel that has a gill net onboard will be subject to the catch limits and harvest restrictions for gill nets (including requiring the 50 percent bycatch provision) and will be considered a gill net trip regardless of whether the gill net was used.

Summary: If an area is open to both commercial hook and line harvest and the use of gill nets, and a vessel has a gill net onboard, the vessel is subject to the catch limits and regulations governing the use of gill nets.

DISTINGUISH COMMERCIAL FROM RECREATIONAL OR FOR-HIRE TRIPS

Some individuals hold for-hire, commercial, and/or recreational fishing licenses. The use of hook and line has typically been sufficient to delineate commercial participants from recreational and for-hire sectors. A concern of allowing hook and line gear to be used both recreationally and commercially is latent SCFL or RSCFL holders and for-hire vessel captains who also hold commercial licenses using hook and line gear to land higher commercial trip limits for recreational purposes.

The number of participants landing striped bass in the commercial fishery has steadily declined in the ASMA and CSMA since the late 1990s. The number of participants peaked at 449 in the ASMA in 1999 and declined to 155 in 2020, while the number of participants peaked at 297 in the CSMA in 1997 and fell to 95 in 2018. However, the number of commercial license holders residing in counties surrounding the ASMA and CSMA that could legally participate in the fishery is much higher. In 2020, there were 1,632 SCFL/RSCFL licenses held by individuals residing in counties adjoining the ASMA and 5,282 in counties adjoining the CSMA.

Allowing hook and line as a commercial harvest gear provides individuals who hold multiple license types the ability to retain commercial limits on what would otherwise be recreational or for-hire hook and line trips. Striped bass harvested in this manner would not be sold and not reported in the NC Trip Ticket Program (TTP), resulting in an underestimate of commercial harvest from the stock. To mitigate this scenario, commercial hook and line only trips for striped bass will be restricted to no more than two people per vessel. Appropriately licensed and permitted vessels with two people or less may harvest striped bass commercially in a manner and amount defined by proclamation, and landings concerns will be addressed by reporting requirements.

Summary: Commercial hook and line harvest for striped bass will be limited to no more than two persons per vessel.

Landing and reporting requirements

It is a requirement that all striped bass landed commercially be tagged. The purpose of this tagging requirement is to minimize the illegal harvest and sale of striped bass. North Carolina requires commercially harvested striped bass to be tagged by the dealer at the point of sale. Dealers are required to report to DMF daily the number and pounds of striped bass tagged. This daily reporting requirement allows DMF to monitor harvest in near real-time which aids in ensuring the annual TAL is not exceeded.

Fish kept for personal consumption by SCFL and RSCFL holders are not sold and accounted for as landings. Without a record of sale, this harvest would not be captured in the TTP, leading to an underestimate of total removals from the stock. An accurate estimate of total removals is important information for stock assessments to estimate population abundance and determine stock status. There is no evidence that unreported landings are occurring in any significant amount with the current harvest methods allowed in the estuarine striped bass fishery. However, without additional reporting requirements the use of hook and line as a commercial gear could increase uncertainty in stock removal estimates. To minimize the uncertainty in these removal estimates, SCFL or RSCFL holders using hook and line as a commercial gear could be required to report the disposition of all retained striped bass catch (sold or kept for personal use) through the TTP. The establishment of a reporting requirement for all retained striped bass catch by commercial license holders is an option that can pursued by DMF and MFC, however enacting this requirement would need legislative action and a change to the North Carolina General Statutes.

Summary: Maintain established tagging and reporting requirements for all landed striped bass and explore options for additional reporting requirements for all commercial license holders on the disposition of all retained striped bass catch (sold or kept for personal use) through the TTP.

The ASMA is the only management area currently open to the commercial harvest of striped bass, and this stock has been determined to be overfished. To recover this stock, harvest must remain at or below the established TAL. This relatively low TAL was reached and exceeded in 16 days in 2021, with only the amount of effort and participation occurring under the current regulatory structure. By allowing the use of hook and line as gear, there is the potential for additional effort to occur in the commercial fishery. Given the current low TAL, any increase in effort may make it more difficult to constrain commercial landings within the current TAL and impact the sustainable management of this fishery. However, immediately allowing hook and line as a means of commercial harvest concurrent with the use of gill nets, even under the current low TAL, could be a proactive approach providing additional means to harvest striped bass. This additional gear may become necessary as striped bass stocks recover and the TAL increases, assuming current gill net restrictions remain in place.

Implementation of the use of hook and line gear in the commercial fishery could be delayed again until potential future restrictions or prohibitions on the use of gill nets prevent commercial striped bass harvest with this gear, or the stocks have recovered to a point where any increase in effort will not potentially impact the ability to sustainably manage harvest in the fishery. However, an additional management tool which may be necessary to consider given current stock status and the very low TAL, is limited entry. North Carolina General Statute 113-182.1 states the MFC can only recommend the General Assembly limit participation in a fishery if the commission determines sustainable harvest in the fishery cannot otherwise be achieved. In North Carolina General Statute 143B-289.52 (d1) the MFC can already regulate participation in a federal fishery, subject to a federal fishery management plan, if that plan imposes a quota on the State for the harvest and landing of fish in the fishery. As both the ASMA and CSMA striped bass stocks are in poor condition, maintaining sustainable harvest is a concern. Because the ASMA striped bass stock is overfished the MFC can consider whether the only way to achieve sustainable harvest goals in this fishery is by limiting participation.

Adaptive Management

Adaptive management allows managers to change management strategies when new information or data becomes available. Management options, which are selected during the FMP process, account for the most recent data on the biological and environmental factors that affect the stock. After implementation of the FMP, if additional data are available about a fishery or key factors change, adaptive management provides the flexibility to incorporate this new information to inform alternative and/or additional actions needed for sustainable fisheries management. A range of adaptive management actions, as well as criteria for their application, can be established within the FMP management framework to improve both short- and long-term management outcomes.

Targeted data collected from the Striped Bass Hook and Line Permit, Marine Patrol enforcement activity, as well as DMF License and Statistics TTP and Quota Monitoring data will be used to evaluate effort, participation, and striped bass hook and line landings.

The proposed adaptive management framework for the use of hook and line as a commercial gear in the estuarine striped bass fishery consists of the following:

1. Allow hook and line as a commercial gear for the harvest of striped bass.
    a. If hook and line is allowed for the commercial harvest of striped bass and TTP and Quota Monitoring data indicate the TAL will <u>either</u> be quickly exceeded <u>or</u> unable to be met during the potential striped bass season, then management measures may be re-evaluated and adjusted by the proclamation authority granted to the Fisheries Director (as is currently occurring under the existing management strategy).
    b. If hook and line is allowed for the commercial harvest of striped bass and Marine Patrol enforcement activity or License and Statistics data suggest significant amounts of unreported commercial striped bass catch is occurring, then additional tagging or reporting requirements may be developed and implemented.

2. Management measures that may be adjusted include means and methods, harvest area, as well as season, size, and quantity.
3. Implementation of adaptive management measures to enact additional increased tagging or reporting requirements is contingent on evaluation of these measures by the Striped Bass Plan Development Team and consultation with the MFC.

MANAGEMENT OPTIONS

+ (Potential positive impact of the action)
- (Potential negative impact of the action)

1. Hook and Line as a Commercial Gear
   - A. Do not allow hook and line as a commercial gear in the estuarine striped bass fishery at this time
     - + No incentive for increased effort on overfished/overfishing stock
     - + No additional regulatory burden to harvesters (additional TTP reporting)
     - - Does not provide an alternate gear for harvest with increasing regulation on gill nets
     - - Does not provide DMF additional harvest data collection (via permits and TTP)
   - B. Allow hook and line as a commercial gear in the estuarine striped bass fishery at this time
     - + Provides an alternate gear for harvest with increasing regulation on gill nets
     - + Provides DMF additional harvest data collection (via permits and TTP)
     - - Incentive for increased effort on overfished/overfishing stock

2. Adaptive Management
   - If hook and line is allowed for the commercial harvest of striped bass and NC TTP and Quota Monitoring data indicate the TAL will <u>either</u> be quickly exceeded <u>or</u> unable to be met during the potential striped bass season, then management measures may be re-evaluated and adjusted by the proclamation authority granted to the Fisheries Director (as is currently occurring under the existing management strategy).
   - If hook and line is allowed for the commercial harvest of striped bass and Marine Patrol enforcement activity or License and Statistics data suggest significant amounts of unreported commercial striped bass catch is occurring, then additional tagging or reporting requirements may be developed and implemented.
   - Management measures that may be adjusted include means and methods, harvest area, as well as season, size and limit.
   - Implementation of adaptive management measures to enact additional increased tagging or reporting requirements is contingent on evaluation of these measures by the Striped Bass Plan Development Team and consultation with the Marine Fisheries Commission.

RECOMMENDATIONS

See Appendix 6 for DMF, WRC, and advisory committees recommendations and a summary of online public.

NCMFC Preferred Management Strategy

Options: 1.A. and 2.

APPENDIX 6: SUMMARY OF DMF, WRC, MFC ADVISORY COMMITTEE RECOMMENDATIONS, AND ONLINE SURVEY RESPONDENTS FOR ISSUE PAPERS IN THE NORTH CAROLINA ESTUARINE STRIPED BASS FMP AMENDMENT 2

Table 6.1. Summary of DMF, WRC, MRC standing and regional Advisory Committee recommendations, and summary of online survey respondents for management options in the North Carolina Estuarine Striped Bass FMP Amendment 2.

Issue Paper	DMF and WRC Recommendations	Northern Regional Advisory Committee Recommendation	Southern Regional Advisory Committee Recommendation	Finfish Standing Advisory Committee Recommendation	Online Questionnaire Summary of Support *
APPENDIX 2: ACHIEVING SUSTAINABLE HARVEST FOR THE ALBEMARLE SOUND-ROANOKE RIVER STRIPED BASS STOCK	DMF: Option 1.A. WRC: Option 1.A.	No recommendation passed	Support the DMF and WRC staff initial recommendation, Option 1.A.	Support the DMF and WRC staff initial recommendation, Option 1.A.	53% Option 1.B. 41% Option 1.A. If a moratorium was in place 56% would still target striped bass for recreational catch-and-release
	DMF: Option 2.A. WRC: Option 2.A.	Support the DMF and WRC staff initial recommendation, Option 2.A.	Support the DMF and WRC staff initial recommendation, Option 2.A.	Support the DMF and WRC staff initial recommendation, Option 2.A.	70% Option 2.A. 8% Option 2.B.
	DMF: Option 3.D. WRC: Do not support any options as written; support the following modified option:	Support the DMF recommendation, Option 3.D.	Support the DMF recommendation, Option 3.D.	Support the DMF recommendation, Option 3.D.	68% single fishery payback above TAL 9% divide across all fisheries 8% single fishery pay back a portion of landings above TAL (buffer) 5% no payback
	WRC language: If the landings in any one of the three fisheries (RRMA recreational, ASMA recreational, and ASMA commercial) exceed their allocated TAL by 5% in a calendar year, any landings in excess of their allocated TAL and 5% buffer will be deducted from that fishery's allocated TAL the next calendar year. If the payback for a fishery exceeds the next year's allocated TAL, the fishery will be closed the subsequent year with no additional payback required.				
	DMF: Options 4.C. and 4.E. WRC: Options 4.C. and 4.E.	Support the DMF and WRC staff initial recommendation, Options 4.C. and 4.E.	Support the DMF and WRC staff initial recommendation, Options 4.C. and 4.E.	Support the DMF and WRC staff initial recommendation, Options 4.C. and 4.E.	83% size limit changes to increase older fish 71% Options 4.C. and 4.E. 11% status quo.

Table 6.1. Continued.

Issue Paper	DMF and WRC Recommendations	Northern Regional Advisory Committee Recommendation	Southern Regional Advisory Committee Recommendation	Finfish Standing Advisory Committee Recommendation	Online Questionnaire Summary of Support *
APPENDIX 2: CONTINUED	DMF: Options 5.A. and 5.E. WRC: Options 5.A. and 5.E.	Support the DMF and WRC staff initial recommendation, Options 5.A. and 5.E.	Support the DMF and WRC staff initial recommendation, Options 5.A. and 5.E.	Support the DMF and WRC staff initial recommendation, Options 5.A. and 5.E.	49% Option 5.B. 19% Option 5.D. 17% Option 5.E. 11% Option 5.C.
	DMF: Support all Adaptive Management measures WRC: Support all Adaptive Management measures	Support the DMF and WRC staff initial recommendation to support all Adaptive Management measures	Support the DMF and WRC staff initial recommendation to support all Adaptive Management measures	Support the DMF and WRC staff initial recommendation to support all Adaptive Management measures	N/A
APPENDIX 3: ACHIEVING SUSTAINABLE HARVEST FOR THE TAR-PAMLICO AND NEUSE RIVERS STRIPED BASS STOCKS	DMF: Option 1.A. WRC: Option 1.A.	Recommend to end no-possession measure.	Support the DMF and WRC staff initial recommendation, Option 1.A.	Support the DMF and WRC staff initial recommendation, Option 1.A.	59% Option 1.A. 32% Option 1.B.
	DMF: No recommendation WRC: Option 2.A.	Ask the MFC to end the gill net closure above the ferry lines and return to NCDMF regulations prior to the 2019 closure.	Recommend to MFC to remove the gill net moratorium above the ferry lines and re-implement the management measures prior to the 2019 closure.	No recommendation.	60% support maintaining closure above ferry lines and 3-foot tie down use below ferry lines 12% opposed
	DMF: Support all Adaptive Management measures WRC: Support all Adaptive Management measures with additional language	Support the DMF and WRC staff initial recommendation to support the Adaptive Management measure	Support the DMF and WRC staff initial recommendation to support the Adaptive Management measure	Support the DMF and WRC staff initial recommendation to support the Adaptive Management measure	N/A

Table 6.1. Continued.

Issue Paper	DMF and WRC Recommendations	Northern Regional Advisory Committee Recommendation	Southern Regional Advisory Committee Recommendation	Finfish Standing Advisory Committee Recommendation	Online Questionnaire Summary of Support *
APPENDIX 4: ACHIEVING SUSTAINABLE HARVEST FOR THE CAPE FEAR RIVER STRIPED BASS STOCK	DMF: Option 1.A. WRC: Option 1.B.	Support the DMF initial recommendation, Option 1.A.	Support the DMF initial recommendation, Option 1.A.	Support the DMF initial recommendation, Option 1.A.	65% Support continued harvest moratorium 14% opposed
	DMF: Support all Adaptive Management measures WRC: Support all Adaptive Management measures	Support the DMF and WRC staff initial recommendation to support all Adaptive Management measures	Support the DMF and WRC staff initial recommendation to support all Adaptive Management measures	Support the DMF and WRC staff initial recommendation to support all Adaptive Management measures	N/A
APPENDIX 5: THE USE OF HOOK AND LINE AS A COMMERCIAL GEAR IN THE ESTUARINE STRIPED BASS FISHERY	DMF: Option 1.A. WRC: Option 1.A.	Support the DMF initial recommendation, Option 1.A.	Support the DMF initial recommendation, Option 1.A.	Support the DMF initial recommendation, Option 1.A.	65% Option 1.A If harvest is allowed: 15% Option 1.B. 16% Option 1.C. 16% Option 1.D. 54% uncertain or no opinion.
	DMF: Support all Adaptive Management measures WRC: Support all Adaptive Management measures	Support the DMF initial recommendation to support all Adaptive Management measures	Support the DMF initial recommendation to support all Adaptive Management measures	Support the DMF initial recommendation to support all Adaptive Management measures	N/A

Breakdown of respondents: Recreational Fishing (84%), Charter/For-Hire (5%), Seafood Consumer (4%), Other (4%), Commercial Fishing (2%), NGO (2%), Seafood Dealer/Retail/Restaurant (0%), and Academic (0%).

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FISHERY MANAGEMENT PLAN UPDATE
STRIPED MULLET
AUGUST 2022

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	April 2006	
Amendments:	Amendment 1	November 2015
Revisions:	None	
Supplements:	None	
Information Updates:	None	
Schedule Changes:	None	
Comprehensive Review:	July 2020	

The North Carolina Striped Mullet Fishery Management Plan (FMP) was adopted in April 2006. The management plan established minimum and maximum commercial landings triggers of 1.3 and 3.1 million pounds (NCDMF 2006). If annual landings fall below the minimum trigger, the North Carolina Division of Marine Fisheries (NCDMF) would determine whether the decrease in landings is attributed to stock decline, decreased fishing effort, or both. If annual landings exceed the maximum trigger, NCDMF would determine whether harvest is sustainable and what factors are driving the increase in harvest. The striped mullet FMP established a daily possession limit of 200 mullets (white and striped in aggregate) per person per day in the recreational fishery.

Amendment 1 to the FMP was adopted in November 2015, and the subsequent rules were implemented in April 2016. Amendment 1 resolved issues with Newport River gill net attendance, mitigated known user group conflicts, updated the management framework, and updated minimum and maximum commercial landings triggers to 1.13 and 2.76 million pounds (NCDMF 2015). Amendment 1 maintains the 200-mullet possession limit per person in the recreational fishery.

Commercial landings in 2016 were 965,198 pounds, which is below the minimum landings trigger of 1.13 million pounds (Figure 3A). As required by the FMP, the NCDMF initiated data analysis in July 2017 to determine whether the decrease was attributed to a stock decline, decreased fishing effort, or both. The NCDMF presented preliminary findings and recommendations to the North Carolina Marine Fisheries Commission (NCMFC) during its November 2017 business meeting. It was determined by the NCDMF that no management actions were necessary at that time, but a more comprehensive analysis with data through 2017 was needed.

The NCDMF presented results of their comprehensive analysis at the February 2018 NCMFC business meeting and concluded the stock had likely declined since completion of the 2013 stock assessment, which had a terminal year of 2011. The NCDMF recommended updating the 2013 stock assessment model to include data through 2017 prior to taking management action. As an assessment update, there were no changes to model parameters and peer review was not required, as the configuration of the model that previously passed peer review was maintained. Results of the stock assessment indicated overfishing was not occurring through 2017 but could not determine if the stock was overfished (NCDMF 2018).

Subsequent management options were developed by the NCDMF and presented to the Finfish, Southern, and Northern advisory committees in July 2018 to receive input prior to finalizing the NCDMF recommendation. Recommendations were then presented to the NCMFC at its August 2018 business meeting. The NCDMF and the advisory committees recommended no management action be taken since the stock assessment update indicated overfishing was not occurring. The NCDMF would, however, continue to monitor trends in the commercial fishery and fishery-independent indices. The recommendation was approved by the NCMFC.

Review of the 2021 commercial landings indicate neither the maximum or minimum triggers have been exceeded. Review of the FMP was initiated in 2020, following the FMP review schedule.

Management Unit

Coastal and joint waters of North Carolina.

Goal and Objectives

The goal of Amendment 1 to the North Carolina Striped Mullet FMP is to manage the striped mullet fishery to preserve the long-term viability of the resource, maintain sustainable harvest, maximize social and economic value, and consider the needs of all user groups. The following objectives will be used to achieve this goal:

- Use a management strategy that provides for conservation of the striped mullet resource and promotes sustainable harvest while considering the needs of all user groups.
- Promote the protection, enhancement, and restoration of habitats and water quality necessary for the striped mullet population.
- Minimize conflict among user groups, including non-fishing user groups and activities.
- Promote research to improve the understanding of striped mullet population dynamics and ecology to improve management of the striped mullet resource.
- Initiate, enhance, and/or continue studies to collect and analyze the socio-economic data needed to properly monitor and manage the striped mullet fishery.
- Promote public awareness regarding the status and management of the North Carolina striped mullet stock.

DESCRIPTION OF THE STOCK

Biological Profile

Striped mullet are found in a wide range of depths and habitats but primarily inhabit freshwater to estuarine environments until migrating to the ocean to spawn in the fall (Able and Fahay 1998; Pattillo et al. 1999; Cardona 2000; Whitfield et al. 2012). Striped mullet serve as an ecological link between some of the smallest aquatic organisms and the highest-level predators in the marine food chain. Striped mullet feed on microorganisms such as bacteria and single-celled algae found on aquatic plants, in mud, silt, sand and decaying plant material (Odum 1968; Moore 1974; Collins 1985a; Larson and Shanks 1996; Torras et al. 2000). In turn, striped mullet are prey to top predators such as birds, fish, sharks, and porpoises (Breuer 1957; Thomson 1963; Collins 1985a; Barros and Odell 1995; Fertl and Wilson 1997).

The male and female maximum ages for striped mullet in North Carolina are 14 and 13 years old and a 15-year-old striped mullet of unknown sex was observed in 2017 by NCDMF (NCDMF 2022). The maximum size of striped mullet in North Carolina is recorded at 27.5 inches' total length (NCDMF 2022).

Striped mullet are highly fecund (upwards of 4 million eggs for a large female: Bichy 2000) and spawn in large aggregations near inlets to offshore areas (Collins and Stender 1989). Spawning individuals have been reported from September to March; however, peak spawning activity occurs from October to early December (Bichy 2000). Skipped spawning has been exhibited by striped mullet on the east coast of Florida (Myers et al. 2020) and on the eastern coast of Australia (Fowler et al. 2016). Striped mullet in North Carolina appear to mature at a younger age and larger size than other striped mullet populations (Bichy 2000). Length at 50 percent maturity occurs at 11.1 inches fork length for males (Bichy 2000) and 12.6 inches fork length for females (NCDMF 2021a).

Stock Status

The 2022 North Carolina striped mullet stock assessment (NCDMF 2022) indicated the striped mullet stock in North Carolina is overfished and overfishing is occurring.

Stock Assessment

The North Carolina striped mullet stock was modeled using stock synthesis version 3.30, an integrated statistical catch-at-age, forward-projecting, length based, age-structured model using data from 1950 to 2019. Input data included commercial landings, recreational harvest, fisheries-independent survey indices (Program 915), and biological data collected.

Both the observed data and the model predictions suggest a decreased presence of larger, older striped mullet in the population. The model has estimated declining trends in age-0 recruitment and female spawning stock biomass (SSB) over the last several decades. Estimates of fishing mortality (F) exhibit an increasing trend. Model results also indicate consistent overestimation of biomass and the highest risk for overfishing.

A fishing mortality threshold of $F_{25\%}$ and a fishing mortality target of $F_{35\%}$ were maintained from the prior assessment since the fishery continues to target mature female fish during the spawning season and the ecological importance of striped mullet. Complementary reference points for stock size were adopted based on female SSB, $SSB_{25\%}$ and $SSB_{35\%}$. The stock assessment model estimated a value of 0.37 for $F_{25\%}$ and a value of 0.26 for $F_{35\%}$. These estimates represent numbers-weighted values for ages 1 through 5. Predicated F in 2019 is 0.42, which is larger than the $F_{25\%}$ threshold and so suggests that overfishing is occurring (Figure 1). The model estimated a value of 1,364,895 (619 metric tons) for the $SSB_{25\%}$ threshold and a value of 2,238,075 (1,015 metric tons) for the $SSB_{35\%}$ target. Female SSB in 2019 was estimated at 579,915 pounds (263 metric tons), which is smaller than the $SSB_{25\%}$ threshold and so suggests the stock is overfished (Figure 2).

An external peer review was held in April 2022. The panel concluded the assessment model and results ae suitable for providing management advice for at least the next five years. The Panel considers the current model a substantial improvement from the previous assessment, representing the best scientific information available for the stock.

DESCRIPTION OF THE FISHERY

Current Regulations

There are no size restrictions, but as of July 1, 2006, there is a 200 mullet (white and striped aggregate) daily possession limit per person in the recreational fishery and the mutilated finfish rule was modified in 2006 to exempt mullet from the requirements of the rule to continue allowing mullet to be used for cut bait.

Commercial Fishery

Historically, beach seines and gill nets are the two primary gear types used in the striped mullet commercial fishery, with most commercial landings prior to 1978 coming from the beach seine fishery. Gill nets (runaround, set, and drift) replaced seines as the dominant commercial gear type in 1979. Because the commercial fishery primarily targets striped mullet for roe, the fishery is seasonal with the highest demand and landings occurring in the fall when large schools form during their spawning migration to the ocean and females are ripe with eggs. Striped mullet are primarily targeted commercially using runaround gill nets in the estuarine and ocean waters of North Carolina. The striped mullet beach seine fishery primarily occurs in conjunction with the Bogue Banks stop net fishery. The stop net fishery has operated under fixed seasons and net and area restrictions since 1993. Stop nets are limited in number (four), length (400 yards), and mesh sizes (minimum eight inches outside panels, six inches middle section). Stop nets are only permitted along Bogue Banks (Carteret County) in the Atlantic Ocean from October 1 to November 30. However, the stop net season was extended to include December 3 to December 17 in 2015 due to minimal landings of striped mullet (Proclamation M-28-2015). In 2020 and 2021, the stop net fishery was open from October 15 through December 31 (Proclamations M-17-2020 and M-21-2021). Due to the schooling nature of striped mullet, the beach seine fishery has the potential to be, and historically has been, a high-volume fishery with thousands of pounds landed during a single trip. In addition, the use of cast nets in the striped mullet commercial fishery has been increasing since around 2003.

Since 1991, commercial landings have ranged from a low of 965,198 pounds in 2016 to a high 3,063,853 pounds in 1993 (Table 1; Figure 3A). From 2003 to 2009, landings were stable between 1,598,617 and 1,728,607 pounds before increasing to 2,082,832 pounds in 2010. Landings fluctuated annually between 1.5 and 2.0 million pounds from 2010 to 2014 before declining in 2015 and again in 2016, dropping below the minimum commercial landings trigger established by Amendment 1. Commercial landings in 2021 increased to 2,135,952 pounds, which is 1,005,952 pounds above the minimum commercial landings trigger.

Recreational Fishery

The federal Marine Recreational Information Program (MRIP) is primarily designed to sample anglers who use rod and reel as the mode of capture. Since most striped mullet are caught with cast nets for bait, striped mullet recreational harvest data are imprecise. In addition, angler misidentification between striped mullet and white mullet is common, and bait mullet are usually released by anglers before visual verification by creel clerks is possible. As such, mullets are not identified to the species level in the MRIP data (Catch Type B). Beginning in 2002, MRIP began deferring to mullet genus to classify unobserved type B1 (harvested/unavailable catch) and B2 (released/unavailable catch) catch. As a result, the magnitude of recreational harvest for mullet genus in units of numbers far exceeds that of both striped mullet and white mullet. This methodological improvement served to greatly increase the precision of estimates albeit without species level resolution. As such, estimates of recreational harvest for mullet prior to 2002 are considered unreliable.

The 2022 striped mullet stock assessment used the sum of recreational striped mullet harvest and a proportion of the recreational harvest of mullet genus for removals by the recreational fleet (NCDMF 2022). The proportion of mullet genus assumed to be striped mullet in the recreational harvest was 29%, a value derived from a study by the NCDMF of cast net recreational harvest for striped mullet (NCDMF 2006).

Recreational harvest peaked in 2002 and 2003 at greater than four million fish harvested (Table 1, Figure 3B). From 2004 to 2017 recreational harvest remained stable at around one million fish before declining in 2018, 2019 and 2020 to around 500,000 fish. This decline was likely related to decreased abundance of striped mullet and regulations that drastically shortened the recreational fishing season for southern flounder, a fishery where live mullet is a popular bait. Recreational harvest in 2021 was 1,484,850 fish.

The length-frequency distributions collected in North Carolina's MRIP survey are considered to be an inaccurate representation of the recreational fishery. This is due to biases in the methodology of the program and angler behavior. Lengths collected in North Carolina's MRIP survey are recorded at the dock and therefore only represent fish brought back to be kept by the angler. Anglers typically only keep the largest mullet, whether it be for personal consumption, or to be saved for use as cut bait. This bias toward keeping only the largest striped mullet has caused them to be disproportionately represented in the MRIP data. The vast majority of striped mullet harvested in the recreational fishery are used as live bait for other fisheries. For this type of fishing, "finger mullet", or age-0 fish, approximately four inches in total length are used.

Striped mullet harvest data from the Recreational Commercial Gear License (RCGL) were collected from 2002 to 2008. The program was discontinued in 2009 due to a lack of funding and the minimal contributions from RCGL to overall harvest. From 2002 through 2008, an average of 41,512 pounds of striped mullet were harvested per year using a RCGL (NCDMF 2021b).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The number of striped mullet measured per year in fishery-dependent programs between 1994 and 2021 ranged from 123 to 13,212 with the lowest number measured in 1996 (Table 2). In 2021, 7,239 striped mullet were measured from commercial catches; a more than 70% increase from the previous year. Variation in mean length was low, usually falling between 12.0- and 14.5-inches fork length (FL), with the lowest mean length occurring in 1997 (12.8 inches FL). Minimum and maximum lengths fell within a small range with maximum length ranging from 20.0 to 28.0 inches fork length, though in 1994 and 1996, maximum length was below 20.0 inches (Table 3).

From 1994 through 2021 the size range of striped mullet captured in the commercial fishery as determined from commercial fish house samples ranged from 6.0 to 28.0 inches FL (Figure 4). Modal length generally falls between 11.0 and 15.0 inches. In all years there are few striped mullet over 18.0 inches present in the catch.

Fishery-Independent Monitoring

The Fishery-Independent Gill-Net Survey (Program 915), began in 2001 and included sampling in the Pamlico Sound along the Hyde and Dare County shorelines. In July 2003, sampling was expanded to include the Neuse, Pamlico, and Pungo rivers. Additional areas in the Southern District including the New and Cape Fear rivers were added in April 2008. A stratified random sampling design is used based on area and water depth. Sampling occurs from mid-February to mid-December using an array of gill nets with stretched mesh sizes ranging from 3.0 inches to 6.5 inches.

To provide the most relevant indices for use in the 2022 stock assessment, Program 915 data were limited to those collected from shallow water during August through December. A combined index, with a starting year of 2008 and data collected from the Pamlico Sound, Pamlico River, Pungo River, Neuse River, and New River was calculated. Relative abundance increased through 2011 before declining to its lowest point in 2015 (Figure 5). Since 2015, abundance has increased with peaks in 2018 and 2021.

From 2008 to 2021, the size of striped mullet captured during the August to November portion of Program 915 in the Pamlico Sound, Pamlico River, Pungo River, Neuse River, and New River ranged from 7.0 to 26.0 inches FL (juveniles excluded, see NCDMF 2022 for juvenile length cut offs; Figure 6). Modal length ranged from 11.0 to 13.0 inches FL and was 12.0 inches FL in most years. Few striped mullet less than 10.0 inches FL and greater than 15.0 inches FL are captured in this survey.

During 2020 no indices of abundance are available for striped mullet from Program 915. Sampling in this program was suspended in February 2020 due to COVID-19 restrictions and protected species interactions but resumed July 2021.

Striped mullet age samples are collected from numerous NCDMF fishery independent and dependent sources. Modal age was two in all years except 1996, 1999, 2001, 2003 and 2005 when modal age was one, and 2017 when modal age was 1-2 (Table 3). Minimum age was zero in every year except 2010 when the minimum age was one. Maximum age ranged from six in 1996, 2012, 2014, and 2015 to 15 in 2017. There is substantial overlap in length at age for striped mullet (Figure 7). Striped mullet grow quickly from age 0 to age 2 before growth slows after age 3.

RESEARCH NEEDS

The following research needs were compiled from those listed in the 2022 Striped Mullet Stock Assessment (NCDMF 2022). Improved assessment and management of striped mullet is dependent upon research needs being met. Research needs are broken into high, medium, and low priority.

High

- Increase sampling of recreational mullet catches to determine the proportion of striped versus white mullet and improve estimates of recreational landings.
- Improve characterization of the length and age structure of recreational fisheries removals by increasing the number of age samples and number of trips sampled for lengths and ages from fisheries-dependent sources.
- Develop a reliable fisheries-independent abundance index for larger juveniles to characterize trends in recruitment.
- Consider expanding Program 915 to include the northern part of the state (Albemarle sound and major tributaries).
- Evaluate the current sampling methodology of Program 146 and effectiveness for sampling striped mullet; since this survey was not considered useful for the assessment of striped mullet, consider dropping this survey and focusing effort elsewhere if it is not contributing to management of other species.
- Consider running a simpler, single-sex version of the stock assessment model.

Medium

- Consider a tagging program to provide estimates of stock size, F, and M.
- Consider genetic and/or tagging studies to examine extent of the unit stock on a regional basis for the south Atlantic as well as the Gulf of Mexico.
- Expand ichthyoplankton survey to other inlets throughout the state.
- Conduct an age validation study of known age fish to provide estimates of ageing error.

- Consider alternative weighting of data sources in future stock assessments.
- Develop estimates of fecundity for North Carolina striped mullet.

Low

- Perform an acoustic tagging study to evaluate spatial and temporal variation in habitat use to more effectively design and conduct fisheries-independent surveys.
- Investigate the predation impact on striped mullet; striped mullet is widely believed to be an important forage species but there is little evidence to support this claim in the North Carolina stock.
- Investigate environmental factors that influence the spatial and temporal distribution of larval striped mullet.

MANAGEMENT STRATEGY

The management strategy for the striped mullet fisheries in North Carolina is to: 1) optimize resource utilization over the long-term; 2) reduce user group conflicts; 3) promote public education. The first strategy will be accomplished by protecting critical habitats and monitoring stock status. To address user group conflicts, a rule change was made to limit how much of a waterway may be blocked by runaround, drift, or other non-stationary gill nets. Specific user group conflicts will continue to be dealt with on a case-by-case basis and management actions will be implemented to address specific fishery-related problems. Issues addressed in formulating Amendment 1 of the management plan for North Carolina's striped mullet fishery included: 1) resolution of the Newport River gill net attendance; 2) user group conflicts; 3) updating the management framework for the N.C. striped mullet stock.

Minimum and maximum landings triggers of 1.13 and 2.76 million pounds have been established to monitor the striped mullet fishery. If landings fall below the minimum landings trigger or exceed the maximum landings trigger, the NCDMF will determine if a new stock assessment and/or interim management action is needed. The management strategy is under review as part of the scheduled review of the plan and the overfished and overfishing stock status determined from the most recent stock assessment.

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATIONS

Striped mullet commercial landings in 2021 were 2,135,952 pounds, which is above the minimum and below the maximum commercial landing triggers established in Amendment 1. Review of the plan is underway. Results of the 2022 striped mullet stock assessment (NCDMF 2022) indicate the North Carolina striped mullet stock is overfished and overfishing is occurring through the terminal year of 2019. As statutorily required, management measures will be developed through Amendment 2 to end overfishing and rebuild spawning stock biomass.

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TABLES

Table 1. Recreational harvest (number of fish landed and weight in pounds) and releases (number of fish) and commercial harvest (weight in pounds) of spotted seatrout from North Carolina, 1991–2021. Number released and weight landed cannot be determined because of uncertainty in reported species identification.

Year	Recreational			Commercial	
	Number Landed	Number Released	Weight Landed (lb)	Weight Landed (lb)	Total Weight (lb)
1991	.	.	.	1467448	1467448
1992	.	.	.	1820494	1820494
1993	.	.	.	3063853	3063853
1994	.	.	.	1726242	1726242
1995	.	.	.	2298446	2298446
1996	.	.	.	1756863	1756863
1997	.	.	.	2442657	2442657
1998	.	.	.	2218108	2218108
1999	.	.	.	1460850	1460850
2000	.	.	.	2829086	2829086
2001	.	.	.	2317655	2317655
2002	5967684	.	.	2596304	2596304
2003	4090368	.	.	1629314	1629314
2004	1394707	.	.	1598617	1598617
2005	1312234	.	.	1620394	1620394
2006	1059444	.	.	1728607	1728607
2007	1766373	.	.	1668804	1668804
2008	1191633	.	.	1675859	1675859
2009	1167086	.	.	1685615	1685615
2010	1319070	.	.	2082832	2082832
2011	1139786	.	.	1627894	1627894
2012	1369975	.	.	1859587	1859587
2013	1453038	.	.	1549157	1549157
2014	1352690	.	.	1828351	1828351
2015	1420378	.	.	1247044	1247044
2016	1491533	.	.	965337	965337
2017	1537183	.	.	1366351	1366351
2018	489321	.	.	1314385	1314385
2019	562089	.	.	1362217	1362217
2020	531875	.	.	1299464	1299464
2021	1484850	.	.	2135952	2135952
Total	1671366	.	.	1803594	1803594

Table 2. Mean, minimum, and maximum lengths (fork length, inches) of striped mullet measured from the commercial fisheries, 1994–2021.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
1994	13.0	6.1	19.1	302
1995	14.5	9.3	21.6	255
1996	13.5	10.0	18.5	123
1997	12.8	9.2	22.8	2,048
1998	13.1	8.6	25.4	1,600
1999	13.4	8.7	23.9	1,759
2000	13.4	8.3	23.5	7,522
2001	14.1	8.1	20.9	5,726
2002	13.2	5.9	21.3	10,989
2003	13.2	6.3	24.5	7,170
2004	13.1	7.6	24.4	12,778
2005	13.5	7.8	22.6	10,270
2006	13.7	7.8	22.2	12,108
2007	13.5	7.1	27.5	12,141
2008	14.1	8.4	24.1	13,212
2009	14.1	8.0	22.4	8,241
2010	13.9	8.1	22.7	10,991
2011	13.9	6.5	22.1	7,750
2012	14.0	7.9	22.2	12,833
2013	14.2	8.3	24.3	8,535
2014	13.8	7.7	24.0	6,517
2015	14.2	8.1	24.9	5,923
2016	14.3	8.9	24.1	5,661
2017	14.2	7.8	28.6	4,480
2018	14.5	8.3	22.5	4,111
2019	14.6	8.7	22.8	4,922
2020	13.8	8.3	21.9	4,246
2021	14.3	8.8	24.7	7,239

Table 3. Modal age, minimum age, maximum age, and number aged for striped mullet collected through NCDMF sampling programs, 1996–2021. Age data from 2021 are preliminary.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
1996	1	0	6	163
1997	2	0	7	344
1998	2	0	7	717
1999	1	0	8	753
2000	2	0	10	1,122
2001	1	0	11	705
2002	2	0	7	625
2003	1	0	13	765
2004	2	0	9	1,142
2005	1	0	10	654
2006	2	0	10	685
2007	2	0	10	699
2008	2	0	10	771
2009	2	0	13	349
2010	2	1	8	748
2011	2	0	14	633
2012	2	0	6	873
2013	2	0	7	850
2014	2	0	6	855
2015	2	0	6	769
2016	2	0	8	956
2017	1-2	0	15	695
2018	2	0	10	770
2019	2	0	13	827
2020	2	0	7	269
2021	2	0	10	933

FIGURES

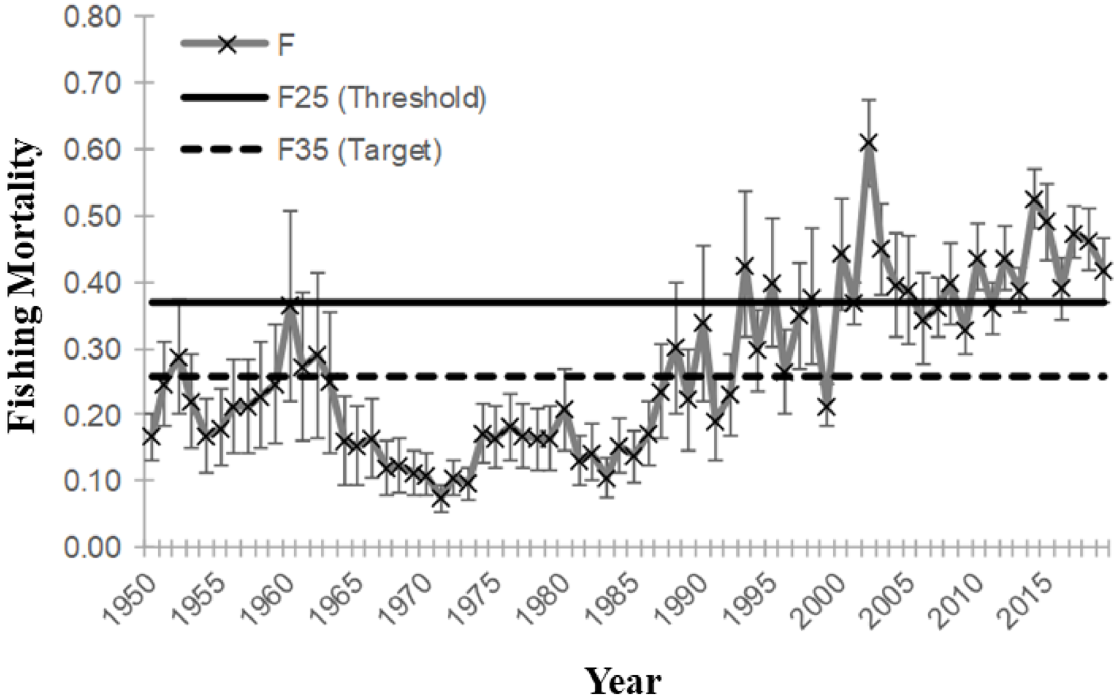

Figure 1. Annual predicted fishing mortality rates (numbers-weighted, ages 1–5) compared to estimated FThreshold (F25%) and FTarget (F35%), 1950–2019. 2019 is the terminal year for the most recent striped mullet stock assessment (NCDMF 2022).

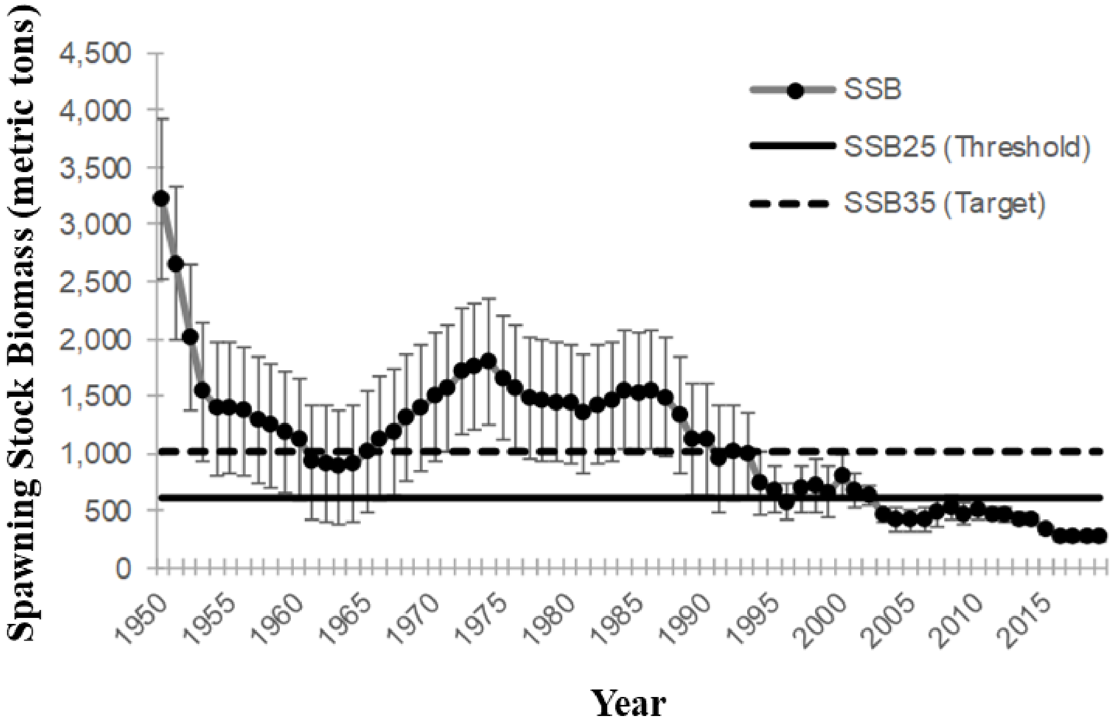

Figure 2. Annual predicted spawning stock biomass in metric tons, compared to estimated SSBThreshold (SSB25%) and SSBTarget (SSB35%), 1950–2019. 2019 is the terminal year for the most recent striped mullet stock assessment (NCDMF 2022).

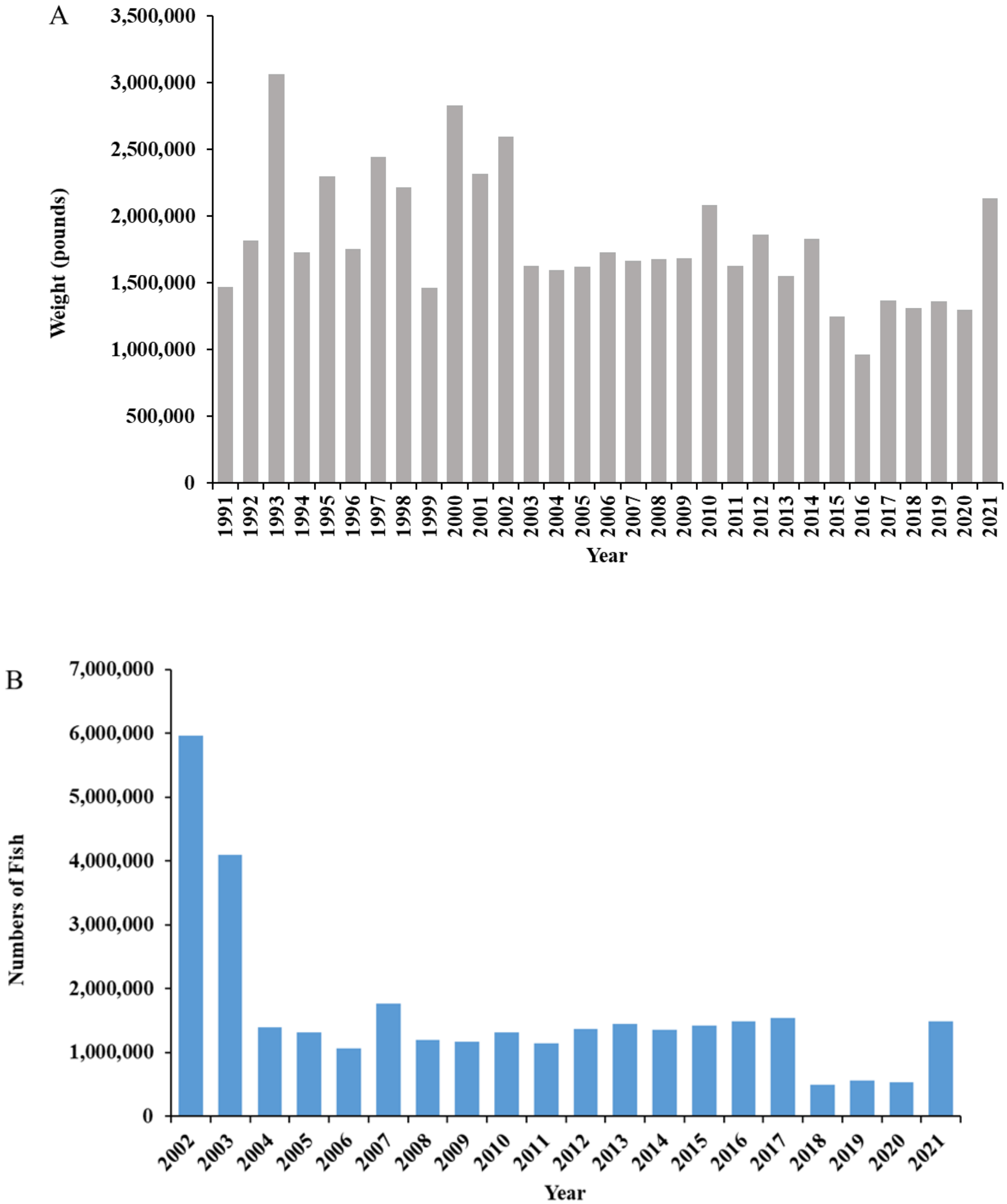

Figure 3. Striped mullet commercial landings (pounds) reported through the North Carolina Trip Ticket Program (A), 1991–2021. Recreational landings (Type A + B1; numbers of fish) includes estimates of striped mullet plus 29% of the mullet genus harvest from the Marine Recreational Information Program survey for North Carolina, 2002–2021 (B).

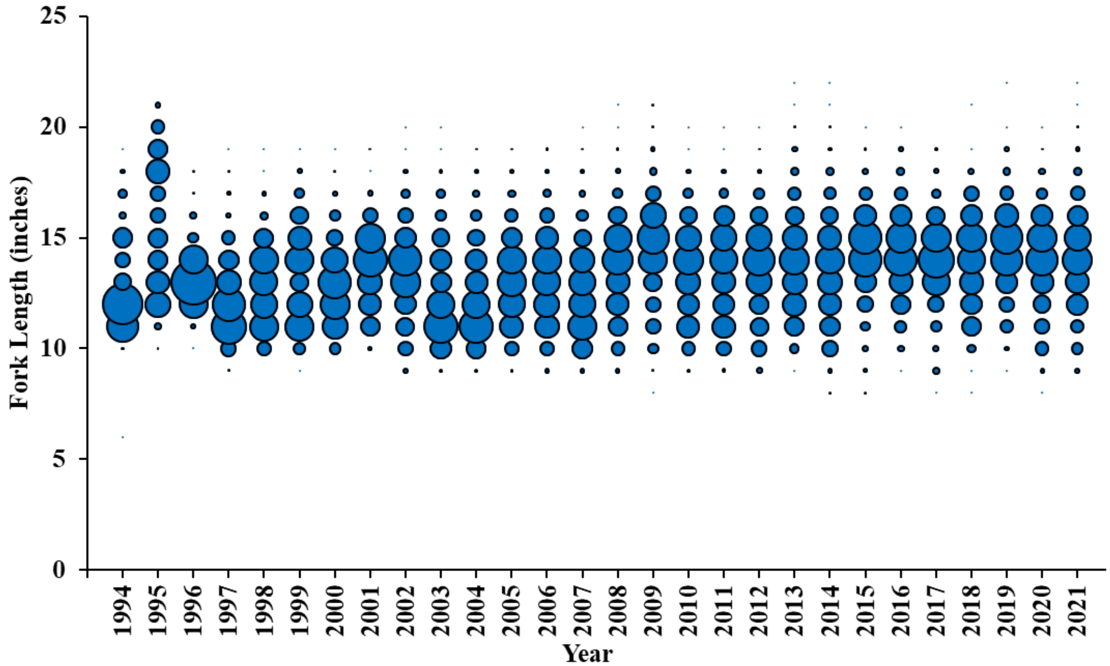

Figure 4. Commercial length frequency (fork length, inches) of striped mullet harvested, 1994–2021. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

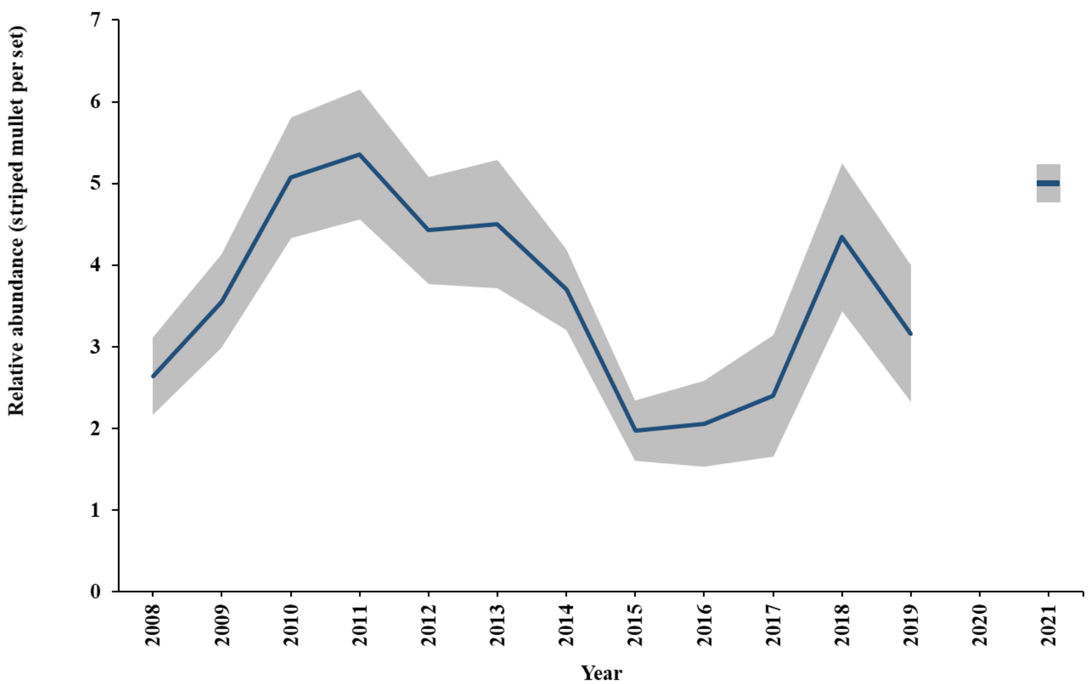

Figure 5. Relative Abundance index (fish per set) of striped mullet collected from Program 915 in Pamlico Sound, Pamlico, Pungo, Neuse and New rivers from August-December 2008–2021. Gray shading represent ± 1 standard error. Sampling was not conducted in 2020.

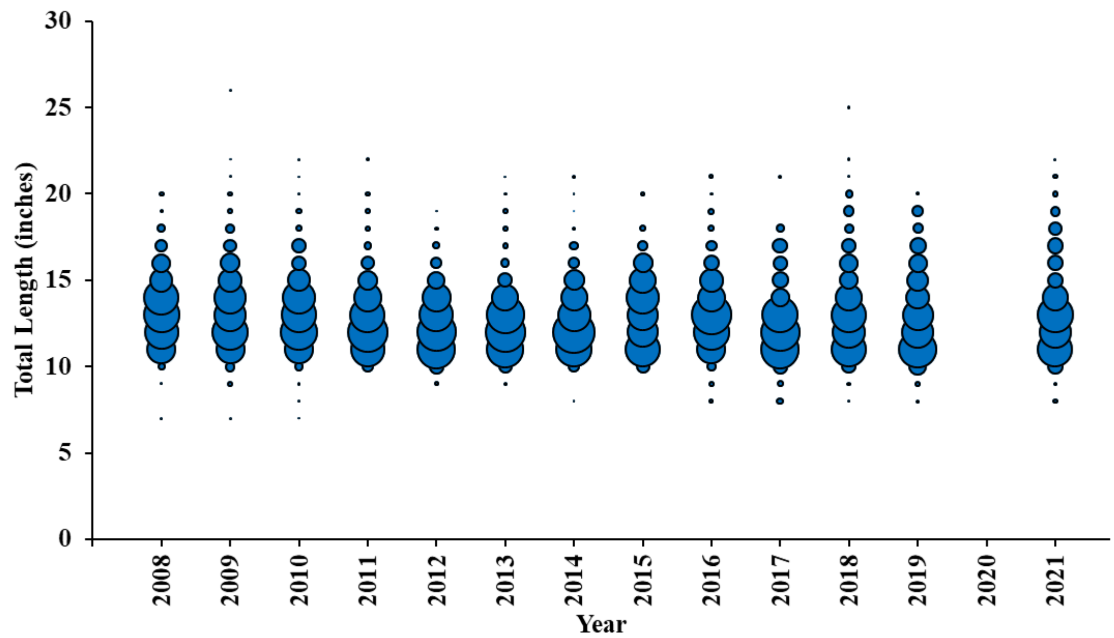

Figure 6. Length frequency (fork length, inches) of striped mullet collected from Program 915 in Pamlico Sound, Pamlico, Pungo, Neuse and New rivers from August-December (juveniles excluded), 2008–2021. Sampling was not conducted in 2020.

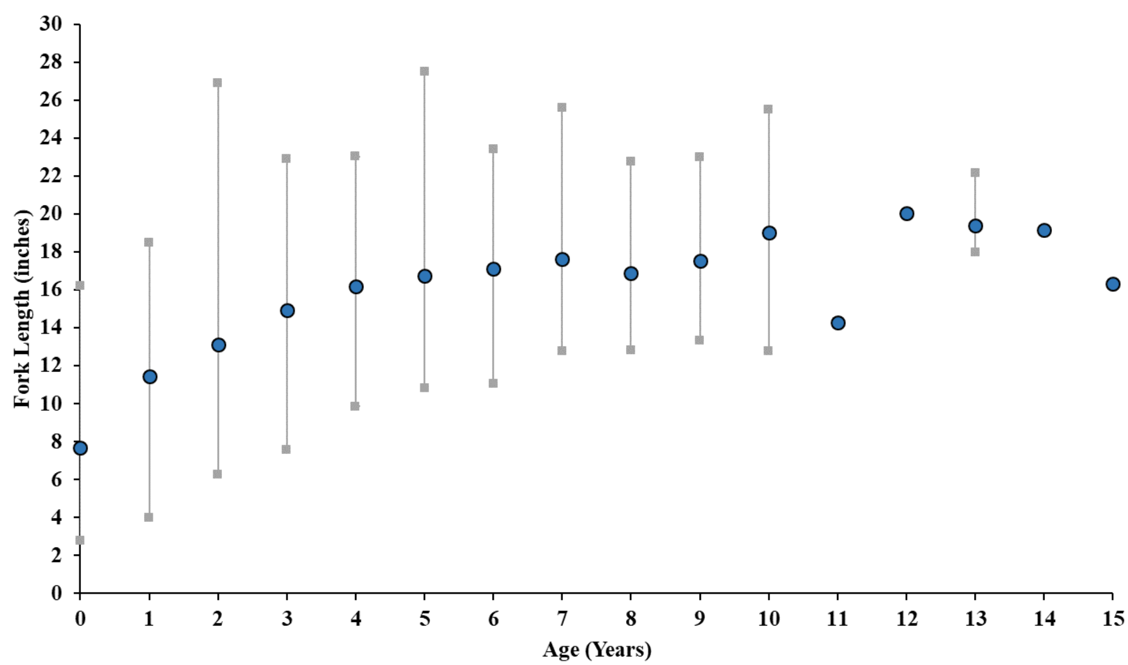

Figure 7. Striped mullet length at age based on all age samples collected, 1996–2021. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed size for each age.

DRAFT – SUBJECT TO CHANGE

SUPPLEMENT A TO AMENDMENT 1 TO THE N.C. STRIPED MULLET FISHERY MANAGEMENT PLAN

November 2022

ISSUE

Consideration of Supplement A to Amendment 1 to the N.C. Striped Mullet Fishery Management Plan (FMP) to implement temporary management measures to immediately address overfishing of the striped mullet stock while Amendment 2 is developed.

ORIGINATION

The North Carolina Division of Marine Fisheries (DMF).

BACKGROUND

The North Carolina striped mullet stock is overfished and overfishing is occurring in 2019, the terminal year of the stock assessment (NCDMF 2022). As statutorily required, management measures will be developed through Amendment 2 to end overfishing and rebuild spawning stock biomass. Development of Amendment 2 is underway, with final adoption and implementation tentatively scheduled for 2024. Because of the timeline of FMP development, there will be four-years between the terminal year of the stock assessment and implementation of management measures to address the stock status. The supplement allows for implementation of temporary management measures to supplement Amendment 1 until Amendment 2 is adopted.

General Statute 113-182.1 provides a mechanism to supplement management under a Fishery Management Plan (FMP) between scheduled reviews when the Secretary of the Department of Environmental Quality (DEQ) determines it is in the interest of the long-term viability of the fishery. The draft supplement contains analysis of the proposed management change, projected outcomes, and proposed rules or proclamation measures necessary to implement the management change. The North Carolina Marine Fisheries Commission (MFC) may only consider a single management issue for each draft supplement. The supplement allows for implementation of temporary management measures to supplement Amendment 1 until Amendment 2 is adopted. NCMFC Rule 15A NCAC 03M .0502 provides the Director proclamation authority to implement restrictions in the taking of mullet. In accordance with the MFC FMP Guidelines, the MFC will review the draft supplement and reject (end of process), approve, or modify and approve it for public comment.

The North Carolina Striped Mullet FMP was adopted in April 2006 and established minimum and maximum commercial landings triggers of 1.3 and 3.1 million pounds (NCDMF 2006). If annual landings fall below the minimum trigger, the DMF would determine whether the decrease in landings is attributed to stock decline, decreased fishing effort, or both. If annual landings exceed the maximum trigger, DMF would determine whether harvest is sustainable and what factors are driving the increase in harvest. The Striped Mullet FMP established a daily possession limit of 200 mullets (white and striped combined) per person per day in the recreational fishery, through NCMFC Rule 15A NCAC 03M .0502.

The Striped Mullet FMP Amendment 1 was adopted in November 2015. The associated rules from Amendment 1 were implemented in April 2016; to resolve issues with Newport River gill net attendance and mitigate known user group conflicts. Amendment 1 also updated the management framework and updated minimum and maximum commercial landings triggers to 1.13 and 2.76 million pounds (NCDMF 2015). Amendment 1 maintains the recreational fishery limit. Other than the recreational daily possession limit there are no management measures directly limiting harvest of striped mullet.

Stock assessments for the North Carolina striped mullet stock were conducted by the DMF in 2006 (NCDMF 2006), 2013 (NCDMF 2015), 2018 (NCDMF 2018), and 2022 (NCDMF 2022). In each assessment, a fishing mortality threshold of $F_{25\%}$ was used to determine if overfishing was occurring. The 2022 assessment also used a spawning stock biomass (SSB) threshold of $SSB_{25\%}$ to determine if the stock was overfished. Stock assessments in 2006, 2013, and 2017 determined overfishing was not occurring but could not determine whether the stock was overfished. While these assessments concluded overfishing was not occurring, each noted concerning trends, data uncertainty, and the potential impact of future poor recruitment events. Given this concern, the commercial landings triggers and adaptive management framework were approved in the Striped Mullet FMP and updated in Amendment 1.

Commercial landings in 2016 were 965,198 pounds, less than the minimum commercial landings trigger. As required under the FMP, the DMF initiated data analysis and ultimately recommended updating the 2013 stock assessment with data through 2017 prior to considering any management action. As an assessment update, there were no changes to model parameters and peer review was not required, as the configuration of the model that previously passed peer review was maintained. The 2018 stock assessment concluded overfishing was not occurring in 2017 but indicated declining spawning stock biomass, declining recruitment, and increasing fishing mortality. A major concern in the 2017 assessment was lack of contrast in commercial landings data and lack of contrast and high variability associated with fishery-independent indices including the Fishery-Independent Gill Net Survey (Program 915), the Striped Mullet Electrofishing Survey (Program 146), and the Striped Bass Independent Gill Net Survey (Program 135). Also of concern were the poor fits to survey data and length compositions.

At its August 2018 business meeting, the DMF presented its recommendation along with recommendations from the Northern, Southern, and Finfish Advisory Committees to the NCMFC that no management action be taken since the stock assessment update indicated overfishing was not occurring. The DMF would, however, continue to monitor trends in the commercial fishery and fishery-independent indices. The recommendation was approved by the MFC.

For the 2022 striped mullet stock assessment, a F threshold of $F_{25\%}$ and a target of $F_{35\%}$ were maintained from the prior assessment since the commercial fishery continues to target mature female fish during the spawning season and the ecological importance of striped mullet. Complementary reference points for stock size were adopted based on female SSB, with a threshold of $SSB_{25\%}$ and a target of $SSB_{35\%}$. The stock assessment model estimated a value of 0.37 for the $F_{25\%}$ threshold and a value of 0.26 for the $F_{35\%}$ target. In 2019, the terminal year of the assessment, F was 0.42, higher than the $F_{25\%}$ threshold, indicating overfishing is occurring (Figure 1). The model estimated a value of 1,364,895 pounds for the $SSB_{25\%}$ threshold and a value of 2,238,075 pounds for the $SSB_{35\%}$ target. Female SSB in 2019 was estimated at 579,915 pounds, smaller than the $SSB_{25\%}$ threshold, indicating the stock is overfished (Figure 2).

An external peer review workshop was held in April 2022. The panel concluded the assessment model and results are suitable for providing management advice for at least the next five years. The panel considers the current model a substantial improvement from the previous assessment, representing the best scientific information available for the stock.

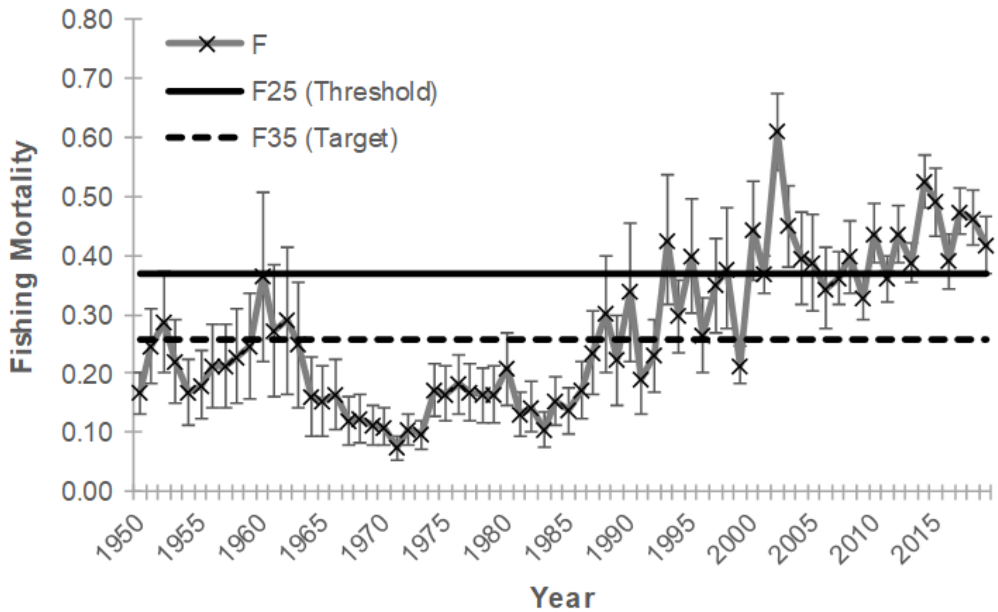

Figure 1. Comparison of annual estimates of fishing mortality (numbers weighted, ages 1-5) to the fishing mortality target (F35%) and threshold (F25%). Error bars represent ± 2 standard deviations.

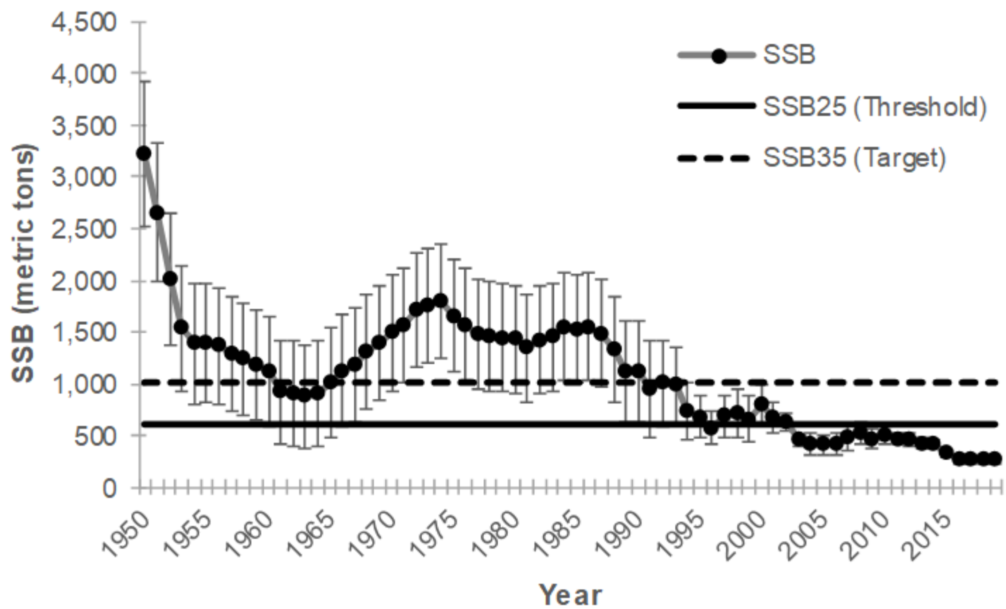

Figure 2. Comparison of annual estimates of female spawning stock biomass (SSB) to the SSB target (SSB35%) and threshold (SSB25%). Error bars represent ± 2 standard deviations.

AUTHORITY

G.S. 113-134 RULES
G.S. 113-182 REGULATION OF FISHING AND FISHERIES
G.S. 113-182.1 FISHERY MANAGEMENT PLANS
G.S. 113-221.1. PROCLAMATIONS; EMERGENCY REVIEW
G.S. 143B-289.52 MARINE FISHERIES COMMISSION-POWERS AND DUTIES
15A NCAC 03M .0502 MULLET
15A NCAC 03H .0103 PROCLAMATIONS, GENERAL

DISCUSSION

The 2022 stock assessment (NCDMF 2022) indicates recruitment has not only declined but has been below average since 2009 (Figure 3). The decline in recruitment coincides with declining spawning stock biomass while fishing mortality has increased (Figures 1-2).

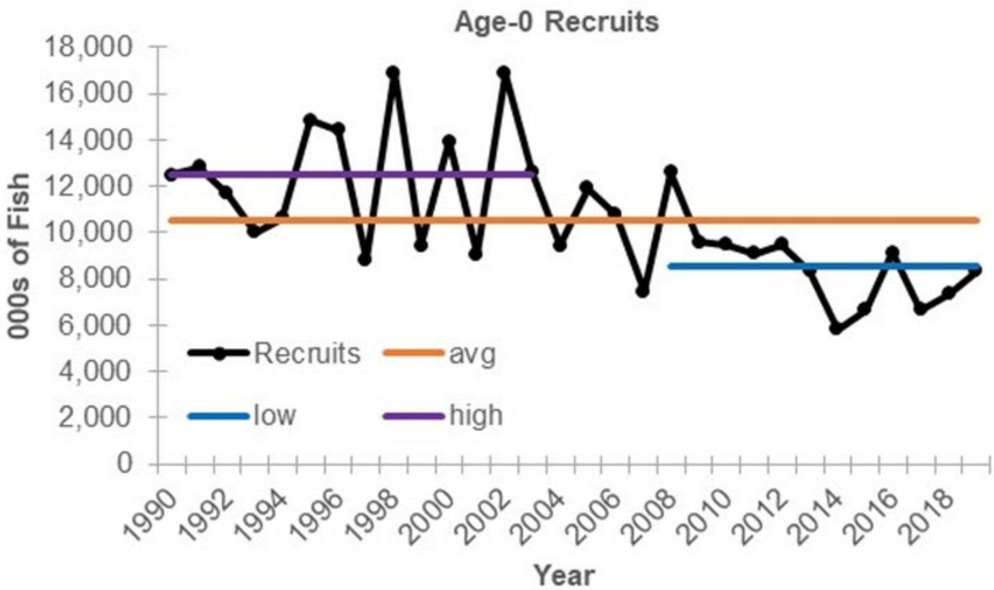

Figure 3. Estimates of striped mullet recruitment from the 2022 striped mullet stock assessment (NCDMF 2022). Average recruitment is the average number of recruits from 1990 to 2019, high recruitment is the average number of recruits from 1990 to 2003, and low recruitment is the average number of recruits from 2008 to 2019.

A 9.3% reduction in total removals relative to landings in 2019 is needed to reduce fishing mortality to the threshold and a 33% reduction is needed to reach the target. Amendment 1 to the Striped Mullet FMP included adaptive management allowing for implementation of management measures if commercial landings exceeded or fell below commercial landings triggers. Because neither the minimum or maximum commercial landings triggers were exceeded in 2022, adaptive management cannot be used to immediately implement management measures. A supplement to Amendment 1 is the only option to immediately implement management measures to end overfishing of the striped mullet stock. Given the stock is overfished and overfishing is occurring, ending overfishing immediately is in the long-term interest of the fishery because it begins rebuilding spawning stock biomass and meets the statutory requirement to end overfishing in two years. Measures addressing sustainable harvest and stock recovery will be explored and implemented through Amendment 2.

Implementation of quotas, seasons, size limits, area closures, gear restrictions, and harvest limits were discussed in Amendment 1 (NCDMF 2015). However, because management measures implemented through a supplement are intended to address a single issue, in this case ending overfishing, size limits, area closures, and gear restrictions are not considered viable options, and are not recommended, because they are unlikely to result in necessary harvest reductions without other measures in being place. A harvest quota would result in necessary harvest reductions and should be considered as a practical long-term option for management of the striped mullet fishery. However, because of the time needed to develop a quota monitoring framework and update infrastructure it is not considered a practical option through the supplement process and is not recommended. Trip limits, in conjunction with other options, could result in necessary reductions but given the high-volume nature of the striped mullet fishery may result in excessive dead discards. Trip limits should be explored during Amendment 2 but are not recommended for the supplement.

Given the inherent seasonality of the striped mullet fishery and life history characteristics that make striped mullet more vulnerable to the fishery during certain times of year, season closures are considered the most effective and efficient method to achieve the necessary reductions that can be implemented immediately through a supplement. Striped mullet are highly fecund (upwards of 4 million eggs for a large female; Bichy 2000) and spawn in large groups near inlets and in offshore areas (Collins and Stender 1989). Spawning individuals have been reported from September to March; however, peak spawning activity occurs from October to early December (Bichy 2000). Prior to spawning, striped mullet form large schools in estuaries and can be easily spotted near the surface making them particularly vulnerable to harvest. Closing a portion of the fall season to possession of striped mullet would reduce landings in the targeted striped mullet fishery, where most effort occurs. Targeting a season closure to the period of peak striped mullet harvest minimizes the length of the closure and the numbers of discards that might occur in other fisheries.

Characterization of the Fishery

Recreational Fishery

The federal Marine Recreational Information Program (MRIP) is primarily designed to sample anglers who use rod and reel as the mode of capture. Since most striped mullet are caught with cast nets for bait, striped mullet recreational harvest data are imprecise. In addition, angler misidentification between striped mullet and white mullet is common, and bait mullet are usually released by anglers before visual verification by creel clerks is possible. As such, mullets are not identified to the species level in MRIP data (Catch Type B). Beginning in 2002, MRIP began deferring to mullet genus to classify unobserved type B1 (harvested/unavailable catch) and B2 (released/unavailable catch) catch. As a result, the magnitude of recreational mullet genus harvest far exceeds that of both striped mullet and white mullet. This methodological improvement increased the precision of mullet harvest estimates albeit without species level resolution. As such, estimates of recreational harvest for mullet prior to 2002 are considered unreliable.

The 2022 striped mullet stock assessment used the sum of recreational striped mullet harvest and a proportion of the recreational harvest of mullet genus to estimate removals by the recreational fleet (NCDMF 2022). The proportion of mullet genus assumed to be striped mullet in the recreational harvest was 29%, a value derived from a DMF striped mullet recreational cast net harvest study (NCDMF 2006).

Recreational harvest peaked in 2002 and 2003 at greater than four million fish harvested (Table 1). From 2004 to 2017 recreational harvest remained stable at around one million fish before declining in 2018, 2019 and 2020 to around 500,000 fish. This decline was likely related to decreased abundance of striped mullet and regulations that drastically shortened the recreational fishing season for southern flounder, a fishery where live mullet is a popular bait. Recreational harvest in 2021 was 1,484,850 fish.

Generally, most recreational striped mullet harvest occurs during the late summer and early fall. From 2017 to 2021 most recreational harvest occurred during September/October with some harvest during July/August (Figure 4). Based on MRIP harvest estimates very few, if any, striped mullet are harvested recreationally during the January/February or March/April waves (Table 2).

Striped mullet harvest data from the Recreational Commercial Gear License (RCGL) were collected from 2002 to 2008. The program was discontinued in 2009 due to a lack of funding and the minimal contributions from RCGL to overall harvest. From 2002 through 2008, an average of 41,512 pounds of striped mullet were harvested per year using a RCGL (Table 3).

Table 1. Recreational harvest (number of fish landed) of striped mullet and mullet genus estimated from MRIP sampling, 2002-2021. Based on results of a DMF cast net study (NCDMF 2006), 29% of the mullet genus harvested are assumed to be striped mullet.

	Striped Mullet		Mullet Genus		Striped Mullet from Mullet Genus (29%)	Striped Mullet + Mullet Genus
Year	Harvest (A+B1)	PSE	Harvest (B1)	PSE	Harvest (B1)	Striped Mullet Total Harvest
2002	4,668,427	18.0	4,480,197	36.3	1,299,257	5,967,684
2003	3,368,881	29.6	2,487,885	20.4	721,487	4,090,368
2004	5,496	101.7	4,790,382	16.1	1,389,211	1,394,707
2005	10,795	61.5	4,487,719	21.4	1,301,439	1,312,234
2006	15,706	63.5	3,599,098	21.4	1,043,738	1,059,444
2007	301,004	81.3	5,052,995	22.3	1,465,369	1,766,373
2008	3,458	65.0	4,097,156	14.4	1,188,175	1,191,633
2009	83,480	90.6	3,736,571	14.3	1,083,606	1,167,086
2010	126,250	44.7	4,113,171	14.3	1,192,820	1,319,070
2011	80,267	28.6	3,653,514	14.3	1,059,519	1,139,786
2012	351,960	79.5	3,510,395	16.3	1,018,015	1,369,975
2013	150,020	53.9	4,493,166	20.5	1,303,018	1,453,038
2014	50,381	67.0	4,490,722	26.2	1,302,309	1,352,690
2015	142,696	64.5	4,405,800	21.5	1,277,682	1,420,378
2016	29,965	50.6	5,039,891	55.6	1,461,568	1,491,533
2017	37,791	43.9	5,170,318	55.2	1,499,392	1,537,183
2018	35,565	59.3	1,564,676	31.7	453,756	489,321
2019	324,986	52.0	817,596	25.3	237,103	562,089
2020	323,102	43.2	719,908	23.2	208,773	531,875
2021	1,194,213	73.6	1,002,195	31.6	290,637	1,484,850

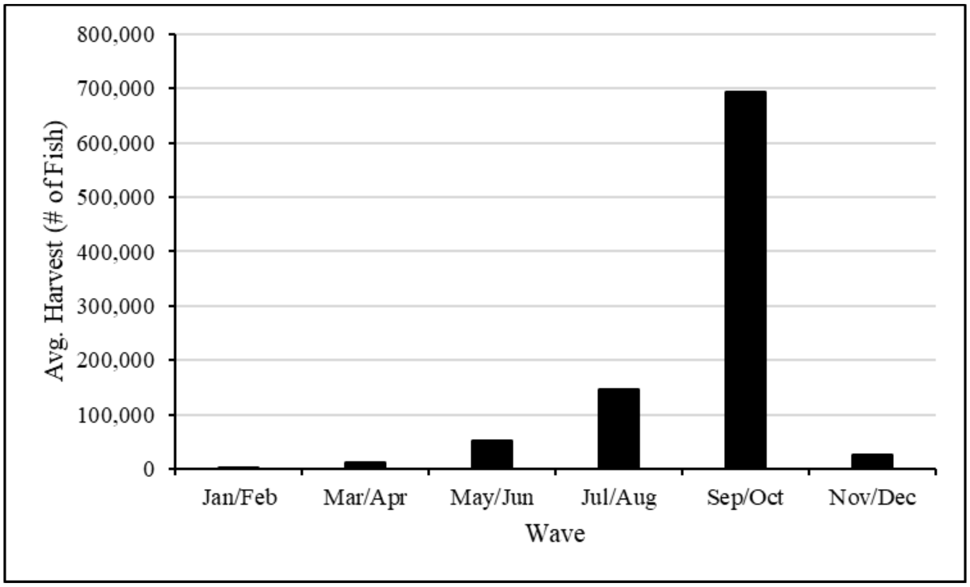

Figure 4. Average number of striped mullet harvested by the recreational fishery by wave based on MRIP estimates, 2017-2021.

Table 2. Recreational harvest (number of fish landed) of striped mullet and mullet genus by wave estimated from MRIP sampling, 2002-2021. Striped mullet assumed as 29% of mullet genus.

		Striped Mullet	Mullet Genus	Striped Mullet from Mullet Genus (29%)	Striped Mullet + Mullet Genus
Year	Wave	Harvest (A+B1)	Harvest (B1)	Harvest (B1)	Striped Mullet Total Harvest
2017	January/February	.	.	.	.
2017	March/April	.	82,931	24,050	24,050
2017	May/June	27,708	284,430	82,485	110,193
2017	July/August	8,505	354,629	102,842	111,347
2017	September/October	1,579	4,432,737	1,285,494	1,287,073
2017	November/December	.	15,590	4,521	4,521
2018	January/February	.	.	.	.
2018	March/April	.	.	.	.
2018	May/June	2,239	136,595	39,613	41,852
2018	July/August	18,993	750,891	217,758	236,751
2018	September/October	13,505	457,709	132,736	146,241
2018	November/December	828	219,480	63,649	64,477
2019	January/February	.	.	.	.
2019	March/April	.	32,700	9,483	9,483
2019	May/June	11,773	86,637	25,125	36,898
2019	July/August	82,801	280,921	81,467	164,268
2019	September/October	217,317	367,020	106,436	323,753
2019	November/December	13,096	50,318	14,592	27,688
2020	January/February	1,648	1,540	447	2,095
2020	March/April	.	21,050	6,105	6,105
2020	May/June	6,308	78,303	22,708	29,016
2020	July/August	40,470	239,694	69,511	109,981
2020	September/October	274,675	370,617	107,479	382,154
2020	November/December	.	8,704	2,524	2,524
2021	January/February	.	6,340	1,839	1,839
2021	March/April	7,087	.	.	7,087
2021	May/June	1,336	144,319	41,853	43,189
2021	July/August	21,670	292,846	84,925	106,595
2021	September/October	1,164,119	558,690	162,020	1,326,139
2021	November/December	.	.	.	.

Table 3. North Carolina Recreational Commercial Gear License (RCGL) survey estimates of the number of striped mullet harvested, pounds harvested, number released, and total number caught. The survey was discontinued in 2009.

Year	Number Harvested	Pounds Harvested	Number Released	Total Number
2002	66,305	64,213	6,549	72,854
2003	28,757	24,774	3,514	32,270
2004	34,736	35,947	2,875	37,611
2005	35,888	36,314	3,492	39,380
2006	38,175	37,385	5,352	43,527
2007	35,472	40,168	7,449	42,921
2008	51,465	51,785	9,207	60,672

Commercial Fishery

Since 1972, striped mullet commercial landings have ranged from a low of 965,198 pounds in 2016 to a high of 3,063,853 pounds in 1993 (Figure 5). From 2003 to 2009, landings were stable between 1,598,617 and 1,728,607 pounds before increasing to 2,082,832 pounds in 2010. Landings fluctuated annually between 1.5 and 2.0 million pounds from 2010 to 2014 before declining in 2015 and again in 2016, dropping below the minimum commercial landings trigger established by Amendment 1. Commercial landings in 2021 increased to 2,135,952 pounds, which is 1,005,952 pounds above the minimum commercial landings trigger.

Historically, beach seines and gill nets were the two primary gear types used in the striped mullet commercial fishery, with most commercial landings prior to 1978 coming from the beach seine fishery. Gill nets (runaround, set, and drift) replaced seines as the dominant commercial gear type in 1979 and since 2017 runaround gill nets have accounted for most (>70%) striped mullet commercial landings (Figure 6).

Because the commercial fishery primarily targets striped mullet for roe, the fishery is seasonal with the highest demand and landings occurring in October and November when large schools form during their spawning migration to the ocean and females are ripe with eggs (Figures 7-8). Striped mullet are primarily targeted commercially using runaround gill nets in the estuarine and ocean waters of North Carolina. The striped mullet beach seine fishery primarily occurs in conjunction with the Bogue Banks stop net fishery. The stop net fishery has operated under fixed seasons and net and area restrictions since 1993. Currently, stop nets are limited in number (four), length (400 yards), and mesh sizes (minimum eight inches outside panels, six inches middle section). Stop nets have typically been permitted along Bogue Banks (Carteret County) in the Atlantic Ocean from October 1 to November 30. However, the stop net season was extended to include December 3 to December 17 in 2015 due to minimal landings of striped mullet (Proclamation M-28-2015). In 2020 and 2021, the stop net fishery was open from October 15 through December 31 (Proclamations M-17-2020 and M-21-2021). Due to the schooling nature of striped mullet, the beach seine fishery has the potential to be, and historically has been, a high-volume fishery with thousands of pounds landed during a single trip. In addition, the use of cast nets in the striped mullet commercial fishery has been increasing since around 2003.

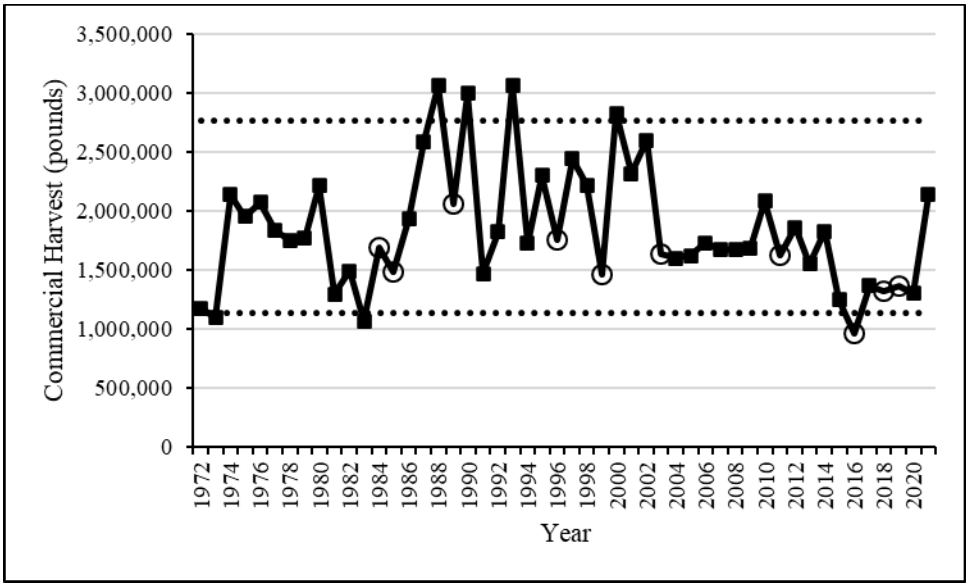

Figure 5. Striped mullet commercial landings (pounds) reported through the North Carolina Trip Ticket Program, 1972–2021 Lower dashed line (1.13 million lb.) and upper dashed line (2.76 million lb.) represent landings limits that trigger closer examination of data. Open circles represent years with significant hurricanes of storms.

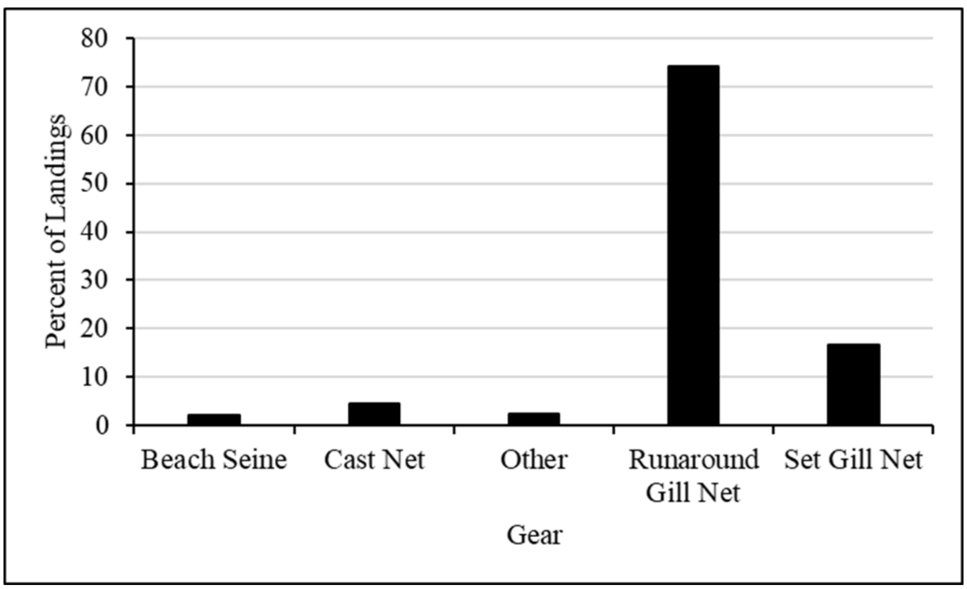

Figure 6. Percent of striped mullet commercial landings reported through the North Carolina Trip Ticket Program by gear, 2017–2021.

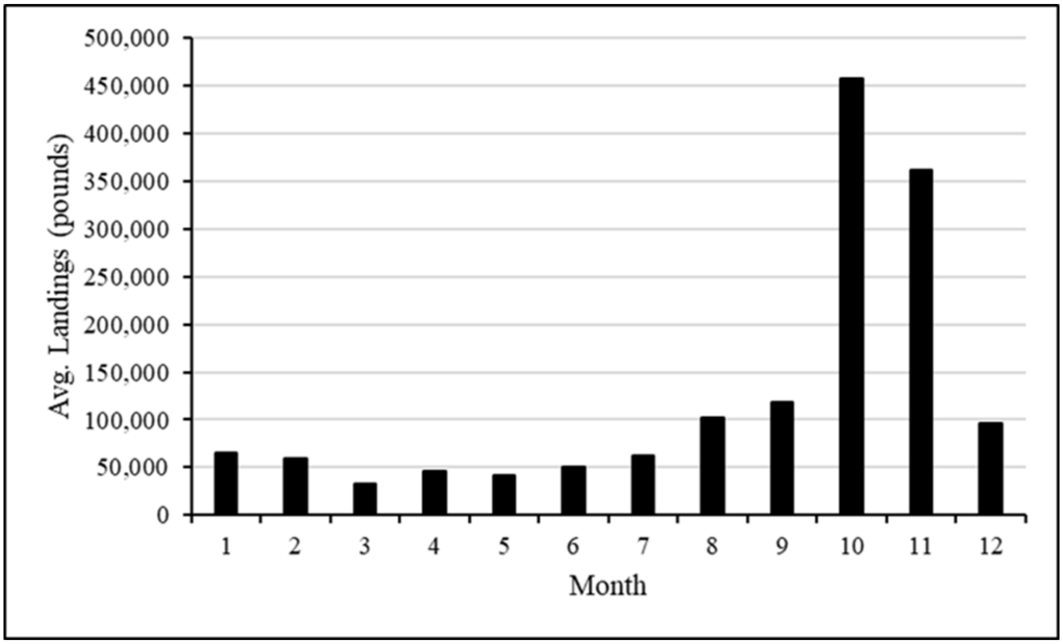

Figure 7. Average commercial landings of striped mullet by month, 2017-2021.

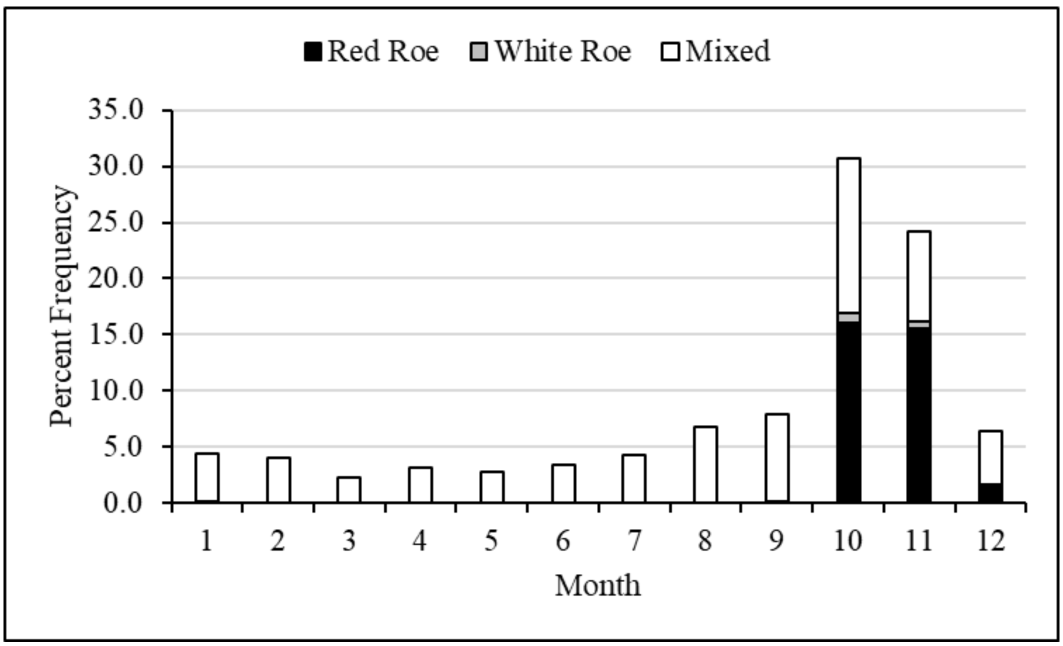

Figure 8. Percent frequency of striped mullet commercial landings by market grade and month, 2017-2021. Red Roe includes striped mullet graded as Red Roe and Roe. White Roe includes striped mullet graded as White Roe. Mixed includes striped mullet graded as Jumbo, Large, Medium, Mixed, Small, and X-Small.

PROPOSED MANAGEMENT OPTIONS

The goal of this supplement is to reduce fishing mortality and end overfishing with simple quantifiable measures as quickly as possible. A 9.3% reduction in total removals relative to landings in 2019 is needed to reduce fishing mortality to the threshold and a 33% reduction is needed to reach the target. The Division recommends harvest reductions of 20-33% to exceed the F threshold and either reach or approach the F target. This level of reduction increases the probability of, at a minimum, ending overfishing even if there is variability in fishing effort, market demand, striped mullet availability to the fishery, or recruitment.

Non-quantifiable measures such as gear restrictions, area closures, size limits, and recreational specific measures were not considered because they may not quantifiably reduce harvest. A quota system was not considered because the infrastructure is not in place to quickly implement this type of management. Management strategies such as daily trip limits, day of the week closures, and early or mid-season closures were not considered because the risk of recouped catches would likely limit the realized reductions of these management measures. Rather than reduce harvest, measures like early season closures would likely just act to delay harvest.

End of year season closures are considered the most effective and efficient management option that can be implemented through the supplement process and be expected to successfully limit striped mullet harvest. An end of year season closure would be implemented as no possession across both commercial and recreational sectors with no additional modification or prohibition of gears. Despite the closure occurring across all sectors, reductions cannot be quantified for the recreational sector due to data limitations. Therefore, overall reduction calculations are based solely on striped mullet landings from the commercial fishery. A 9.3% overall reduction equates to a 9.9% reduction in commercial harvest, and a 20-33% overall reduction equates to a 21.3-35.4% reduction in commercial harvest. All management options are presented as percent reductions to the commercial harvest relative to commercial landings in 2019 (terminal year of the stock assessment).

End of Year Closures

Historically, peak striped mullet roe landings have occurred in October-November, with most landings occurring from approximately October 15-November 15. An end of year season closure during this time provides the greatest reduction over the shortest period. The closure occurring at the end of the year, does not allow for recoupment of catch that year, increasing the probability of successfully reducing harvest, and ending overfishing. The closure must occur during the peak fall roe harvest season, which impacts the most economically valuable segment of the striped mullet fishery. An end of year closure also creates regulatory discards associated with fisheries that do not target striped mullet during the closed period. However, much of the striped mullet harvest during this time comes from directed trips where runaround gill nets are used to capture visible, schooling striped mullet so discards in other fisheries are unlikely to be excessive. A wrap-around end of year closure extending into January was not considered because of the minimal benefit to striped mullet and to avoid creating striped mullet discards in other fisheries. A closure extending into January would not yield any significant extension to the fall striped mullet season and would likely increase pressure on other fisheries, like spotted seatrout. An end of year closure is most likely to achieve the necessary reductions because recoupment would be less significant than other management options not considered in this supplement.

Summary of Economic Impacts

Modeling software, IMPLAN, is used to estimate the economic impacts of an industry to the state at-large, accounting for revenues and participation. For a detailed explanation of the methodology used to estimate the economic impacts please refer to DMF's License and Statistics Section Annual Report on the Fisheries Statistics page (NCDMF 2021). Due to the management options being considered, this analysis focuses on the commercial industry.

Commercial landings and effort data collected through the DMF Trip Ticket Program are used to estimate the economic impact of the commercial fishing industry. For commercial fishing output, total impacts are estimated by incorporating modifiers from NOAA's Fisheries Economics of the United States report (NMFS 2022), which account for proportional expenditures and spillover impacts from related industries. By assuming the striped mullet fishery's contribution to expenditure categories at a proportion equal to its contribution to total commercial ex-vessel values, it is possible to generate an estimate of the total economic impact of striped mullet statewide.

From 2011 to 2021 striped mullet ex-vessel value has been about $1 million dollars and impacts about 800 jobs annually (Table 4). Annual sales impacts have varied but averaged $3.6 million from 2011 to 2021. In general, these estimates demonstrate the striped mullet fishery contributes to about 1% of commercial fishing sales impact statewide.

Table 4. Annual commercial estimates of annual economic impact to the state of North Carolina from striped mullet harvest, 2011-2021. Economic impacts are reported in 2020 dollars.

Year	Pounds Landed	Ex-Vessel Value	Job Impacts	Income Impacts	Value-Added Impacts	Sales Impacts
2021	2,135,952	$ 1,333,475	714	$ 1,860,564	$ 3,503,122	$ 4,004,336
2020	1,299,464	$ 651,104	658	$ 1,330,677	$ 2,257,282	$ 2,912,396
2019	1,362,212	$ 929,282	673	$ 1,502,372	$ 2,344,706	$ 3,475,378
2018	1,312,121	$ 953,667	731	$ 1,502,185	$ 2,686,226	$ 3,303,076
2017	1,366,338	$ 1,037,526	802	$ 1,571,518	$ 2,564,816	$ 3,559,251
2016	965,337	$ 669,843	716	$ 1,006,728	$ 1,739,854	$ 2,240,287
2015	1,247,044	$ 804,675	784	$ 1,203,068	$ 2,086,467	$ 2,663,251
2014	1,828,351	$ 1,112,465	912	$ 1,735,047	$ 3,293,379	$ 3,936,322
2013	1,549,157	$ 1,402,914	1,042	$ 2,318,409	$ 3,902,777	$ 5,173,187
2012	1,859,587	$ 1,041,659	948	$ 1,957,469	$ 3,167,843	$ 4,390,261
2011	1,627,894	$ 1,015,852	885	$ 1,890,316	$ 3,371,858	$ 4,175,332
Average	1,504,860	$ 995,678	806	$ 1,625,305	$ 2,810,757	$ 3,621,189

DRAFT – SUBJECT TO CHANGE

Table 5. Monthly commercial estimates of annual economic impact to the state of North Carolina from striped mullet harvest over five years, 2017-2021. Economic impacts are reported in 2020 dollars.

Month	Pounds Landed	Ex-Vessel Value	Job Impacts	Income Impacts	Value Added Impacts	Sales Impacts
1	65,170	$ 36,107.03	130	$ 53,057.71	$ 98,355.14	$ 114,549.45
2	59,618	$ 33,227.53	129	$ 49,108.96	$ 90,877.25	$ 106,053.22
3	32,731	$ 18,569.84	122	$ 28,460.61	$ 52,101.53	$ 61,568.49
4	45,885	$ 25,851.76	141	$ 39,856.46	$ 72,837.04	$ 86,245.48
5	41,826	$ 23,508.17	121	$ 35,221.68	$ 64,912.23	$ 76,114.04
6	50,157	$ 28,058.94	131	$ 43,466.77	$ 79,323.84	$ 94,077.95
7	62,675	$ 36,047.32	139	$ 54,151.74	$ 99,720.97	$ 117,036.20
8	101,967	$ 60,393.25	179	$ 91,585.84	$ 168,184.68	$ 198,027.77
9	118,860	$ 69,487.04	210	$ 103,726.30	$ 191,374.87	$ 224,109.33
10	458,246	$ 328,837.30	361	$ 485,746.18	$ 899,026.44	$ 1,048,966.80
11	362,172	$ 261,014.19	297	$ 357,945.86	$ 688,459.22	$ 766,383.96
12	95,910	$ 59,908.44	176	$ 83,266.89	$ 157,024.20	$ 179,263.56

To further understand the dynamics of the striped mullet fishery the monthly economic impacts over the last five years are reported in Table 5. The striped mullet commercial fishery is driven by seasonal changes in population availability. The estimated change in job impacts and sales impacts reflect the availability of striped mullet throughout the year. Most of the harvest and economic impacts are concentrated in October and November of each year.

Management Option Scenarios

Management options for consideration include end of year closures that end December 31 (Table 6). All options provided in Table 6 meet the statutory requirement to end overfishing.

Table 6. Management options that satisfy the 9.9% commercial harvest reduction to end overfishing. All reductions are calculated from 2019 commercial harvest levels (terminal year of stock assessment).

Single Management Measures that Satisfy Reduction	Management Measure	Estimated Commercial Harvest Reduction (%)
	Season Closures	
1	October 29 – December 31	33.7
2	November 7 – December 31	22.1
3	November 13 - December 31	10.9

End of Year Season Closure (options 1 and 2)

(+ potential positive impact of action)
(- potential negative impact of action)

+ No additional resources required to implement
+ No additional reporting burden on fishermen or dealers
+ Reduces effort from current level
+ High likelihood of ending overfishing
+ Increases probability of ending overfishing stock or fishery conditions are variable
– Weather may prevent fishing during open periods
– Effort may increase during the open period reducing the effectiveness of the closure
– Reduction in fishing mortality may not be achieved
– Overfishing may still occur if recruitment is low
– May adversely impact some fisheries and fishermen more than others
– Create regulatory discards in the closed period

End of Year Season Closure (option 3)

(+ potential positive impact of action)
(- potential negative impact of action)

+ No additional resources required to implement
+ No additional reporting burden on fishermen or dealers
+ Reduces effort from current level
+ Could potentially end overfishing
– No buffer to increase probability of ending overfishing if stock or fishery conditions are variable
– Weather may prevent fishing during open periods
– Effort may increase during the open period reducing the effectiveness of the closure
– Reduction in fishing mortality may not be achieved
– Overfishing may still occur if recruitment is low
– May adversely impact some fisheries and fishermen more than others
– Create regulatory discards in the closed period

RECOMMENDATION

DMF Recommended Management Strategy:

The DMF recommends approval of the supplement to implement either option 1 or 2. To achieve a 20-33% reduction, any end of year season closure must begin no sooner than October 29 and no later than November 7 and continue through December 31. The Division supports a 20-33% reduction to exceed the threshold and either meet or approach the target. This reduction level increases the probability of, at a minimum, ending overfishing even if there is variability in fishing effort, market demand, striped mullet availability to the fishery, or recruitment fluctuations.

MFC Selected Management Strategy:

LITERATURE CITED

Bichy, J. 2000. Reproductive biology of Striped Mullet, *Mugil cephalus*, in North Carolina. Final Report to North Carolina Sea Grant. Fishery Resource Grant Project No. 97-FEG-09. 90 pp.

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Prepared by Daniel Zapf, Daniel.Zapf@ncdenr.gov, 252-948-3874, and
Jeffrey Dobbs, Jeffrey.Dobbs@ncdenr.gov, 252-808-8193
October 28, 2022

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Nov. 17, 2022

MEMORANDUM

TO: North Carolina Marine Fisheries Commission

FROM: Daniel Zapf and Jeff Dobbs
Striped Mullet Fishery Management Plan Co-Leads

SUBJECT: Striped Mullet Fishery Management Plan Amendment 2

Issue
Review the Striped Mullet Fishery Management Plan (FMP) Amendment 2 draft goal and objectives and discuss potential management strategies.

Action Needed
Vote on approval of Striped Mullet FMP Amendment 2 goal and objectives

Background
Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the Marine Fisheries Commission (MFC) at its May business meeting. The peer reviewed stock assessment was approved for management use and indicates the North Carolina striped mullet stock is overfished and overfishing is occurring in the terminal year of the assessment (2019). Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest.

Goal and Objectives
The division has completed the scoping period for Amendment 2. The next step in the FMP process is for the MFC to consider approval of the Amendment 2 goal and objectives. The division will develop draft Amendment 2 to achieve the goal and objectives in collaboration with the Striped Mullet FMP Advisory.

The draft goal and objectives are:

Goal:
Manage the striped mullet fishery to achieve a self-sustaining population that provides sustainable harvest using science-based decision-making processes.

State of North Carolina | Division of Marine Fisheries
3441 Arendell Street | P.O. Box 769 | Morehead City, North Carolina 28557
252-726-7021

Objectives:

- Implement management strategies within North Carolina that sustain and/or restore the striped mullet spawning stock with adequate age structure abundance to maintain recruitment potential and prevent overfishing.
- Promote the restoration, enhancement, and protection of critical habitat and environmental quality in a manner consistent with the Coastal Habitat Protection Plan, to maintain or increase growth, survival, and reproduction of the striped mullet stock.
- Use biological, social, economic, fishery, habitat, and environmental data to effectively monitor and manage the fishery and its ecosystem impacts.
- Advance stewardship of the North Carolina striped mullet stock by promoting practices that minimize bycatch and discard mortality.

Scoping Period

The division developed a scoping document identifying potential management strategies and held a public scoping period for Amendment 2, Sept. 26-Oct. 7, 2022. In addition to accepting comments through an online questionnaire and U.S. Mail, the division held three in-person meetings in Manteo, Morehead City, and Wilmington. Over 200 stakeholders participated by attending in-person meetings or submitting comments online. The division received input from meeting attendees and 153 online comments. Comments centered on concerns over the stock assessment results, changes in market demand, regional management, gear specific management, year-round fishing needs, recreational fisheries, support for adaptive management, and concerns about the amount of finger mullet harvest.

Potential Management Strategies

Potential management strategies include sustainable harvest, recreational fishery management, small mesh gill net fishery management, stop net fishery management, and migration corridors. The MFC will have the opportunity to inform potential management strategies to be considered during development of Amendment 2.

Potential Striped Mullet FMP Amendment 2 Management Strategies

Sustainable Harvest

- Quota management
- Fishing Seasons/days
- Trip Limits
- Size Limits (min/max/slot)
- Adaptive management
- Gear modifications

Recreational Fishery

- Characterize recreational fishery
- Support sustainable harvest
- Non-quantifiable measures
- Mutilated finfish rule

Small Mesh Gill Nets

- As tasked by MFC
- Support sustainable harvest
- Regulatory complexity
- Bycatch reduction
- Conflict

Stop Net Fishery

- Effectiveness of current management
- Support sustainable harvest

Migration Corridors

- Migration corridors to support sustainable harvest


Picture by Nolen Vinay

Scoping Document

Striped Mullet Fishery Management Plan

What is Scoping?

Scoping is the first stage of the Division of Marine Fisheries (DMF) Fishery Management Plan (FMP) process. Scoping serves to:

(1) Provide notice to the public that a formal review of the FMP is underway.

(2) Inform the public of the stock status, when available.

(3) Solicit stakeholder input on relevant management strategies and issues that may need addressed.

(4) Recruit potential FMP advisory committee (AC) members to assist the DMF in drafting the plan.

Scoping is the best opportunity to provide input for consideration during FMP development.

This document provides an overview of the initial management strategies and issues identified by the DMF, as well as background information on the fisheries and stock. Management strategies developed in Amendment 2 will be dependent on statutory requirements, available data, research needs, and the consequences of management.

Fishery Management

Management **PLANS** set specific management goals for a fishery. Management **STRATEGIES** are techniques to achieve the set management goals. Management **MEASURES** are the actions to achieve the management strategies.

September 2022

The N.C. Division of Marine Fisheries seeks your input on management strategies for the Striped Mullet Fishery Management Plan

Striped Mullet Scoping Period

September 26 - October 7, 2022

Meetings

DMF staff will provide information about the N.C. Striped Mullet FMP Amendment 2. Following the presentation, the public will have an opportunity to give comment and speak directly with DMF staff.

Three in-person meetings will be held across the state with one meeting being available virtually. Links to scoping information, including webinar information and reference documents, can be found through the Striped Mullet Amendment 2 Information Page.

Tuesday, September 27

6 p.m. to 8 p.m.

Dare County Administration Building
Commissioners Meeting Room
954 Marshall C. Collins Drive
Manteo

Tuesday, October 4

6 p.m. to 8 p.m.

DMF Central District Office
5285 Highway 70 West
Morehead City

OR

Virtually through WebEx
Event number 2436 717 6123
Event password 1234

Thursday, October 6

6 p.m. to 8 p.m.

Department of Environmental Quality
Wilmington Regional Office
127 Cardinal Drive
Wilmington

Can't attend but want to submit comments?

Written comments can be submitted by online form or U.S. mail. Comments must be received by October 7, 2022.

To comment by online form:

To comment by U.S. mail, mail to:

N.C. Division of Marine Fisheries
N.C. Striped Mullet Scoping
P.O. Box 769
Morehead City, NC 28557

FMP Process Questions?
Contact the FMP Coordinator
Corrin Flora
Corrin.Flora@ncdenr.gov
252-808-8014

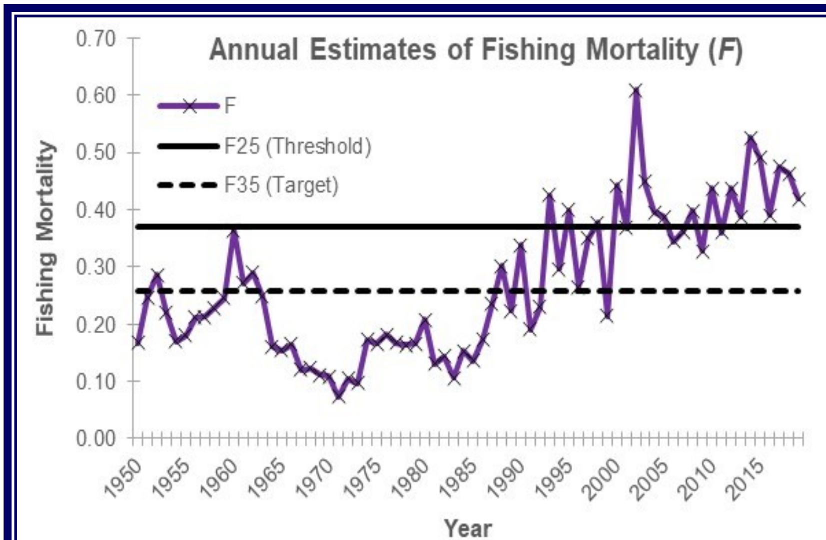
2022 STOCK ASSESSMENT

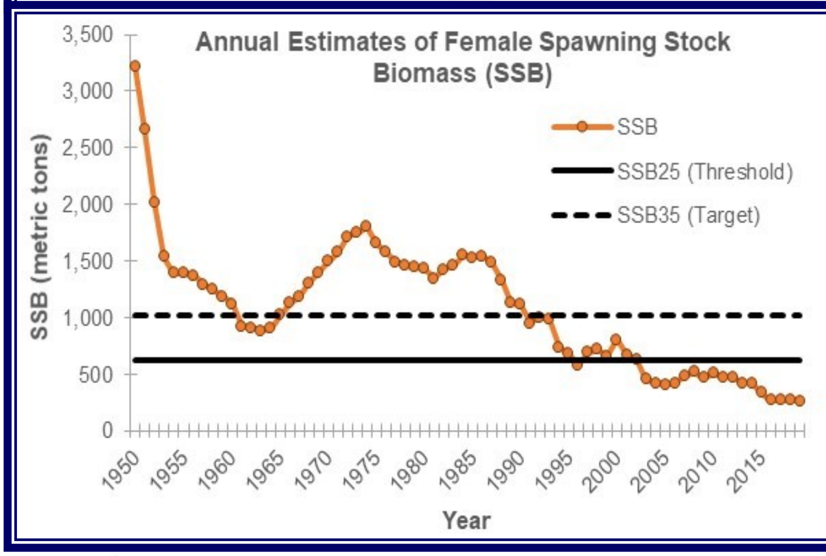
Status of the Stock

The 2022 stock assessment indicates overfishing is occurring in the striped mullet fisheries and the North Carolina striped mullet stock is overfished.

Stock status is based on the 2019 fishing mortality (*F*) and spawning stock biomass (SSB). Both exceeded the reference points established in the Striped Mullet FMP Amendment 1.

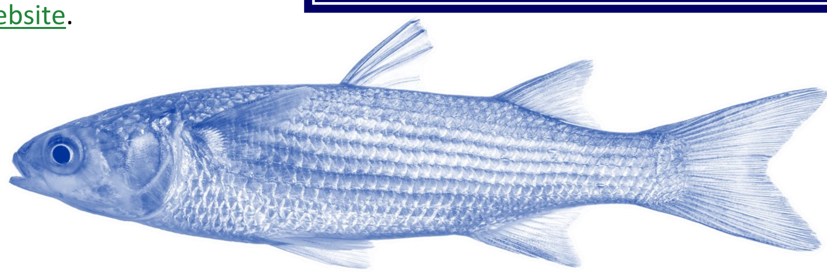
The North Carolina Fishery Reform Act of 1997 requires management end overfishing and achieve a sustainable harvest. To reach these goals within the 10-year time period, conservative management measures require a 20—33% reduction in total removals from 2019 landings.





Stock Assessment Report and Fishery Management Plan

The complete 2022 Stock Assessment of Striped Mullet is available on the DMF website.



Striped Mullet Questions?
Contact lead biologists

Daniel Zapf
Daniel.Zapf@ncdenr.gov
252-948-6481

Jeffrey Dobbs
Jeffrey.Dobbs@ncdenr.gov
252-808-8193

AMENDMENT 2

Statutorily Required Management Strategy: Sustainable Harvest

Background

The Fisheries Reform Act requires implementing management to end overfishing in two years and rebuild the spawning stock biomass to a level of sustainable harvest in 10 years upon adoption of the plan. Projections based on the stock assessment indicate a conservative 20-33% reduction in total removals is needed to end overfishing and rebuild the spawning stock of striped mullet to a sustainable level. If reductions only come from the commercial sector a 35.4% reduction is needed. The division asks for public input about how the striped mullet resource is used by stakeholders and considerations to account for in the fishery when making management decisions. Possible management measures to achieve sustainable harvest include:

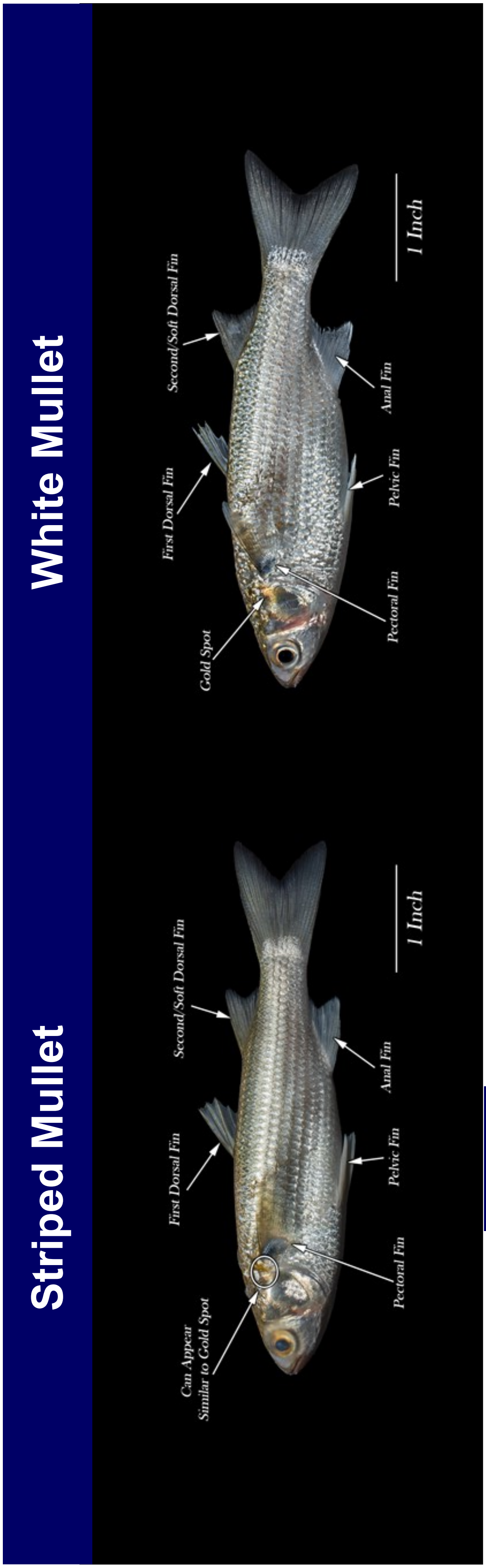
- Quota management
- Fishing seasons
- Trip limits
- Size limits (minimum, maximum, or slot limits)
- Specific fishing days (weekday vs. weekend)
- Gear modifications
- Area closures


Picture by Nolen Vinay

STAKEHOLDER INPUT

Answers to these questions are an important part of plan development and a valuable part of our process.

- Why do you fish for striped mullet (roe, bait, meat, or other)?
- What size striped mullet do you target?
- How often do you fish for striped mullet?
- What time of year is most important to have access to striped mullet?
- What area do you fish for striped mullet?
- What ideas do you have to end overfishing and rebuild the striped mullet stock?
- Should management measures be considered statewide or regionally?
- Should management be considered to protect migrating striped mullet?
- Should roe, bait, and food fish be managed separately?



Additional Management Strategies: Recreational Fishery

Background

Under Amendment 1, recreational harvest of striped mullet is limited to 200 mullet (white and striped combined) per person per day. Since July 2006, striped mullet has been exempt from the mutilated finfish rule, allowing it to be used as cut bait.

Striped mullet recreational harvest estimates in North Carolina are highly uncertain with proportional standard error (PSE) exceeding 50% in most years. This means the fishers sampled may or may not represent the fishery and harvest may be much more or less than estimated. Uncertainty may be due to limited bait samples since most recreational harvest of striped mullet is for live or cut bait in other fisheries. Recent limitations on fishing seasons of target species, like southern flounder, have likely decreased demand for striped mullet as live bait. However, there are many other fisheries which use striped mullet as bait.

Further characterization of the recreational mullet fishery is needed to understand stakeholder use.

Even though recreational estimates are uncertain, non-quantifiable management measures restricting recreational harvest of striped mullet may be necessary. The division is interested in public input about how the striped mullet resource is used by recreational stakeholders and what the most important aspects of the fishery are when making management decisions.

STAKEHOLDER INPUT

Answers to these questions are an important part of plan development and a valuable part of our process.

- What gear do you use to catch mullet?
- How many mullet do you typically catch and keep in a trip?
- What size mullet do you prefer?
- Do you purchase mullet for bait?
- Could other species be used for bait instead of mullet?
- What species do you target when using mullet as bait?
- What seasons do you use mullet as bait?

Additional Management Strategies: Small Mesh Gill Net

Background

Gill nets are one of the most controversial fishing gears used in North Carolina waters. Although gill net fishing effort has decreased significantly over the last two decades, this gear continues to be the subject of debate and opinion concerning the impact on our fisheries. At the direction of the MFC, in 2021 the DMF drafted an **issue paper** reviewing rules and available data for the small mesh gill net fishery and developed potential options for rulemaking. The issue paper characterized the estuarine small mesh gill net fisheries in North Carolina and included options aimed at simplifying small mesh gill net regulations, reducing bycatch, and reducing conflict between stakeholders.

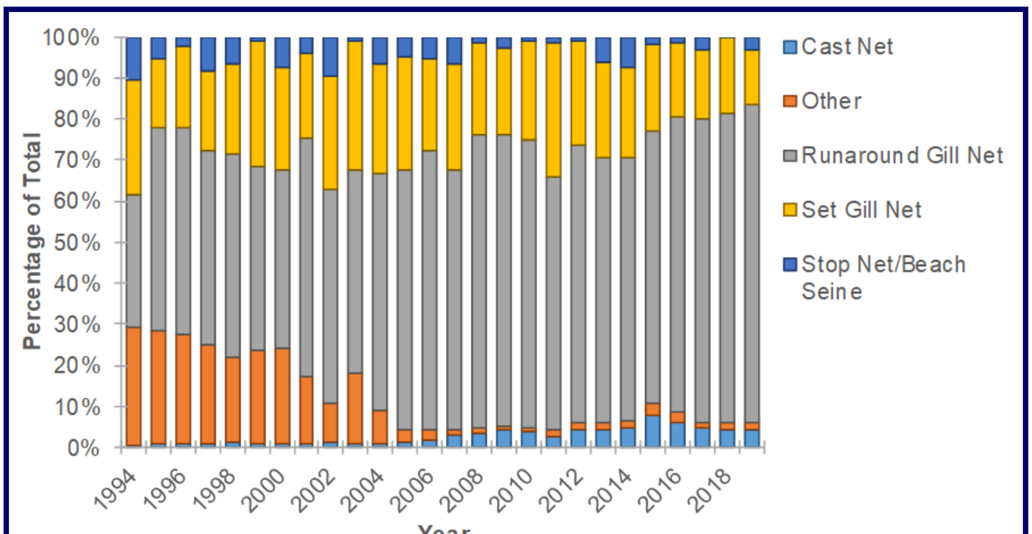
At its August 2021 business meeting, the MFC passed a motion to not initiate rulemaking on small mesh gill nets but refer the issue through the FMP process for each species, and any issues or rules coming out of the species-specific FMP to be addressed at that time.

Small mesh gill nets are the predominant gear used to harvest striped mullet in North Carolina. Most striped mullet are harvested commercially using runaround or other actively fished gill nets. Because there are no direct regulations limiting the commercial harvest of striped mullet, commercial discards are currently not an issue. Typically all striped mullet caught in commercial operations are landed and sold. However, if regulations are implemented to recover the stock, it may be necessary to address discards. The division is interested in public input about modifications that could be made to small mesh gill net regulations to address regulatory complexity, bycatch reduction, and reduction of conflict between stakeholders.

STAKEHOLDER INPUT

Answers to these questions are an important part of plan development and a valuable part of our process.

- What modifications would you make to your fishing operation to catch less striped mullet in your gill net?
- Do you actively fish your nets more frequently when attendance requirements are in place?
- Do you set nets when attendance is mandatory? How do attendance requirements affect your fishing operation?
- What are the major causes of conflict between small mesh gill netters and other stakeholders?
- How would a minimum mesh size affect you? Why do you use your preferred mesh size?
- How would a yardage limit effect you? Why do you use your preferred yardage?
- How does fishing area effect the choices in gill net mesh size and yardage?



Percentage of North Carolina's commercial striped mullet landings from major gear types,

Additional Management Strategies: Stop Net Fishery

Background

Stop nets and seines were the dominant gears in the early years of the fishery up to 1978, accounting for upwards of 70% of the commercial landings. Due to the schooling nature of striped mullet, the beach seine fishery has the potential to be and historically has been a high volume fishery, landing thousands of pounds in a single trip.

STAKEHOLDER INPUT

Answers to these questions are an important part of plan development and a valuable part of our process.

- Has management reduced conflict between users of different gear types (e.g. gill net and stop net users)?

Additional Management Strategies: Migration Corridor

Background

Striped mullet undergo annual spawning migrations in the fall from estuarine waters to the ocean. Large schools of striped mullet form, making them easy to target and harvest in large quantities. Designation of seasonal or permanent migration corridors limiting harvest or fishing gears could be used to provide additional protection to the spawning stock.

STAKEHOLDER INPUT

Answers to these questions are an important part of plan development and a valuable part of our process.

- Would designation of migration corridors alter the way you fish?
- Is it important to have access to striped mullet in all areas at all times of year?
- Are there areas or times when fishing for striped mullet should not be allowed?

Other Management

Are there other relevant strategies that should be considered for Amendment 2? The division wants to hear from stakeholders on their ideas.

Management strategies considered in Amendment 2 are dependent on statutory requirements, available data, research needs, and the effectiveness of the solution.

NC Marine Fisheries Commission

Rulemaking

November 2022 Business Meeting

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

October 21st, 2022

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Steve Poland, Fisheries Management Section Chief

SUBJECT: Temporary Rule Suspensions

Issue
In accordance with the North Carolina Division of Marine Fisheries Resource Management Policy Number 2014-2, Temporary Rule Suspension, the North Carolina Marine Fisheries Commission will vote on any new rule suspensions that have occurred since the last meeting of the commission.

Findings
Rule 15A NCAC 03R .0117 delineates boundaries for oyster sanctuaries in internal coastal waters and was recently amended to add newly established and expanded sanctuaries. After publication and adoption of the newly amended rule, it was determined that coordinates published for the Pea Island and Raccoon Island sanctuaries were incorrectly recorded in the text. Additionally, the Swan Island Sanctuary boundaries were expanded since the publication of the rule and no longer consistent with the published coordinates. To ensure that the sanctuaries continue to be protected according to the FMP restrictions, the director suspended the portions of the rule that incorrectly delineated the sanctuaries and issued Proclamation SF-6-2022 which provides the correct and current boundary coordinates as well as harvest restrictions. The division requests an indefinite suspension to portions of the rule that incorrectly delineates the sanctuaries to provide time for the rule to be amended.

Action Needed
****Vote to suspend subsections (c), (i), and (j) of section (1) of NCMFC Rule 15A NCAC 03R .0117 OYSTERS SANCTUARIES for an indefinite period****

Overview
In accordance with policy, the division will report current rule suspensions previously approved by the commission as non-action items. They include:

NCMFC Rule 15A NCAC 03M .0515 (a)(2) Dolphin

Suspension of portion of this rule for an indefinite period. Suspension of this rule allows the division to adjust the recreational vessel limit to complement management of dolphin under the South Atlantic Fishery Management Council's Amendment 10 to the Fishery Management Plan for the Dolphin and Wahoo Fishery of the Atlantic. This suspension was implemented in Proclamation FF-30-2022.

NCMFC Rule 15A NCAC 03L .0105 (2) Recreational Shrimp Limits

Suspension of portion of this rule for an indefinite period. Suspension of this rule allows the division to modify the recreational possession limit of shrimp by removing the four quarts heads on and two and a half quarts heads off prohibition from waters closed to shrimping in accordance with Amendment 2 to the North Carolina Shrimp Fishery Management Plan. This suspension was implemented in Proclamation SH-4-2022.

NCMFC Rule 15A NCAC 03J .0103 (h) Gill Nets, Seines, Identification, Restrictions

Continued suspension a portion of this rule for an indefinite period. Suspension of this rule allows the division to implement year-round small mesh gill net attendance requirements in certain areas of the Tar-Pamlico and Neuse rivers systems. This action was taken as part of a department initiative to review existing small mesh gill net rules to limit yardage and address attendance requirements in certain areas of the state. This suspension continues in Proclamation M-13-2022.

NCMFC Rule 15A NCAC 03R .0110 (4) and (5) Crab Spawning Sanctuaries

Continued suspension portions of this rule is for an indefinite period. Suspension of this rule allows the division to revise the boundaries for the Drum Inlet and Barden Inlet crab spawning sanctuaries in accordance with Amendment 3 to the N.C. Blue Crab Fishery Management Plan. This suspension was implemented in Proclamation M-7-2020 and continues in M-12-2022.

NCMFC Rules 15A NCAC 03L .0201 (a) and (b) Crab Harvest Restrictions, 03L .0203 (a) Crab Dredging and 03J .0301 (a)(1), (g), and (h) Pots

Suspension of portions of these rules is for an indefinite period. Suspension of these rules allows the division to implement requirements for the blue crab fishery in accordance with Amendment 3 to the N.C. Blue Crab Fishery Management Plan. These suspensions were implemented in Proclamation M-1-2021.

NCMFC Rule 15A NCAC 03L .0103 (a)(1) Prohibited Nets, Mesh Lengths and Areas

Continued suspension of portions of this rule for an indefinite period. This allows the division to adjust trawl net minimum mesh size requirements in accordance with the Amendment 2 to the North Carolina Shrimp Fishery Management Plan. This suspension was implemented in proclamation SH-3-2019 and continues in SH-1-2022.

NCMFC Rule 15A NCAC 03J .0501 (e)(2) Definitions and Standards for Pound Nets and Pound Net Sets

Continued suspension portions of this rule for an indefinite period. This allows the division to increase the minimum mesh size of escape panels for flounder pound nets in accordance with Amendment 2 of the North Carolina Southern Flounder Fishery Management Plan. This suspension was implemented in Proclamation M-34-2015.

NCMFC Rule 15A NCAC 03M .0519 (a) and (b) Shad & 03Q .0107 (4) Special Regulations: Joint Waters

Continued suspension portions of these rules for an indefinite period. This allows the division to change the season and creel limit for American shad under the management framework of the North Carolina American Shad Sustainable Fishery Plan. These suspensions were continued in Proclamation FF-67-2021(Revised)

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Oct. 21, 2022

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Catherine Blum, Rulemaking Coordinator
Marine Fisheries Commission Office

SUBJECT: Rulemaking Update

Issue
Update the N.C. Marine Fisheries Commission (MFC) on the status of rulemaking in support of the Periodic Review and Expiration of Existing Rules per N.C.G.S. § 150B-21.3A.

Action Needed
For informational purposes only; no action is needed at this time.

Overview
- Periodic Review and Readoption of Rules – Requirements
  - North Carolina G.S. § 150B-21.3A, enacted in 2013, requires state agencies to review existing rules every 10 years in accordance with a prescribed process that includes rule readoption.
    - 15A NCAC 03 – Marine Fisheries: On June 14, 2018, the Rules Review Commission (RRC) approved the readoption schedule of June 30, 2022, for 172 MFC rules.
    - 15A NCAC 18A – Sanitation: On Jan. 16, 2020, the RRC approved the readoption schedule of June 30, 2024, for 164 MFC rules.
  - The MFC must readopt these rules by these deadlines or the rules will expire and be removed from the N.C. Administrative Code.
- At its November meeting, the MFC is scheduled to receive an update about the three ongoing packages of proposed rules.

2021-2022 Annual Rulemaking Cycle Update

"Package B" (109 rules)

At its August 2021 business meeting, the MFC approved Notice of Text for Rulemaking to begin the process for 109 rules. The MFC gave final approval of the rules at its February 2022 business meeting. There were 38 rules that were not automatically subject to legislative review that became effective June 1 or July 1, 2022. Most fishermen saw very little change from these rules. A news release and a rulebook supplement were distributed on each of these dates. The remaining 71 rules are automatically subject to legislative review pursuant to Session Law 2019-198 and N.C.G.S. § 14-4.1, and thus are expected to have a delayed effective date. Three rules, covering highly efficient gears, artificial reefs, and research sanctuaries, became effective Aug. 23, 2022, which was the 31st legislative day of the 2022 short session; a news release and a rulebook supplement were distributed. The remaining 68 rules will be available for legislative review during the 2023 long session.

These 68 rules cover the following subjects:

- Shellfish leasing regulations;
- 15A NCAC 03 rules with conforming changes;
- 15A NCAC 03I, 03J, 03K, 03O, and 03R for imported species, recordkeeping, gear, marketing shellfish, and licenses;
- Commercial blue crab harvest and gear regulations;
- Permit and license suspensions and revocations and pound net gears; and
- 15A NCAC 03K and 18A crustacea and shellfish.

"Package C" (9 rules)

At its March 2022 special meeting, the MFC approved Notice of Text for Rulemaking to begin the process for nine joint rules that pertain to the classification of the waters of North Carolina as coastal fishing waters, inland fishing waters, and joint fishing waters. The rules were proposed for readoption with no changes. The MFC gave final approval of the rules at its June 23, 2022, special meeting, and the Wildlife Resources Commission (WRC) gave its concurrence of the MFC's rules at its June 28, 2022, special meeting. These nine MFC rules and the 11 WRC joint rules (that the WRC approved April 14, 2022, and for which the MFC gave its concurrence May 26, 2022) became effective Sept. 1, 2022, except for one MFC rule (15A NCAC 03Q .0107) that is automatically subject to legislative review pursuant to Session Law 2019-198 and N.C.G.S. § 14-4.1 and will be available for legislative review during the 2023 long session.

2022-2023 Annual Rulemaking Cycle Update (2 rules)

At its August 2022 business meeting, the MFC approved Notice of Text for Rulemaking to begin the rule amendment and readoption process for two rules. A table of the steps in the process is included in the briefing materials and a summary of the proposed rules by subject is provided below. The proposed rules were published in the Oct. 3, 2022, issue of the *N.C. Register*, beginning the public comment process; an excerpt is included in the briefing materials. The 60-day public comment period is from Oct. 3 through 5 p.m. Dec. 2, 2022, with a single public hearing via WebEx on Nov. 1. Details are described in the Oct. 3 news release, which is included in the briefing materials. The MFC is scheduled to receive the public comments and vote on final approval of the rules at its February 2023 business meeting. The mutilated finfish rule is automatically subject to legislative review pursuant to Session Law 2019-198 and G.S. § 14-4.1 and would not be reviewed until the 2024 short session. The intended effective date of the marinas rule is May 1, 2023.

MUTILATED FINFISH
(15A NCAC 03M .0101)

Proposed amendments to this rule would provide flexibility to manage variable conditions for the use of finfish as cut bait by simplifying the rule such that only species subject to a possession limit are subject to the requirements unless otherwise specified in a MFC rule or a proclamation issued under the authority of a MFC rule. The original intent of the mutilated finfish rule was to provide added resource protection for finfish species subject to a size or bag limit. Proposed amendments to this rule would provide flexibility to manage current conditions for the use of certain finfish species as cut bait, as well as variable conditions that could occur in the future, all while continuing to protect fisheries resources. Proposed amendments would also clarify requirements, benefitting affected stakeholders and Marine Patrol officers.

Due to current possession limits, use of American eel, spot, Atlantic croaker, and bluefish as cut bait creates conflicts with the current mutilated finfish rule based on communication from stakeholders, feedback from Marine Patrol officers, and implications from stock assessments and fishery management plans. Additionally, changes to the current exception for mullet may be needed based on the outcome of the striped mullet stock assessment and management changes developed through the fishery management plan process. It is likely that species beyond the five outlined could require similar consideration in the future. Therefore, the proposed changes would amend the rule in a way that can resolve current conflicts with species used as cut bait, provide flexibility to manage variable conditions, and allow all requirements for a particular finfish species to be aggregated in a single proclamation (including for bait usage) for more comprehensive management, all while continuing to protect fisheries resources. It is important to note there is no guarantee that species allowed to be cut now would continue or that relief would be granted for the use of species that are prohibited now. The amended rule would only provide the Fisheries Director the authority to use her discretion to determine, in the context of the then-current variable conditions and available data and information, if it would be appropriate to issue a proclamation that would allow a particular species to be cut for use as bait.

MARINAS, DOCKING FACILITIES, AND OTHER MOORING AREAS (15A NCAC 18A .0911)

This rule is proposed for readoption pursuant to the requirements of G.S. § 150B-21.3A and proposed for amendment. The marinas rule, as it is currently written, may not be fully in compliance with national program requirements for shellfish harvesting closures and does not use the best available methodology to do so for the protection of public health. Proposed amendments would help ensure that North Carolina remains in full compliance with national requirements, allow the Division of Marine Fisheries to determine necessary buffer closures based on a more scientific and public health-based rationale, and make implementation and enforceability clearer.

For the harvest classification of shellfish growing waters in and around marinas, the National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish requires that a pollution assessment be used to determine the necessary classification in and around the marina docks, and that a dilution analysis be used to determine the size of any harvest closure that may be necessary because of the pollution assessment. The current rule already requires that a pollution assessment be used to determine the necessary classification in and around the marina docks, but it does not require a dilution analysis to determine closure size, and instead prescribes specific closure measurements based on a limited number of marina characteristics. The proposed rule would maintain the pollution assessment requirement and would also require that a dilution analysis be used to determine closure size. Also, the elimination of an exemption clause from the rule would allow for more clarity among stakeholders and help ensure consistent, clear, and more efficient enforcement across marinas. With the elimination of this portion of the rule, slip owners at these marinas would have additional flexibility with the type and size of boat they are able to dock there. Division of Marine Fisheries and Division of Coastal Management staffs spend resources repeatedly enforcing marinas' designations over time with changing homeowners' associations. Division of Marine Fisheries resources could be used in other ways if the exemption is eliminated. Overall, the acreage of water that could potentially change designation is an extremely small amount: approximately 58 acres out of 1.46 million acres that are open to shellfish harvest.

2023-2024 Annual Rulemaking Cycle Preview

Division of Marine Fisheries staff will provide a preview of potential rules in the MFC's 2023-2024 annual rulemaking cycle at its November 2022 business meeting. Additional rules in 15A NCAC 18A proposed for readoption are expected to be part of the rulemaking cycle. Please see Figure 1, detailed in the Background Information section below, that shows the MFC's rule readoption schedule. This cycle is scheduled to begin the rulemaking process at the MFC's May 2023 business meeting. Proposed rules would have an earliest effective date of April 1, 2024, except for rules automatically subject to legislative review per Session Law 2019-198 and N.C.G.S. § 14-4.1. Rules that are subject would likely be reviewed during the 2024 short session.

Background Information

<u>Periodic Review and Expiration of Existing Rules per N.C.G.S. § 150B-21.3A</u>

Session Law 2013-413, the Regulatory Reform Act of 2013, implemented requirements known as the "Periodic Review and Expiration of Existing Rules." These requirements are codified in a new section of Article 2A of Chapter 150B of the General Statutes in N.C.G.S. § 150B-21.3A. Under the requirements, each agency is responsible for conducting a review of all its rules at least once every 10 years in accordance with a prescribed process.

The review has two parts. The first is a report phase, which has concluded, followed by the readoption of rules. An evaluation of the rules under the authority of the MFC was undertaken in two lots (see Figure 1.) The MFC has 211 rules in Chapter 03 (Marine Fisheries), of which 172 are subject to readoption, and 164 rules in Chapter 18, Subchapter 18A (Sanitation) that are also subject to readoption. The MFC is the body with the authority for the approval steps prescribed in the process.

Rules	2017	2018	2019	2020	2021	2022	2023	2024
Chapter 03 (172 rules)	Report	41 Rules Readopted	2 Rules Readopted	13 Rules Readopted	116 Rules Readopted	6/30/22 deadline		
Subchapter 18A (164 rules)			Report	42 Rules Readopted	42 Rules Readopted	Rule Readoption (1)	Rule Readoption (79)	6/30/24 deadline

Figure 1. Marine Fisheries Commission rule readoption schedule to comply with N.C.G.S. § 150B-21.3A, Periodic Review and Expiration of Existing Rules.

N.C. Marine Fisheries Commission
2022-2023 Annual Rulemaking Cycle

November 2022

Time of Year	Action
February-July 2022	Fiscal analysis of rules prepared by DMF staff and approved by Office of State Budget and Management
Aug. 19, 2022	MFC approved Notice of Text for Rulemaking
Oct. 3, 2022	Publication of proposed rules in the *North Carolina Register*
Oct. 3-Dec. 2, 2022	Public comment period held
Nov. 1, 2022	Public hearing held via WebEx at 6 p.m.
Feb. 22-24, 2023	MFC votes on approval of permanent rules
April 20, 2023	Rules reviewed by Office of Administrative Hearings/ Rules Review Commission
May 1, 2023	Proposed effective date of 1 rule not subject to legislative review
May 1, 2023	Rulebook supplement available online
2024 legislative session	Possible effective date of 1 rule subject to legislative review per S.L. 2019-198 and G.S. 14-4.1.
June 30, 2024	Readoption deadline for 15A NCAC 18A

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For questions or concerns regarding the Administrative Procedure Act or any of its components, consult with the agencies below. The bolded headings are typical issues which the given agency can address but are not inclusive.

Rule Notices, Filings, Register, Deadlines, Copies of Proposed Rules, etc.

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NORTH CAROLINA REGISTER
Publication Schedule for January 2022 – December 2022

FILING DEADLINES			NOTICE OF TEXT		PERMANENT RULE			TEMPORARY RULES
Volume & issue number	Issue date	Last day for filing	Earliest date for public hearing	End of required comment Period	Deadline to submit to RRC for review at next meeting	RRC Meeting Date	Earliest Eff. Date of Permanent Rule	270th day from publication in the Register
36:13	01/03/22	12/08/21	01/18/22	03/04/22	03/21/22	04/21/2022	05/01/22	09/30/22
36:14	01/18/22	12/22/21	02/02/22	03/21/22	04/20/22	05/19/2022	06/01/22	10/15/22
36:15	02/01/22	01/10/22	02/16/22	04/04/22	04/20/22	05/19/2022	06/01/22	10/29/22
36:16	02/15/22	01/25/22	03/02/22	04/18/22	04/20/22	05/19/2022	06/01/22	11/12/22
36:17	03/01/22	02/08/22	03/16/22	05/02/22	05/20/22	06/16/2022	07/01/22	11/26/22
36:18	03/15/22	02/22/22	03/30/22	05/16/22	05/20/22	06/16/2022	07/01/22	12/10/22
36:19	04/01/22	03/11/22	04/16/22	05/31/22	06/20/22	07/21/2022	08/01/22	12/27/22
36:20	04/18/22	03/25/22	05/03/22	06/17/22	06/20/22	07/21/2022	08/01/22	01/13/23
36:21	05/02/22	04/08/22	05/17/22	07/01/22	07/20/22	08/18/2022	09/01/22	01/27/23
36:22	05/16/22	04/25/22	05/31/22	07/15/22	07/20/22	08/18/2022	09/01/22	02/10/23
36:23	06/01/22	05/10/22	06/16/22	08/01/22	08/22/22	09/15/2022	10/01/22	02/26/23
36:24	06/15/22	05/24/22	06/30/22	08/15/22	08/22/22	09/15/2022	10/01/22	03/12/23
37:01	07/01/22	06/10/22	07/16/22	08/30/22	09/20/22	10/20/2022	11/01/22	03/28/23
37:02	07/15/22	06/23/22	07/30/22	09/13/22	09/20/22	10/20/2022	11/01/22	04/11/23
37:03	08/01/22	07/11/22	08/16/22	09/30/22	10/20/22	11/17/2022	12/01/22	04/28/23
37:04	08/15/22	07/25/22	08/30/22	10/14/22	10/20/22	11/17/2022	12/01/22	05/12/23
37:05	09/01/22	08/11/22	09/16/22	10/31/22	11/21/22	12/15/2022	01/01/23	05/29/23
37:06	09/15/22	08/24/22	09/30/22	11/14/22	11/21/22	12/15/2022	01/01/23	06/12/23
37:07	10/03/22	09/12/22	10/18/22	12/02/22	12/20/22	01/19/2023	02/01/23	06/30/23
37:08	10/17/22	09/26/22	11/01/22	12/16/22	12/20/22	01/19/2023	02/01/23	07/14/23
37:09	11/01/22	10/11/22	11/16/22	01/03/23	01/20/23	02/16/2023	03/01/23	07/29/23
37:10	11/15/22	10/24/22	11/30/22	01/17/23	01/20/23	02/16/2023	03/01/23	08/12/23
37:11	12/01/22	11/07/22	12/16/22	01/30/23	02/20/23	03/16/2023	04/01/23	08/28/23
37:12	12/15/22	11/22/22	12/30/22	02/13/23	02/20/23	03/16/2023	04/01/23	09/11/23

This document is prepared by the Office of Administrative Hearings as a public service and is not to be deemed binding or controlling.

EXPLANATION OF THE PUBLICATION SCHEDULE

This Publication Schedule is prepared by the Office of Administrative Hearings as a public service and the computation of time periods are not to be deemed binding or controlling. Time is computed according to 26 NCAC 2C .0302 and the Rules of Civil Procedure, Rule 6.

GENERAL

The North Carolina Register shall be published twice a month and contains the following information submitted for publication by a state agency:

(1) temporary rules;
(2) text of proposed rules;
(3) text of permanent rules approved by the Rules Review Commission;
(4) emergency rules
(5) Executive Orders of the Governor;
(6) final decision letters from the U.S. Attorney General concerning changes in laws affecting voting in a jurisdiction subject of Section 5 of the Voting Rights Act of 1965, as required by G.S. 120-30.9H; and
(7) other information the Codifier of Rules determines to be helpful to the public.

COMPUTING TIME: In computing time in the schedule, the day of publication of the North Carolina Register is not included. The last day of the period so computed is included, unless it is a Saturday, Sunday, or State holiday, in which event the period runs until the preceding day which is not a Saturday, Sunday, or State holiday.

FILING DEADLINES

ISSUE DATE: The Register is published on the first and fifteen of each month if the first or fifteenth of the month is not a Saturday, Sunday, or State holiday for employees mandated by the State Personnel Commission. If the first or fifteenth of any month is a Saturday, Sunday, or a holiday for State employees, the North Carolina Register issue for that day will be published on the day of that month after the first or fifteenth that is not a Saturday, Sunday, or holiday for State employees.

LAST DAY FOR FILING: The last day for filing for any issue is 15 days before the issue date excluding Saturdays, Sundays, and holidays for State employees.

NOTICE OF TEXT

EARLIEST DATE FOR PUBLIC HEARING: The hearing date shall be at least 15 days after the date a notice of the hearing is published.

END OF REQUIRED COMMENT PERIOD
An agency shall accept comments on the text of a proposed rule for at least 60 days after the text is published or until the date of any public hearings held on the proposed rule, whichever is longer.

DEADLINE TO SUBMIT TO THE RULES REVIEW COMMISSION: The Commission shall review a rule submitted to it on or before the twentieth of a month by the last day of the next month.

(1) Aluminum;
(2) Antimony;
(3) Arsenic;
(4) Barium;
(5) Beryllium;
(6) Boron;
(7) Cadmium;
(8) Calcium;
(9) Chromium, Hexavalent (Chromium VI);
(10) Chromium, Total;
(11) Chromium, Trivalent (Chromium III);
(12) Cobalt;
(13) Copper;
(14) Hardness, Total (Calcium + Magnesium);
(15) Iron;
(16) Lead;
(17) Lithium;
(18) Magnesium;
(19) Manganese;
(20) Mercury;
(21) Molybdenum;
(22) Nickel;
(23) Potassium;
(24) Phosphorus;
(25) Selenium;
(26) Silica;
(27) Silver;
(28) Sodium;
(29) Strontium;
(30) Thallium;
(31) Tin;
(32) Titanium;
(33) Vanadium; and
(34) Zinc.

(d) Organics: Each of the organic Parameters listed in this Paragraph shall be considered a certifiable Parameter. One or more Parameter Methods shall be listed with a laboratory's certified Parameters. Analytical methods shall be determined from the sources listed in Rule .0805(a)(1) of this Section. Certifiable organic Parameters are as follows:

(1) 1,2-Dibromoethane (EDB); 1,2-Dibromo-3-chloro-propane (DBCP); 1,2,3-Trichloropropane (TCP);
(2) Acetonitrile;
(3) Acrolein, Acrylonitrile;
(4) Adsorbable Organic Halides;
(5) Base/Neutral and Acid Organics;
(6) Benzidines;
(7) Chlorinated Acid Herbicides;
(8) Chlorinated Hydrocarbons;
(9) Chlorinated Phenolics;
(10) Explosives;
(11) Extractable Petroleum Hydrocarbons;
(12) Haloethers;
(13) N-Methylcarbamates;
(14) Nitroaromatics and Isophorone;
(15) Nitrosamines;
(16) Nonhalogenated Volatile Organics;
<u>(17) Organic Fluorine;</u>
~~(17)~~<u>(18)</u> Organochlorine Pesticides;
~~(18)~~<u>(19)</u> Organophosphorus Pesticides;
<u>(20) Per- and Polyfluoroalkyl Substances (PFAS);</u>
~~(19)~~<u>(21)</u> Phenols;
~~(20)~~<u>(22)</u> Phthalate Esters;
~~(21)~~<u>(23)</u> Polychlorinated Biphenyls;
~~(22)~~<u>(24)</u> Polynuclear Aromatic Hydrocarbons;
~~(23)~~<u>(25)</u> Purgeable Aromatics;
~~(24)~~<u>(26)</u> Purgeable Halocarbons;
~~(25)~~<u>(27)</u> Purgeable Organics;
~~(26)~~<u>(28)</u> Total Organic Halides;
~~(27)~~<u>(29)</u> Total Petroleum Hydrocarbons – Diesel Range Organics;
~~(28)~~<u>(30)</u> Total Petroleum Hydrocarbons – Gasoline Range Organics; and
~~(29)~~<u>(31)</u> Volatile Petroleum Hydrocarbons.

Authority G.S. 143-215.3(a)(1); 143-215.3(a)(10).

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***Notice** is hereby given in accordance with G.S. 150B-21.2 and G.S. 150B-21.3A(c)(2)g. that the Marine Fisheries Commission intends to amend the rule cited as 15A NCAC 03M .0101 and readopt with substantive changes the rule cited as 15A NCAC 18A .0911.*

Link to agency website pursuant to G.S. 150B-19.1(c): *https://deq.nc.gov/mfc-proposed-rules*

Proposed Effective Date:
15A NCAC 03M .0101- Subject to Legislative Review
15A NCAC 18A .0911-May 1, 2023

Public Hearing:
Date: *November 1, 2022*
Time: *6:00 p.m.*
Location:
WebEx Events meeting link: https://ncdenrits.webex.com/ncdenrits/onstage/g.php?MTID=e18e682448138378a2107f624ed6aad80 Event number: 2435 343 7920
Event password: 1234
Event phone number: 1-415-655-0003
Listening station: Division of Marine Fisheries Central District Office, 5285 Highway 70 West, Morehead City, NC 28557

Reason for Proposed Action:
***Rule 15A NCAC 03M .0101** is proposed for amendment to provide flexibility to manage variable conditions for the use of finfish as cut bait by simplifying the rule such that only species subject to a possession limit are subject to the requirements unless otherwise specified in a Marine Fisheries Commission rule or a proclamation issued under the authority of a Marine Fisheries Commission rule.*
***Rule 15A NCAC 18A .0911** is proposed for amendment in accordance with G.S. 150B-21.3A to help ensure that North Carolina remains in full compliance with national requirements so that N.C. shellfish can continue to be sold through interstate*

commerce; allow the Division of Marine Fisheries to determine necessary buffer closures for shellfish growing waters in and around marinas based on a more scientific and public health-based rationale; and make implementation and enforceability of requirements clearer.

Comments may be submitted to: *Catherine Blum, P.O. Box 769, Morehead City, NC 28557 (Written comments may also be submitted via an online form available at https://deq.nc.gov/mfc-proposed-rules)*

Comment period ends: *December 2, 2022*

Procedure for Subjecting a Proposed Rule to Legislative Review:
If an objection is not resolved prior to the adoption of the rule, a person may also submit written objections to the Rules Review Commission. If the Rules Review Commission receives written and signed objections in accordance with G.S. 150B-21.3(b2) from 10 or more persons clearly requesting review by the legislature and the Rules Review Commission approves the rule, the rule will become effective as provided in G.S. 150B-21.3(b1). The Commission will receive written objections until 5:00 p.m. on the day following the day the Commission approves the rule. The Commission will receive those objections by mail, delivery service, hand delivery, or email. If you have any further questions concerning the submission of objections to the Commission, please call a Commission staff attorney at 984-236-1850.

Rule is automatically subject to legislative review: *S.L. 2019-198: 15A NCAC 03M .0101*

Fiscal impact. Does any rule or combination of rules in this notice create an economic impact? Check all that apply.
☒ **State funds affected**
☐ **Local funds affected**
☐ **Substantial economic impact (>= $1,000,000)**
☒ **Approved by OSBM**
☐ **No fiscal note required**

CHAPTER 03 - MARINE FISHERIES

SUBCHAPTER 03M - FINFISH

SECTION .0100 – FINFISH, GENERAL

15A NCAC 03M .0101 MUTILATED FINFISH
It shall be unlawful to possess aboard a vessel or while engaged in fishing any species of finfish that is subject to a ~~size or harvest restriction~~ possession limit, including size limit, recreational bag limit, commercial trip limit, or season, without having head and tail attached, ~~except:~~ unless otherwise specified in a rule of the Marine Fisheries Commission or a proclamation issued pursuant to a rule of the Marine Fisheries Commission.

~~(1) mullet when used for bait;~~
~~(2) hickory shad when used for bait, provided that not more than two hickory shad per vessel or fishing operation may be cut for bait at any one time; and~~
~~(3) tuna possessed in a commercial fishing operation as provided in Rule .0520 of this Subchapter.~~

Authority G.S. 113-134; 113-182; 143B-289.52.

CHAPTER 18 - ENVIRONMENTAL HEALTH

SUBCHAPTER 18A - SANITATION

SECTION .0900 - CLASSIFICATION OF SHELLFISH GROWING WATERS

15A NCAC 18A .0911 ~~MARINAS:~~ MARINAS, DOCKING ~~FACILITIES:~~ FACILITIES, AND OTHER MOORING AREAS
~~Classification of shellfish~~ Shellfish growing waters with respect to marinas, docking facilities, and other mooring areas shall be ~~done~~ classified in accordance with the following:

(1) ~~All~~ all waters within ~~the immediate vicinity of~~ a marina shall be classified as prohibited to the harvesting of shellfish for human consumption. ~~Excluded from this classification are marinas with less than 30 slips, having no boats over 24 feet in length, no boats with heads and no boats with cabins. Marinas permitted prior to the effective date of this Rule may continue to have boats up to 21 feet in length with cabins and not be subject to the mandatory water classification of prohibited in the immediate vicinity of the marina.~~
~~(2) Owners of marinas conforming to the exclusion provisions in Item (1) of this Rule shall make quarterly reports to the Division. These reports shall include the following information:~~
~~(a) number of slips;~~
~~(b) number and length of boats;~~
~~(c) number and length of boats with cabins;~~
~~(d) number of boats with heads; and~~
~~(e) number of boats with "porta-potties."~~

~~Reports to the Division shall cover the occupancy of the marina on the fifth day of the first month of each quarter of the calendar year and shall be post marked on or before the fifteenth day of the reporting month.~~

~~(3) The minimum requirement for the prohibited area beyond the marina shall be based on the number of slips and the type of marina (open or closed system). The prohibited area shall extend beyond the marina from all boat slips, docks, and docking facilities, according to the following:~~

~~Number of Slips in Marina~~	~~Size of Prohibited Area (Feet)~~	
	~~Open System~~	~~Closed System~~
~~11 - 25~~	~~100~~	~~200~~
~~26 - 50~~	~~150~~	~~275~~
~~51 - 75~~	~~175~~	~~325~~

~~76 - 100~~	~~200~~	~~400~~

~~Open system marinas exceeding 100 slips shall require an additional 25 feet for each 25 slips or portion thereof over 100. A closed system marina shall require 50 feet for each 25 slips or portion thereof over 100. Closed system private or residential marinas with more than 75 slips shall require a prohibited area of the number of feet determined above, or 100 feet outside the entrance canal, whichever is greater. Closed system commercial marinas with more than 50 slips shall require a prohibited area of the number of feet determined above, or 100 feet outside the entrance canal, whichever is greater.~~

(2) the Division of Marine Fisheries shall conduct a dilution analysis to determine the minimum extent of the area adjacent to a marina that shall be classified as prohibited to the harvesting of shellfish for human consumption. The prohibited area shall be sized to dilute the concentration of fecal coliform bacteria to less than 14 MPN, as determined by the dilution analysis. The dilution analysis shall be conducted yearly and shall incorporate the following:

- (a) the findings of the shoreline survey, including the presence of a sewage pumpout system or dump station; and
- (b) the physical factors influencing the dilution and dispersion of human wastes; and

~~(4)~~(3) ~~After a marina is put in use water quality impacts of marina facilities may require a change in classification. In determining if a change in classification is necessary, marina design, marina usage, dilution, dispersion, bacteriological, hydrographic, meteorological, and chemical factors will be considered.~~ slip counts and services for marinas, docking facilities, and mooring areas in close proximity to one another shall be combined for the purposes of determining the necessary prohibited area as required in Items (1) and (2) of this Rule. Docking facilities and mooring areas each with three slips or more and marinas shall be considered to be in close proximity to one another if the dilution analysis indicates that the necessary dilution areas meet or overlap.

~~(5) Areas, other than marinas, where boats are moored or docked may be considered on a case-by-case basis with respect to sanitary significance relative to actual or potential contamination and classification shall be made as necessary.~~

~~(6) The cumulative impacts of multiple marinas, entrance canals, or other mooring areas, in close proximity to each other are expected to adversely affect public trust waters. When these situations occur the Division will recommend closures exceeding those outlined in Item (3) of this Rule. The following guides will be used in determining close proximity:~~

- ~~(a) marina entrance canals within 225 feet of each other;~~
- ~~(b) open system marinas within 450 feet of each other (Mooring areas shall be considered open system marinas);~~
- ~~(c) where closure areas meet or overlap; and~~
- ~~(d) open system marinas within 300 feet of a marina entrance canal.~~

Authority G.S. ~~130A-230;~~ 113-134; 113-182; 113-221.2; 143B-289.52.

TITLE 21 - OCCUPATIONAL LICENSING BOARDS AND COMMISSIONS

CHAPTER 16 – BOARD OF DENTAL EXAMINERS

***Notice** is hereby given in accordance with G.S. 150B-21.2 that the Board of Dental Examiners intends to adopt the rules cited as 21 NCAC 16Q .0103, .0104 and amend the rules cited as 21 NCAC 16Q .0202, .0302, .0405 and .0703.*

Link to agency website pursuant to G.S. 150B-19.1(c): *www.ncdentalboard.org*

Proposed Effective Date: *February 1, 2023*

Public Hearing:
Date: *November 17, 2022*
Time: *6:30 p.m.*
Location: *2000 Perimeter Park Drive, Suite 160, Morrisville, NC 27560*

Reason for Proposed Action:
***21 NCAC 16Q .0103** is proposed to address the practice requirements for a permit holder to administer general anesthesia, moderate conscious sedation, and moderate pediatric sedation.*
***21 NCAC 16Q .0104** is proposed to address requirements for facility inspections and evaluations.*
***21 NCAC 16Q .0202** is proposed for amendment to set out modified requirements for a general anesthesia permit applicant or holder.*
***21 NCAC 16Q .0302** is proposed for amendment to set out modified requirements for a moderate conscious sedation permit applicant or holder.*
***21 NCAC 16Q .0405** is proposed for amendment to set out modified requirements for a moderate pediatric conscious sedation permit applicant or holder.*
***21 NCAC 16Q .0703** is proposed for amendment to change requirements for adverse occurrence reporting.*

Comments may be submitted to: *Bobby White, 2000 Perimeter Park Drive, Suite 160, Morrisville, NC 27560*

Roy Cooper
Governor

Elizabeth S. Biser
Secretary

Kathy B. Rawls
Director

Release: Immediate	Contact: Patricia Smith
Date: Oct. 3, 2022	Phone: 252-726-7021

MEDIA ADVISORY: Comment period opens, public hearing scheduled for two marine fisheries rules

MOREHEAD CITY – The N.C. Marine Fisheries Commission is accepting public comment on the proposed re-adoption and amendment of one rule under a state-mandated periodic review schedule and proposed amendments to a second rule.

The first rule sets requirements for the harvest classification of shellfish growing waters in and around marinas, docking facilities, and other mooring areas. It is proposed for re-adoption and amendment to help ensure that North Carolina remains in full compliance with national requirements so that N.C. shellfish can continue to be sold through interstate commerce.

Proposed amendments would also allow the N.C. Division of Marine Fisheries to determine necessary buffer closures for shellfish growing waters in and around these areas based on a more scientific and public health-based rationale and make implementation and enforceability of requirements clearer.

The second rule is proposed with amendments to mutilated finfish requirements. Amendments would provide flexibility to manage variable conditions for the use of finfish as cut bait by simplifying the rule so that only species subject to a possession limit are subject to the mutilated finfish requirements unless otherwise specified in a N.C. Marine Fisheries Commission rule or a proclamation issued under the authority of a N.C. Marine Fisheries Commission rule.

A public hearing will be held by web conference on Nov. 1 at 6 p.m. A listening station will be established at the N.C. Division of Marine Fisheries Central District Office at 5285 Highway 70 West, Morehead City. The public may join the meeting online; however, those who wish to comment during the hearing must register to speak by noon on the day of the hearing.

Members of the public also may submit written comments through an online form or through the mail to N.C. Marine Fisheries Commission Rules Comments, P.O Box 769, Morehead City, N.C. 28557. Comments must be posted online or be received by the N.C. Division of Marine Fisheries by 5 p.m. Dec. 2, 2022.

Links to the public hearing registration form and online comment form, as well as text of the proposed rules and links to join the meeting, can be found on the N.C. Marine Fisheries Commission's Proposed Rules Page.

The proposed rule changes will be presented to the N.C. Marine Fisheries Commission for final approval in February 2023 and have an earliest effective date of May 1, 2023.

For questions about the N.C. Marine Fisheries Commission rulemaking process, email Catherine Blum, rules coordinator for the N.C. Division of Marine Fisheries.

WHO:	Marine Fisheries Commission
WHAT:	Public Hearing for Proposed Rules
WHEN:	Nov. 1 at 6 p.m.

Website: http://www.ncdenr.gov
Facebook: http://www.facebook.com/ncdeq
Twitter: http://twitter.com/NCDEQ
RSS Feed: http://portal.ncdenr.org/web/opa/news-releases-rss
1601 Mail Service Center, Raleigh, NC 27699-1601

Roy Cooper
Governor

Elizabeth S. Biser
Secretary

Kathy B. Rawls
Director

WHERE: Meeting by Web Conference
Click Here for Information and to Sign Up to Speak

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